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and Energy Efficiency

# Public Risk Perceptions, Understandings and Responses to Climate Change in Australia and Great Britain

## Final Report

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## DISCLAIMER

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## SUMMARY STATEMENT

This final report presents and discusses national survey findings from a collaborative and cross-national research project undertaken by Griffith University (Australia) and Cardiff University (UK) examining public risk perceptions, understandings and responses to the threat and unfolding impacts of climate change in Australia and Great Britain. The Australian national survey was undertaken between 6 June and 6 July, 2010 and involved a representative and geographically and demographically stratified national sample of 3096 respondents. The British survey was undertaken between 6 January and 26 March, 2010 and involved a representative quota sample of 1822 respondents residing in England, Scotland and Wales. These articulated surveys were distinctive in their cross-national comparative collaboration, in their psychological and social science nature, focus, and design, in their in-depth nature, and in their focus on underlying public understandings and psychological responses to climate change.

This report addresses common findings from these two linked surveys, and expands discussion of issues and findings from the Australian survey. A report detailing the UK survey findings is available separately (Spence, Venables, Pidgeon, Poortinga, & Demski, 2010). As well as shared questions and objectives, each survey had additional and differing objectives, with the Australian survey also examining in more detail public risk perceptions, direct exposure and experience, and psychological responses and impacts to natural disasters. The British survey examined in more detail respondents' perceptions of energy policies and futures for the United Kingdom. The Australian survey also differed in that it was specifically designed and planned to establish a data base and research platform for documenting and monitoring climate-related changes and impacts in the human landscape over time, including changes in risk perceptions and understandings, psychological responses, and changes in psychological adaptations and impacts.

## Public Risk Perceptions, Understandings, and Responses to Climate Change and Natural Disasters in Australia and Great Britain

At a sample size of 3,096 and assuming random selection, reported proportions are accurate to within maximum of +1.76%. (Illustrative 95% confidence intervals are 1.06% at a 10% or 90% finding, 1.61% at a 30%/70% finding, and 1.76% at a 50%/50% finding).

NOTE: All results show percentages among all respondents, unless otherwise labeled. Totals may occasionally sum to more than 100 percent due to rounding.

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## EXECUTIVE SUMMARY

What follows is a distillation and summary of more noteworthy findings of the Australian national survey undertaken by Griffith University researchers between 6 June and 6 July, 2010, as part of a joint cross-national survey exercise with Cardiff University's Understanding Risk Research Centre in Britain. The respective national survey sample sizes were 3096 for Australia and 1822 for Britain, with these samples being geographically and demographically representative. The Australian sample was further stratified by regional exposure to projected climate change impacts, extreme weather vulnerability, and gender. This final report follows an interim report released on 1 June, 2011, and constitutes a more comprehensive and detailed research report and monograph, including many Australia-specific findings, broader comparison data, methodological and statistical details and background information, and a particular focus and emphasis on descriptive, quantitative, and comparative research findings and their interpretation. A selection and discussion of more qualitative research findings are also included.

The researchers from Australia and Britain are all applied psychologists and social and behavioural 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 report is quite diverse, including fellow climate change researchers, our funding bodies, federal and state level government policy advisers, the Pacific region authors of the next IPCC Report, multiple organisational end users, interested individuals, and an international research community. We have attempted to write a report and monograph which will be accessible and meaningful across this wide spectrum of interest, and have provided a selective glossary of terms in those cases where terms or phrases might not be familiar to some readers and where there exist problems of language use and meaning across disciplinary boundaries, and with respect to both historical and emergent cultures of use.

### PRINCIPAL FINDINGS

**Findings from this collaborative research were striking in a number of respects:**

1. Despite dramatic differences in geographic regions, climate, climate change exposure, and recent histories of extreme weather events, the findings from Australia and Great Britain across most risk perception, belief, and concern domains were remarkably similar.
2. Belief and acceptance of climate change among respondents was very high, with this acceptance including acknowledgment of some level of human causality for the vast majority of respondents.
3. Public concern levels with respect to the threat and perceived impacts of climate change were also very high.

4. Australian respondents viewed climate change as a more immediate, proximal, and certain threat to their local region and nation than was the case for British respondents, for whom the problem was perceived to be more distant, uncertain, and less familiar in terms of anticipated consequences.
5. A distinctive minority of Australian respondents, approximately 6.5%, could be characterised as being disbelievers or strong sceptics with respect to the reality of current climate change and/or the causal role of human activities and environmental impacts. The comparable figure for British respondents who could be characterised as being disbelievers or strong sceptics was 4.0%.
6. Research findings for Australian respondents 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 anticipations, which reflect understandings of climate change in terms of extreme weather events and natural disaster manifestations and consequences.
7. Extent of prior direct experience with extreme weather events and natural disasters for Australian respondents showed consistent but modest positive relationships with climate change-related psychological variables such as belief, concern, psychological adaptation, psychological distress, and behavioural engagement.
8. Direct experience with salient environmental changes or events which respondents attributed to climate change evidenced much stronger positive relationships across all psychological measures than was the case for prior disaster and extreme weather event experience.
9. 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.
10. Survey findings also suggest that the Australian public has been experiencing a range of psychological impacts relating to the threat of climate change, with these impacts in turn associated with psychological adaptation processes and behavioural responses.

## ADDITIONAL CROSS-NATIONAL FINDINGS

11. Seventy-four percent of Australian respondents and 78% of British respondents reported believing 'that the world's climate is changing', with 8% in both countries reporting 'not knowing'.
12. Seventy-one percent of Australian respondents either 'strongly agreed' or 'tended to agree' with the statement, "I am certain that climate change is really happening".
13. Ninety percent of Australian respondents and 89% of British respondents believed that human activities were playing a causal role in climate change.
14. Fifty-four percent of Australian respondents and 41% of British respondents believed that they were already experiencing the effects of climate change. In open-ended survey items Australian respondents provided many examples of direct encounters with what they viewed as evidence of climate change.

15. Sixty-six per cent of Australian respondents and 71% of British respondents reported that they were 'very concerned' or 'fairly concerned' about climate change, with an additional 22% and 19% respectively, i.e., totals of 88% and 90% respectively, indicating some level of concern.
16. Australian and British respondents reported being only slightly less concerned with respect to the *personal impacts* of climate change, with 62% of Australian and 60% of British respondents reporting that they were either 'very concerned' or 'fairly concerned'.
17. Survey findings suggest that the majority of both Australian and British respondents feel that despite clear difficulties and challenges, their actions can make a difference, and that the issue of climate change is serious, urgent, and personally relevant.

Taken as a whole, these Australia/Great Britain comparison findings indicate striking similarities, high levels of climate change concern, and strong belief in both national survey samples that human activities are in part responsible for current global climate change. These findings also suggest that media coverage of public perceptions and responses to the threat of climate change is often very wide of the mark, and that reported declines over the past several years in public acceptance and concern about climate change and its relative importance as an environmental issue and threat have been overstated.

## AUSTRALIA-SPECIFIC RESEARCH FINDINGS:

**Belief and concern about climate change and other environmental risks**

18. Structural equation modeling identified numerous predictors of belief in climate change, with strong linkages from beliefs through distress and self-efficacy to psychological adaptation, and from there to behavioural engagement.
19. Seventy-one percent of Australian respondents reported that their level of concern about climate change had increased over the preceding two years.
20. 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.
21. Seventy-eight percent of Australian respondents agreed that, "If nothing is done to reduce climate change in the future, it will be a 'very serious' or 'somewhat serious' problem for Australia".
22. When asked, "How serious a problem do you think climate change is *right now?*" 45% of Australian respondents reported that it was a serious problem.
23. Twenty-seven percent of respondents reported thinking about the issue of climate change either 'a great deal' or very often.
24. Forty-eight percent of Australian respondents reported that the issue of climate change was 'extremely' or 'very' important to them personally.
25. The relative concern ranking of climate change as compared with other environmental threats for Australian respondents nation-wide was eighth out of a provided list of 13

environmental risks, with water scarcity, drought, and threatened environmental quality and sustainability coming first, second, and third in this rank ordering of mean concern ratings. All environmental risks, however, including climate change, received high mean concern ratings.

26. Water scarcity and drought were the most salient and often-mentioned environmental threats in response to open-ended survey questions. However, all natural disaster and environmental threats appeared to be of high salience and concern for the majority of respondents.
27. Relative concern levels respecting differing environmental risks nonetheless reflected regional exposure and experience. In cyclone-prone northern coastal communities, for example, respondents' highest concern levels were given to cyclones, severe storm activity, and species extinctions, with threatened environmental quality and sustainability coming fourth.

**Knowledge of climate change**

28. 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.
29. Respondent understandings of climate change were both distinct from and more than objective knowledge of climate change science explanations for climate change. These understandings included important emotional responses; responsibility, human agency, and moral dimensions; personal experiential understandings of environmental change and extreme weather events; and cultural and symbolic associations.

**Trust**

30. In response to the question, "How much do you trust what different sources say about the environment?" 50% of respondents answered 'completely' or very substantially in the case of 'scientists'. Comparison figures for the media and for government for complete or substantial trust were only 5% and 8% respectively.

**Responsibility**

31. 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.

**Political affiliation comparisons**

32. Political affiliation, as measured by voting intention 'if there was a Federal election tomorrow', was an important consideration across many key variables for Australian respondents. While 73.6% of Labor preference respondents were 'very' or 'fairly' concerned about climate change, comparison figures for Liberal, National, and Green

preference respondents were 53.9%, 48.6% and 87.9 % respectively. Similarly, with respect to acceptance of some level of human causality with respect to climate change, acceptance level for Labor preference voters was 92.5%, with the respective acceptance levels for Liberal, National, and Green preference respondents being 86.6%, 85.5%, and 96.8%.

**Psychological impacts associated with climate change**

33. An important and neglected domain in climate change surveys relates to possible psychological impacts of the threat and perceived consequences of climate change. In addition to the 88% of respondents reporting some level of concern about climate change, 20% of Australian respondents reported feeling, at times, appreciable distress at the prospect and implications of climate change and its consequences.
34. 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.

**Psychological adaptation to climate change**

35. Australian survey respondents appear to be actively adapting to the threat of climate change, both psychologically and behaviourally.
36. Survey respondents who evidenced high levels of psychological adaptation were much more likely to accept anthropogenic climate change, believe that Australians are already experiencing the effects of climate change, have greater objective knowledge about climate change, have had what they believe to be personal encounters with environmental events or changes associated with climate change, are more concerned and distressed by the implications of climate change, more engaged with the topic and issue, and see themselves as more exposed and vulnerable to the anticipated consequences of climate change.
37. Psychological adaptation to climate change (changes in thoughts, feelings, and understandings about climate change) was the most immediate and principal mediator of pro-environmental behavioural engagement.

**Experience of natural disasters and perceived climate change events and changes**

38. Thirty-seven percent of Australian respondents reported having had direct personal experience with differing natural disaster events, with many respondents having experienced events such as cyclones, floods, bushfires, and drought, five times or more.
39. Forty-eight percent of respondents reported that they live within 50 kilometres of areas “frequently affected by extreme weather events or natural disasters”.
40. Overall, public risk perceptions and understandings of the threat of climate change in Australia appear to be strongly influenced and informed by direct and indirect

exposure to and experience with both acute and chronic natural disasters within the Australian environment.

41. Seventy-one percent of Australian respondents reported believing that climate change was influencing the frequency and intensity of extreme weather events (e.g., floods, cyclones, drought, bushfires).
42. Fifty-nine percent of Australian respondents thought that the region where they lived was vulnerable to the impacts of climate change, with two thirds of these respondents indicating that their location was 'very' or reasonably vulnerable.
43. Forty-five percent of Australian respondents reported having directly experienced noteworthy changes or events which they thought might be due to climate change.
44. 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.

**State and regional comparisons**

45. A number of State, Territory, and regional comparisons of survey responses are included in this report. Mean climate change concern levels, for example, were highest in Victoria and Western Australia, and lowest in Queensland and New South Wales, though mean concern levels were high across all states.
46. Differences between urban and rural Australian respondents were not as marked as might be expected. Rural respondents did report significantly greater residential and lifestyle exposure to and direct experience of natural disasters and extreme weather events. Further significant - though very modest – differences found across key measures for urban versus rural residents were with respect to belief in climate change, climate change concern, and trust in government. Rural respondents reported slightly lower acceptance of and expressed concern about climate change, and slightly less trust in government. No appreciable or significant differences were found with respect to other key variables such as climate change distress, self-efficacy, psychological adaptation, or behavioural engagement.

When a composite statement of individual survey item findings 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 71% 'very' or 'fairly' *certain* that this was happening, and 54% judged it is *already happening in Australia*. In addition 45% reported it being '*a serious problem right now'*, 66% reported being *very or fairly concerned* about climate change, 48% 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. Australian respondents, on the whole appear to feel that they themselves can and should be addressing this environmental threat (59%), that the Australian government, state governments, and corporate Australia should be doing the same (77%, 63%, 75%), they are prepared to greatly

reduce their energy use to help tackle climate change (64%) 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.

These summary findings cannot do justice to the extensive and rich Australian data set provided by our survey respondents. The report which follows can only attempt to more selectively capture and present what constitutes an initial and quite comprehensive set of research findings, covering a particular point in time. A subsequent Griffith University research program national survey was undertaken in July and August of 2011 to provide both longitudinal and repeated cross-sectional data and comparisons over time (samples of $n$ = 1037 repeat respondents and $n$ = 4347 new respondents), and to incorporate a number of additional psychological and situational parameters of particular interest and importance. The results of this 2011 survey are currently being finalised and will form the basis of a 2011 survey report to be released later this year. Further information regarding the 2010 and 2011 survey procedures, measures, overall methodology and administration, and associated research program publications can be obtained through either Michelle Ellul or Joseph Reser in the School of Applied Psychology at Griffith University, Gold Coast Campus.

**Queries relating to this report and research program can be directed to Michelle Ellul m.ellul@griffith.edu.au or Joseph Reser j.reser@griffith.edu.au.**

## BACKGROUND

The research was initiated as a collaborative undertaking between the Understanding Risk Research Group at Cardiff University (UK) and the Psychology and Climate Change Research Group within Griffith University's Climate Change Response Program. This 2010 research undertaking by Cardiff was a continuation of a number of convergent research initiatives addressing climate change and energy futures in Britain (e.g., Bickerstaff, Lorenzoni, Poortinga, Pidgeon, & Simmons, 2008; Lorenzoni & Pidgeon, 2006; Spence, Poortinga, Butler, & Pidgeon, 2011a; Spence, Pidgeon, Poortinga, & Venables, 2010; Spence, Venables et al., 2010). Coincidentally, there was an opportunity to undertake a comprehensive national survey research project addressing public risk perceptions, understandings, and responses to climate change and natural disaster phenomena within a national Australian context. This research was principally funded by the Australian Department of Climate Change under the Disaster Management Research Plan of the National Climate Change Adaptation Research Facility (NCCARF).

The multiple shared objectives of the UK and Australian surveys included documenting public perceptions and attitudes with respect to energy options and climate change considerations, as well as associated public understandings, concerns, and acceptance of policy alternatives. The Australian research also included a specific mandate to examine the nexus between climate change and natural disasters with respect to public perceptions, understandings, and responses. Survey methodologies and instrument items and design were finalised early in 2010, with an agreed set of common questions and items being given a high priority, notwithstanding differing agency and funding body commitments and priorities. The disciplinary base of all researchers was psychology, with a common interest in applying social, health, and environmental psychology to the challenges posed by climate change. The research findings reported in this document encompassed shared components of these national surveys conducted in Great Britain (UK) between 6 January and 26 March and in Australia between 6 June and 6 July 2010, with these periods roughly corresponding to periods of the main winter months in each country.

While many national surveys of public perceptions, beliefs, and responses to 'climate change' now exist and continue to be undertaken, collaborative international studies are rare. Yet national survey findings and data sets by themselves have limited interpretability and meaning without comparative touchstones and reference points. International collaboration between the Understanding Risk Research Group at Cardiff University and the Climate Change Adaptation Response Program at Griffith University has allowed for useful and meaningful comparisons between two countries in very different parts of the world which nonetheless share many common characteristics with respect to population and societal and cultural contexts, as well as political and energy issues and discourses. While similarities between Great Britain and Australia allow for sensitive and relevant comparisons, dramatic geographic and climate change exposure differences also allow for meaningful and informative contrasts. The findings reported and discussed in this report evidence many striking similarities and some differences, with a number of these being both unexpected and

challenging with respect to prevailing assumptions and conventional wisdom. Such research is valuable in providing strong external validity and a compelling global currency to national survey findings, and equally importantly, in identifying those areas, indicators, and specific findings that might require serious reflection and qualification with respect to their interpretation and generalisability.

## RESEARCH AND POLICY CONTEXTS

The strong interest in and proliferation of survey research with respect to climate change and energy futures (e.g., Brechin, 2010; Krosnick, 2008a 2008b; Leiserowitz, Smith, & Marlon, 2010; Leiserowitz, Maibach, & Roser-Renouf, 2010b; Leiserowitz, Maibach, Roser-Renouf, & Smith, 2011a; Leiserowitz, Maibach, Roser-Renouf, Smith, & Hmielowski, 2011b; Leviston & Walker, 2011; Rabe & Borick, 2010; Spence & Pidgeon, 2009; Villar & Krosnick, 2010; Weber & Stern, 2011) reflects the increasingly urgent nature of these related matters within the research community. It is also a strong indicator of political and policy needs for a more informed appreciation of public risk perceptions, understandings, and responses to media communications, and the relative success of public education and policy initiatives relating to climate change adaptation and mitigation. Using survey data to assess constituency preferences, public support, voting predispositions, and behaviour change has a long history across many domains (e.g., political polling, market research, health psychology), and is increasingly used in more reflective and strategic ways to explore public understandings of and psychological and behavioural responses to risk communications and social representations with respect to global climate change.

More recently, a clear need for sensitive measures and appropriate methodologies for documenting and monitoring important impacts and changes in the human landscape over time has become increasingly evident and urgent, such as in the context of addressing adverse impacts, fostering and monitoring adaptive responding on the part of communities, and with respect to evaluating the appropriateness and effectiveness of mitigation and adaptation policy initiatives (e.g., Brewer, 2008; Reser, Bradley, & Ellul, 2012a). This has led many social scientists engaged in environmental issue-focused survey research to review the value and purpose of existing measures and methodologies, and to refocus their work towards a better understanding of 'public understandings' as well as on psychological and behavioural responses to myriad and often conflicting risk communications relating to 'climate change' (e.g., Roser-Renouf & Nisbet, 2008; Trumbo & Shanahan, 2000; Weber & Stern, 2011).

While considerable survey research has been undertaken in the UK and North America with respect to global climate change, relatively little programmatic or longitudinal survey research has taken place in Australia (see Appendices C-E). Climate change survey questions, where they exist, have often constituted no more than several items in the context of broader survey exercises (e.g., Australian Bureau of Statistics (ABS), 2008; Department of Environment, Climate Change and Water NSW (DEECCW), 2009; Hanson, 2010) with some notable recent exceptions (e.g., Ashworth et al., 2009; Ashworth, Jeanneret, Gardner, & Shaw, 2011; Ipsos-Eureka Australia, 2010; Leviston, Leitch, Greenhill, Leonard, & Walker 2011; Leviston & Walker, 2011). This situation is changing with respect to the increasing

numbers and types of surveys relating to this issue, but not, it seems, with respect to programmatic research initiatives with the capacity to measure and monitor important changes in psychological, social and behavioural responses to climate change over time. This 'state of the survey research' does not reflect a lack of climate change interest or saliency in the case of Australia. Indeed for the past decade, climate change has been centre-stage in terms of public debate, political controversy, and as a background issue and a source of increasing anxiety (e.g., Flannery, 2005; Gascoigne, 2008; Hamilton, 2010; Pittock, 2009; Spratt & Sutton, 2008). The latter part of 2010 witnessed the ousting of a sitting Labor Prime Minister and the subsequent toppling of a government, largely or at least partly attributed to the non-recognition of climate change as a profoundly salient public issue and concern (Shanahan, 2010a, 2010b; Weller, 2010).

While the UK and Australia are both defined by their island status, these countries differ greatly in their size, geography, and location. The land mass of the UK, including Northern Ireland is 242,900 square kilometres, whereas that of Australia is 7,692,024 square kilometres, roughly 31 times the size of the UK. Population differences, 22 million (Australia) versus over 59 million (UK), mean that average population density in Australia is 2.6 people per square kilometre compared with 243 people per square kilometre in the UK. However, Australia is one of the most urbanised countries in the world, and despite its continental scale and breadth, approximately 77% of Australians live within 50 kilometres of the coast (ABS, 2006a). It should be noted however that all of Australia's largest cities are also coastal cities. The UK comprises Northern Ireland, England, Scotland, and Wales, though survey sampling by Cardiff was limited to Great Britain (England, Scotland and Wales). Australia, in contrast, is one country, encompassing an entire island continent.

More critically from a climatic perspective, Australia and the UK occupy very different latitudes and global hemispheres. Britain has a temperate climate and ample rainfall, whereas Australia is the driest inhabited continent, and its diverse climate includes a monsoon climate across much of the northern half of the continent, with both Mediterranean and temperate climates across the southwest and southeast parts of the land mass. These differences make comparisons in environmental risk perceptions and responses particularly interesting and valuable, with obtained similarities being in many ways more interesting than found differences, which might be readily expected given these geographic and demographic differences, despite a common language and similar political structures, as well as intertwined cultural histories.

Notwithstanding geographic and climatic differences, societal and cultural similarities and global socioeconomic comparisons are highly relevant to cross-national survey findings relating to a phenomenon and risk domain such as climate change, and to meaningful interpretations of found similarities and differences. In these respects, Australia and Britain are indeed similar. Australia was a colony of Britain, with a shared history extending over 300 years. Both Australia and the UK are developed economies, share a formal constitutional monarchy, have a common political and judicial history, and myriad international linkages spanning cultural exchange, education, immigration, residence, trade, and mutually reflective cultural identities. The UK, for example, is the world's 6$^{th}$ largest economy by nominal GDP

(and the world's first industrialized country). Australia is the 13th largest global economy, and has the 11th highest per capita GDP. While many features of social and cultural life in Australia and the UK underscore similarities and inform important differences, a key point is that it is exactly these geographic, climatic, and people-environment relations and collective experience differences, yet strong cultural and socioeconomic similarities and inter-linkages, which make the present cross-national survey findings particularly interesting and meaningful in the context of global climate change.

Also characterising the Australian geographic, climatic, and cultural contexts, is a wide spectrum of weather-related natural disasters, in a continent far more extensive and diverse than the United Kingdom (e.g., Pittock, 2009). As well, Australia is deemed by many to be the inhabited continent most exposed to the potential ravages of global climate change, with a current public discourse and understanding that would appear to see and understand current natural disaster events and impacts as clear manifestations of unfolding climate change (e.g., Garnaut, 2008; Intergovernmental Panel on Climate Change (IPCC), 2007; Lowe, 2005; Steffen, 2009). Yet there are only now emerging adequate databases and research programs within Australia with which to more closely consider the nature of public risk perceptions, understandings, and concerns, and the nature and extent of current psychological and social impacts of the perceived threat and consequences of climate change.

Notwithstanding the very substantial Australian research investment in the study of biophysical environmental change and impacts, and climate change adaptation and mitigation considerations respecting human settlements and infrastructure (e.g., Department of Climate Change (DCC), 2010; Steffen, 2009), scant attention has been paid to establishing a national database and monitoring program addressing important changes and impacts in the human environment (Brechin, 2010; Garnaut, 2008; Leviston & Walker, 2011). Additionally, very little consideration has been given to more psychological and social considerations relating to public understandings and concerns, psychological responses and motivations, adaptation and coping responses, and impacts on psychological and social wellbeing. This Australian survey was undertaken in 2010 in response to this crucial gap and clear need, and in the face of daunting climate change challenges (e.g., American Psychological Association (APA), 2009; Australian Psychological Society (APS), 2010).

The challenges of a comparative international study include more than historical factors that might be specific to particular countries or cultures (e.g., Cohen, 2007). These include the logistics of administering the survey at the same or equivalent time, similar mode of delivery where possible (online, telephone, face-to-face), translation equivalence if more than one language is involved, differing institutional ethics requirements and clearances, etc. Even timing can be problematic, in that comparable season of the year might be more important than parallel dates of administration, given the clear salience and priming character of prevailing weather circumstances for many respondents.

More challenging is the direct equivalence of item wordings, framings, and response formats and scales. Differing research teams may well have different constraints relating to the possible time series nature of what might be a current iteration or baseline study of a

national survey and prior item wordings or content, or funding requirements. In the current collaboration, the principal Australian funding came with the proviso that the research needed to address public risk perceptions *and* understandings of natural disasters as well as climate change, thereby increasing survey breadth and length, adding time, instrument, and space restrictions. Funding for an international comparative study is not a simple matter, as many funding agencies are loath to fund an expensive national survey in another country, notwithstanding the widespread call for just such collaborative work in the context of social science-based studies of climate change perceptions and responses (e.g., Agrawal, Orlove & Ribot, 2012). A number of invited potential partner countries in the context of the current collaboration were simply not able to find the funding necessary to undertake the survey. There are then the direct item and scale comparison issues, when the exigencies of the research and other standardisation and envisioned longitudinal monitoring have entailed modest differences in item and instrument design. Notwithstanding these clear challenges, which were all encountered in the present research with one exception (language), this collaboration across two dramatically different countries and climate change contexts was very successful and particularly valuable, yielding data which is arguably crucial in the context of this global issue requiring international policy responses.

The two research undertakings differed in survey presentation. The Cardiff survey was administered via computer assisted face-to-face interviews at respondent residences at geographically stratified sampling points in Britain, whereas the Australian survey was administered on-line to panel respondents residing in geographically stratified areas with particular population centres designated. Both research studies used highly regarded service providers Ipsos MORI (UK) and Qualtrics (Australia) for survey administration, data collection, and initial processing. Both surveys achieved broadly representative samples aged 15 and older of their respective populations. A substantial review of the literature has examined the relative strengths and merits of traditional survey administration methodologies compared with on-line surveys, with the strong consensus being that well designed and executed web-based 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, meant that a web-based survey was the only practical option for an in-depth survey including multiple rating scales, considered responses, and a number of open-ended qualitative response items. The striking similarities of many findings in this climate change comparison study involving two countries in very different parts of the world suggest that such administrative differences in the context of these carefully designed and executed collaborative surveys did not substantially affect the survey outcomes.

## RESPECTIVE DEMOGRAPHIC AND GEOGRAPHIC PROFILES

The survey sample sizes were 3096 for Australia and 1822 for Britain, with the respective populations of these countries being 22, 271, 900 (ABS, 2010 a) and 59, 853, 300 (estimate from 2001 census plus current growth statistics). Proportions of male and female respondents were very similar (Australia 47% male, 53% female; UK 48% male, 52% female). The age profile of Australian respondents was (15 to 24, 7.8%; 25-54, 60%; 55 plus, 31.6%), with the corresponding profile for British respondents being (15 to 24, 15%; 25-54, 49%; 55 plus, 36%) representing proportionally fewer younger respondents but proportionally more respondents aged 55 and over. The 2006 Australia census data give a more differentiated population distribution across these age cohorts (17.5%; 54.2%; 28.3%), reflecting the total national population profile, and the fact that respondents associated with a survey panel such as that used by Qualtrics are somewhat more likely to be of working age than is the case in the general population. The patterns of full- and part-time employment status were comparable across the Australian and UK samples, being 38%/20% and 36%/13% respectively. (Appendix A contains more detailed demographic information).

Of particular importance to both surveys was the nature of respondents' residential locations, as greater geographic proximity and/or general exposure to potential threats and climate change outcomes might be expected to influence risk perceptions and concerns, as well as anticipated or actual climate change responses and adaptations (e.g., Brody, Zahran, Vedlitz, & Grover, 2008; Hess, Malilay, & Parkinson, 2008). It is noteworthy that 71% of Australian respondents described their residential circumstances as either urban or suburban, a further 17% as 'country town', and 12% as rural or rural residential. Given the largely urban population and coastal demographic distribution of settlements in Australia, these figures are not surprising and closely reflect national figures. The Australian Bureau of Statistics (ABS, 2006b) reported that 68% of Australians live in major cities. Figure 1 provides a visual and spatial picture of the geographic and demographic distribution of survey respondents and survey sampling centres. Figure 2 shows the categorisation of Australia into regions reflecting varying degrees of remoteness. Together, figures 1 and 2 clearly indicate the dramatically different circumstances across rural and remote Australia.

The sampling procedure and ultimate survey sample reflected, in part, the nature of survey panels used by international research survey companies such as service provider used, Qualtrics. Qualtrics was provided with population centre nodes and radiating suburban, peri-urban and rural regions with designated postal codes, and ideal participant numbers. These geographically stratified nodes and proximal regions were then used to establish survey invitations to panel members reflecting respondent quota numbers sought. Appendix B provides population numbers and subsample sizes for nodes and associated regions selected for the survey. 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, for example, Longreach and Charleville in Queensland had seven and three respondents, respectively; Broome and Laverton, in Western Australia also had seven and three

respondents. Urban centre and region subsamples were 319 for Sydney, 348 for Melbourne, 311 for Adelaide, 315 for Perth, 98 for Hobart. The State of Queensland was strategically oversampled as a number of prospective climate change-related research projects were in train, and the geographic heterogeneity of Queensland and the diversity of population centre sizes and locations made Queensland an ideal State-based survey catchment.


*Figure 1*. Australian population distribution with survey sampling centres marked (Geoscience Australia, 2010).

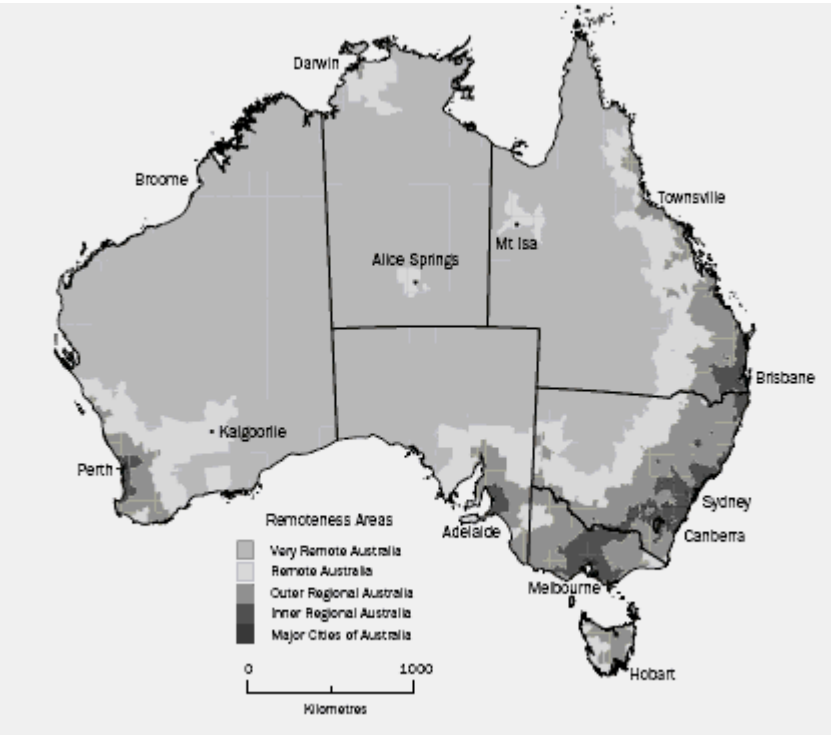


*Figure 2*. Remoteness areas of Australia based on the 2006 Census of Population and Housing (ABS, 2006b).

## OVERVIEW OF THE CONTENT AND SCOPE OF THE SURVEY

The Australian survey addressed a number of differing aspects and considerations relating to public risk perceptions, understandings, and responses to the threat and impacts of climate change. The project, for example, incorporated both an emphasis on energy futures in the context of the collaboration with Cardiff University, and the inclusion of natural disaster and extreme weather perceptions and responses, as a project funded under the NCCARF Disaster Management Research Plan. The project also included those more typical and policy relevant matters and considerations relating to public views and behavioural change. In addition the survey encompassed an unprecedented selection and number of specific psychological variables which, together, allowed for a more comprehensive and in-depth consideration of individual level psychological factors, interactions, and dynamic processes which might be influencing sense making, and psychological and behavioural responses and impacts in the context of a threat and phenomenon such as climate change. Where possible and practical these variables were measured using multi-item rating scales, allowing for more sensitive and valid measurement as well as more sophisticated and multivariate statistical analyses.

Additional variables not commonly found in such surveys included objective knowledge and other parameters which might be considered as aspects of understandings, and a number of convergent items which could clarify causal attributions relating to climate change and how these might be related to motivational processes and individual and collective efficacy in addressing the threat of climate change. In addition a number of conventional psychological measures were modified to be climate change-specific, such as

self-efficacy, concern, and distress. As well, the selection of variables and the development of items and measures were to a large extent theoretically and conceptually driven, with an interest in whether specific variables might be playing important mediating or moderating roles in psychological adaptation to and the psychological impacts of the threat of climate change. As no adequate measures of psychological adaptation or psychological distress in the context of climate change existed, provisional scales were designed and utilised to measure these important and very policy-relevant variables.

## ORGANISATIONAL GUIDE TO REMAINDER OF REPORT

The document which follows is both a research report describing, summarising, and discussing our research findings, and a more detailed research monograph which provides selective information relating to methods, measures, specific issues and caveats, and comparison findings, where possible and useful, with respect to comparable research findings in Australia, Britain, and North America. The progression of the report roughly follows the sequencing of material and items in the survey instrument, Appendix I, and an initial introduction to the circumstances, distinctive nature, and objectives of the research undertaking. As well, the document reflects a progressive organisation and coverage in terms of specific topics and underlying constructs and variables of particular relevance to this consideration of public risk perceptions, understandings, and responses to climate change and natural disasters. There exists, at points, some necessary redundancy and overlap with respect to reported findings, as repeated reference to some findings was required in the context of different comparisons and analyses.

Given the broad scope of the survey, the very substantial number of survey participants involved, and the importance of comparative findings across specific groups, and with other survey research findings in Australia and internationally, an extensive Appendix of findings and ancillary information is provided to which frequent reference is made. The table of contents and headings throughout the report have been designed in such a way as to facilitate the location of specific sections or findings of interest, and Appendix I contains all survey items and response formats in the form in which they appeared in the respective Australian and British surveys, and all pertinent descriptive statistics. As the research and survey instrument was essentially multi-method in its inclusion of nominal response categories, psychometric rating scales and measures, and open-ended, qualitative items, differing reporting and statistical analysis approaches are found, reflecting the nature and level of measurement of the data involved. Where necessary and/or useful, additional detail is provided in identified Appendix sections.

A final and important matter is that the report covers both the reporting of and comparisons with Cardiff survey items for all common items, along with the reporting and discussion of the majority of survey items which were specific to the Australian survey. In each instance where a composite measure of differing items has been used in statistical analyses, this is invariably an Australia only measure. Similarly extreme weather and natural disaster items are Australia only items. Indeed all survey items which come after item 21 in the survey are Australia specific items. When addressing any particular topic, however, such

as belief or concern, both common item findings, and Australia-specific item findings, may be discussed within the same section and/or argument.

## COMPOSITE VARIABLES

In the pages of the report which follow there is repeated reference to those *variables* and *measures* which reflected the considerations, questions, issues, and related 'constructs' that the survey addressed. Core variables, for example, included climate change risk perceptions, beliefs, knowledge, concerns, and associate psychological and behavioural responses, adaptations, and impacts. Each of these variables required conceptual specification and operational 'measures' by way of survey questions and response formats, with a number of these response formats including individual item rating scales and composite psychological scales addressing particular variables. Where no existing and climate change specific scales existed, modified or new scales were designed and used. Appendix item J provides a listing of the more important variables or constructs that were addressed and brief explanation of how each of these was 'operationalised' or measured in the context of the survey, with reference to existing psychological scales where appropriate. Following initial data analyses of modified existing scales and new scales, a multi-item composite scale was specified for each named variable for the purpose of all subsequent data analyses and reported results. These measurement issues are also addressed in text in each of the relevant sections.

Composite (multi-item) scales were constructed to measure 19 key variables. These variables fall into four groups:

1. Three of these variables (Biospheric values, Altruistic values, Egoistic Values) were measured using established and previously validated scales developed by Schultz (2001). Responses to the four items comprising each of these three environmental values scales were summed to form composite scores of each.

2. Two of the variables (Climate Change Media Consumption and Engagement in Carbon Emission-Reducing Behaviours) comprised checklists of items developed for the purposes of this study from knowledge of the extant literature. In each case, the number of items checked by the participants, out of 14 (for Media) or 15 (for Behaviour), was summed to form a composite score. The behaviour items were based on the work of Jon Krosnick, at Stanford University and the Woods Institute for the Environment, and the ABC News polls.

3. One of the variables (Objective Knowledge) was developed for this study based on the climate science literature and on similar items used in past studies (e.g., Ashworth et al., 2011, Roser-Renouf & Nisbet, 2008; Sundblad, Biel, & Gärling, 2007). As the items comprising this scale had objectively correct answers, a total score was obtained by summing all correct answers and subtracting from this the number of incorrect responses.

4. The remaining 13 variables (that is, Residential Exposure, Lifestyle Exposure, Prior Adverse Weather Experience, Connection to Nature, Trust, 'Green' Self-Identity, Belief in Climate Change, Climate Change Concern, Risk Perception, Distress, Self-Efficacy, Felt Personal Responsibility to Act, and Psychological Adaptation) comprised items selected, constructed and/or adapted for the present study from (a) items used in the Cardiff study, (b) items used in past studies (e.g., Gosling, & Williams, 2010; Kellstedt, Zahran, & Vedlitz, 2008, Krosnick, Holbrook, & Visser, 2000; Mayer & Frantz, 2004) and/or (c) our own pilot work.

For the thirteen variables in group 4 above, the scale development process was as follows. First, in the absence of available items or developed scales with acceptable psychometric attributes, new scale items were formed in expert group discussions, based on conceptual and theoretical considerations. Second, items that appeared to represent face valid indices of the focal constructs were grouped together to form rough initial scales. Third, convergent validity was assessed by computing inter-item correlations and Cronbach's alpha reliability coefficients. Poorly correlated items and/or those that detracted from scale reliability were considered for omission, and were in fact deleted if their loss did not to detract greatly from the content validity of the scale and/or from the variance of the total scale scores. Fourth, exploratory factor analyses (using Kaiser's criterion and principal axis factoring, followed by oblique rotation) was performed on the composites of items that purportedly measured multiple conceptually-related constructs (e.g., one analysis involved all the items intended to measure the constructs of Concern, Distress, and Risk Perception). While no items failed to load on their intended factor, in many of these analyses one or more items cross-loaded on multiple factors. These items were deleted or not, subject to other considerations such as the number of items remaining, the response distribution of all items, and the potential impact of item removal on content validity and internal consistency. With one exception, these processes provided support for the dimensionality and validity of the final set of thirteen scales. The single exception was that the items intended to measure Belief and Concern loaded on a single common factor, suggesting that, although these variables are readily and importantly distinguishable on conceptual grounds, the items we used to measure them did not provide sufficiently independent measures of the underlying constructs. In the fourth step in this set of analyses, further evidence as to the divergent and convergent validity of the scales was obtained by computing a series of confirmatory factor analyses. Given the importance of the distinction between belief in human-forced climate change and concern over the adverse impacts of climate change, and given that the fit of a structural model that distinguished these constructs was marginally satisfactory, the decision was taken to compute separate multi-item measures of Belief and Concern.

# RESEARCH FINDINGS

## ENERGY FUTURES

### ALTERNATIVE ENERGY SOURCES

Initial survey items were shared items with Cardiff collaborators relating to a principal focus of the UK survey, alternative energy sources. Item one in the survey explored attitudes towards alternative forms of electricity production. Previous research has found that people are more likely to favour renewable forms of electricity production (e.g., sun/solar power, wind power) rather than those based on the burning of fossil fuels and nuclear power (Pidgeon, Lorenzoni, & Poortinga, 2008; Poortinga, Pidgeon, & Lorenzoni, 2006; Spence, Venables et al., 2010). Respondents were asked how favourable or unfavourable their overall opinions or impressions were in relation to eight different sources of electricity generation (see Figure 3). Solar power was viewed more positively by both Australian (95% 'mainly' or 'very favourable') and UK respondents (88%), followed by wind power (91%, 82%), and hydroelectric power (80%, 76%), with Australians more strongly endorsing these renewable energies compared with UK respondents. In contrast, biomass, another alternative renewable energy source, was more strongly supported by British respondents (57%) than by Australian respondents (37%). Lower levels of support were found for fossil fuel generation. Gas was the most favoured form for both Australian and British respondents (53%, 56% respectively), followed by coal (16%, 36%), and oil (11%, 33%). Similar results were found in relation to nuclear power, with 31% of Australian and 34% of British respondents endorsing 'mainly' or 'very favourable' options. Overall, renewable energies were the most favoured form of electricity production for both Australian and British respondents, while oil, coal, and nuclear power were the least favoured. Also, Australians' attitudes were more highly differentiated than were those of British respondents.

***"Renewable energies were the most favoured form of electricity production for both Australian and British respondents"*** Photo: SCA Svenska Cellulosa Aktiebolaget

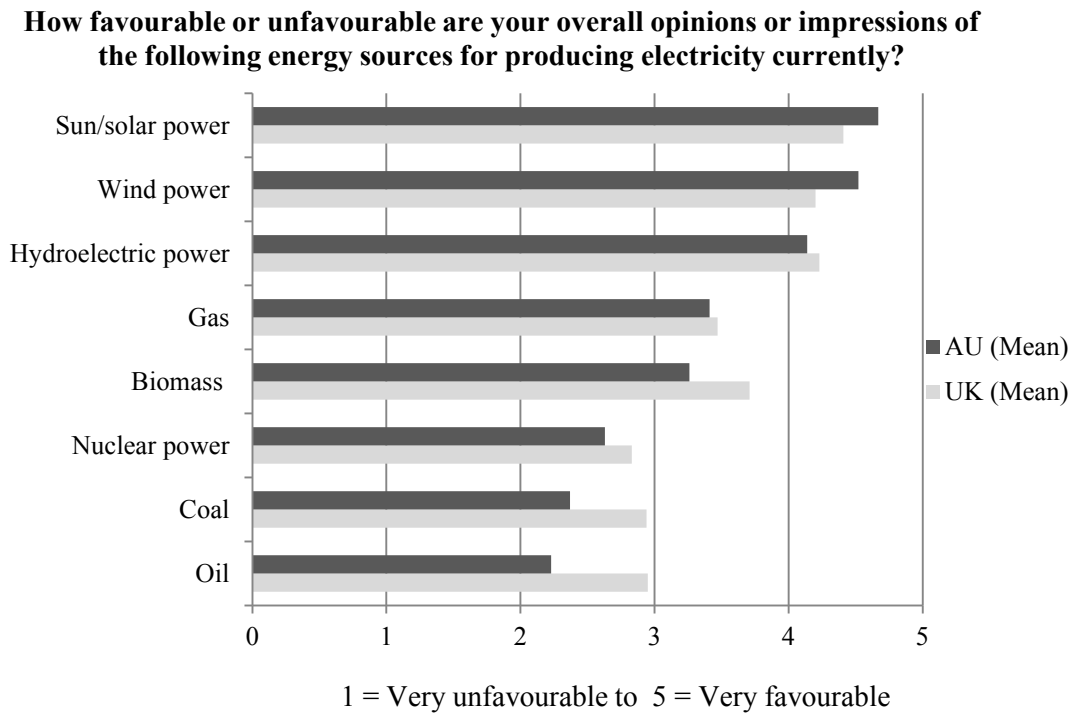


*Figure 3***.** Alternative energy sources.

Respondents from the UK and Australia shared similar concerns in relation to energy futures. Eighty-five percent of Australian respondents indicated that they were 'very' or 'fairly' concerned about the affordability of electricity in the future, as compared with 78.1% of British respondents. A large majority of respondents from both the UK and Australia were concerned about fossil fuel energy supplies (e.g., coal and gas) running out in the future, and that there would be power cuts. Not surprisingly, British respondents were much more concerned (59%) than were Australian respondents (33%) about terrorist attacks causing interruptions to electricity supplies, and about their nation becoming too dependent on energy from other countries (80.5%, 53% respectively). (See Appendix I).

## NUCLEAR POWER

Perceptions of the risk of nuclear power can be influenced by many factors, such as previous incidents and dread risk, but these factors also include dimensions of proximity, such as physical proximity, place attachment and 'experiential closeness' (e.g., Gifford, 2007; Van der Plight, 1992). The similarity of findings in the current study are striking, given that residents of Britain have considerable exposure to nuclear power and nuclear power plants whereas Australian residents by and large have had no exposure to, or direct experience with, such nuclear power generating facilities.

Respondents were asked a series of questions relating to nuclear power, covering such considerations as risks and benefits, and trust, as well as general attitudes and concern levels (questionnaire items #2, #3, #4, #5). When asked about the risks of nuclear power as contrasted with benefits, 42% of Australian respondents agreed that the risks of nuclear power either 'slightly' or 'far outweighed' the benefits, contrasted with 38% of British

respondents. Appreciable numbers of respondents from both countries answered 'don't know' to this question (Australia 10.1%, UK 6.6%). When the question was framed in terms of "**There are risks to people in Australia from nuclear power**", 65% of Australian respondents either 'strongly' agreed or 'tended' to agree, while the corresponding figure for British respondents was 61%.

Australian respondents were also asked whether they favoured or opposed the construction of nuclear power stations in Australia, with the results indicating that nearly 50% of respondents were opposed. Again a substantial proportion of respondents simply reported 'not knowing' (15%). More than half of the survey respondents in both countries were 'very' or 'fairly' concerned about nuclear power (Australia 57%, UK 55%) in their respective countries. Fifty-seven percent of British respondents as opposed to 40% of Australian respondents either 'strongly agreed' or 'tended to agree' with the statement, "**I don't really like the idea of nuclear power, but I reluctantly accept that we will need it to help combat climate change and improve energy security**". Respondents also were asked to indicate their level of trust in relation to nuclear power. Forty-six percent of Australian and 35% of British respondents indicated that they did not trust the nuclear industry to run nuclear power stations safely.

## VOTING PREFERENCES WITH RESPECT TO ENERGY OPTIONS

When respondents were asked to indicate how they would vote in relation to a number of alternative energy sources, both national samples were in favour of voting for renewable energies rather than nuclear or fossil fuels. Forty-one percent of both Australian and British respondents indicated that they would 'probably vote in favour' or 'definitely vote in favour' of building new nuclear power stations, while 92% of Australian and 82% of British respondents indicated that they would vote in favour of building new wind farms. Just over two thirds of Australian and British respondents indicated that they would vote in favour of spending taxpayers' money on projects designed to tackle climate change (67% and 68% respectively).

A very clear finding was that these respective survey samples preferred renewable sources of energy production to nuclear-powered facilities. Overall, respondents expressed a degree of concern about nuclear power, with nearly half of Australian respondents indicating that they did not trust the nuclear industry. British respondents were more likely to show support for nuclear power and to trust the nuclear industry. Public attitudes toward nuclear power, both internationally and in Australia appear to have been shifting over the past several years, as reliable and lower carbon emission alternatives to coal-fired power plants have been seriously addressed. While these public discussions were certainly salient prior to the 2010 surveys in Australia and Britain, the Fukushima Daiichi disaster as a result of the earthquake and tsunami in Japan on 11 March 2011may have profoundly influenced public views around the world. This hybrid natural/technological disaster resulted in the worst nuclear disaster since Chernobyl in 1986, with an estimated 20,000 lives lost in the Fukushima region (e.g., Marks, 2011). The Fukushima event is having profound consequences for Japan's industries and economy, and the future of its 54 nuclear reactors is now very uncertain (e.g., Aldhous & Marks, 2012). These current soundings on public attitudes to nuclear energy alternatives may

prove to be a very valuable benchmark, as post-Fukushima surveys around the world sample and monitor nuclear versus carbon emissions concerns. It is noteworthy that sixty nuclear reactors are under construction globally, with a further 163 ordered or planned, while a number of European countries are now committed to scaling down or ending their nuclear energy programs (Wallace, 2012).

# CLIMATE CHANGE BELIEFS AND UNDERSTANDINGS

## BELIEF THAT THE WORLD'S CLIMATE IS CHANGING

Important initial survey items related to climate change beliefs, risk perceptions, and understandings. The most 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 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 risk representation and communication nature of 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., Eagley & Chaiken, 1993; Crano & Prislin, 2008). 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 often 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 of course a very 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 interests, often slanted media coverage, and differing notional and objective climate change impact exposures across Australia (e.g., Dunlap & McCright, 2008; McCright & Dunlap, 201a, 2011b). Hence asking a question about belief in climate change can be interpreted, depending upon context, as a question about one's political affiliation or in-group/out-group status, contingent upon circumstance. Notwithstanding the complexities of the phenomenon, the issue, and careful question framing and response options in the context of a survey addressing public risk perceptions, understandings, and psychological responses, it has been very important to document as accurately as possible where survey respondents stood on this matter of belief or acceptance of the threat and/or phenomenon of contemporary 'climate change'.

Differences between Australian and British responses to the question, "**As far as you know, do you personally think the world's climate is changing?**" (item #8) were modest, with 73.9% of Australian respondents saying 'Yes', compared with 78.3% of British respondents. Of Australian respondents 7.8% gave a 'don't know' response compared with 6.4% of British respondents. Figure 4 shows relative percentage responses for the 2010 Australian and UK surveys, as well as for UK data from a prior Cardiff survey in 2005 using an identical item. This figure also shows corresponding U.S. survey findings for two points in time in 2010, and at one point in 2008 (Leiserowitz, Maibach, Roser-Renouf, & Smith, 2010; Spence, Venables et al., 2010).

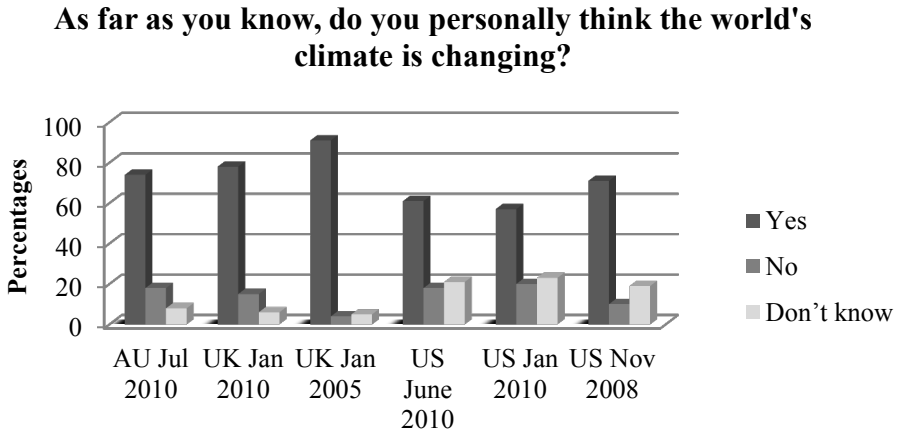


*Figure 4*. Respondents' reported belief in climate change from six surveys.

These North American findings must be interpreted with an awareness that reference to 'global warming' rather than 'climate change' can influence responses, and that reported belief in climate change in the United States can have charged ideological and political party identification connotations, which are more muted in Australia and the UK (Dunlap & McCright, 2008, 2010; Leiserowitz, Smith, et al., 2010; Lewandowsky, 2011; Whitmarsh, 2009). The U.S. findings, however, do provide some bases for comparison. These national findings indicate that roughly three quarters of Australian and British respondents believe that the world's climate is changing, with 'no' responses accounting for 18.2% and 15.3% of responses respectively. A subsequent survey question asked for extent of agreement with the statement, "**I am certain that climate change is really happening**" (#12a). With the item framed in this way, respondents had to indicate agreement with a very strong statement of certainty. Seventy-two percent of Australian respondents chose either 'strongly agree' (31%) or 'tend to agree' (41%), reflecting their belief and/or assessment that climate change is really happening. [As the equivalent British item was worded in terms of being uncertain, a direct comparison was not made].

Note that in both of these belief questions, respondents were asked for their *personal* view and appraisal, with this prefaced by "**as far as you know**". This encouraged respondents to give their own honest view, but perhaps also put participants on the spot, with their response resting upon their personal knowledge base, rather than asking their view of what others thought, or their assessment of scientific opinion. Clearly the framing of survey questions and response options can substantially influence responses with respect to the phenomenon and risk domain in question (e.g., De Vaus, 2002; Keren, 2011; Krosnick & Presser, 2010; Yeager, Larson, Krosnick, & Tompson, 2011). This present framing arguably elicited relatively conservative statements of acceptance or belief, premised as the question was on one's personal knowledge. One might also argue that in the case of item #8, more general reference to normal, naturally-occurring changes in climate was understood by some respondents. But the fact that 18.2% of individuals replied 'No', along with the larger climate change context of the survey, would suggest that this possibility was not at all likely.

It is, of course, important to compare and contrast our survey findings with those of other survey researchers, both in Australia and in North America, where many of the current

standardised items have been used. Such comparisons help both to validate and to benchmark these present survey findings. Not only are these Australian survey results very similar to British findings of the same year for the identical items in an identical survey section, but they are very similar to other Australian and North American findings using similar items, notwithstanding media reports to the contrary (e.g., Ashworth et al., 2011; Krosnick & Villar, 2010; Leiserowitz et al., 2010a, 2010b; Leiserowitz, Maibach, Roser-Renouf, Smith, & Hmielowski, 2011b; Leviston & Walker, 2010, 2011; Reser, 2011a, 2011b).

## COMPOSITE MEASURE OF BELIEF

A four-item composite measure of belief was developed to assist in parametric and non-parametric analyses of research data. The measure included items (#8, #9, #12a, #14) which related to the world's changing climate, causation (e.g., human activity, natural causes), and the certainty and immediacy of climate change impacts. Where responses were not on a 5-point scale, they were converted to such a scale and then scores were summed (possible range 4-24), with higher scores indicating a greater belief in anthropogenic climate change ($M$ = 15.90, $SD$ = 4.16). This scale had a Cronbach's alpha of .85.

## DEMOGRAPHIC ANALYSES

Demographic analyses revealed that female respondents reported significantly higher levels of belief in climate change ($M$ = 16.5, $p < .001$) than did male respondents ($M$ = 15.2). Respondents under 35 years also reported significantly greater levels of belief ($M$ = 16.5, $p < .001$) than did respondents aged 35-54 years ($M$ = 16.1), and respondents aged over 55 years ($M$ = 15.1). Respondents with a tertiary education reported significantly greater levels of belief ($M$ = 17.0, $p < .001$) than did respondents with a trade/certificate qualification ($M$ = 15.9) or those with a high school education ($M$ = 15.8). Interestingly, respondents without children or grandchildren reported significantly higher levels of belief ($M$ = 16.4, $p < .001$) than did parents/grandparents ($M$ = 15.7). Urban respondents had significantly greater levels of belief ($M$ = 16.1, $p < .001$) than rural respondents ($M$ = 15.5), and respondents reporting intention to vote either Green or Labor in the next federal election also reported significantly higher levels of belief ($M$ = 17.1, $p < .001$) than did respondents reporting an intention to vote for another party ($M$ = 14.9). No significant differences were found for belief between sub-groups of the sample formed on the basis of employment status, country of birth, or income.

## CORRELATIONAL ANALYSES

Belief in climate change correlated positively and strongly with climate change concern ($r$ = .82), distress ($r$ = .62), responsibility ($r$ = .62), self-efficacy ($r$ = .60), risk appraisal ($r$ = .60), psychological adaptation ($r$ = .59), objective knowledge ($r$ = .52), trust ($r$ = .48), green self-identity ($r$ = .47), and more moderately with residential exposure/vulnerability ($r$ = .38), behaviour ($r$ = .34), and subjective knowledge ($r$ = .16). All correlations were significant at $p < .001$.

## SUMMARY

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 very carefully measuring and monitoring public understandings and responses to this dramatic global threat.

'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'. That 74% of our Australian respondents (and 79% of British respondents) said yes, "that they thought the world's climate is changing", and a further 7% of Australian respondents did not know, is a strong statement of *acceptance* if not *belief in*. By asking about one's belief in various ways it is also possible to obtain a clearer and nuanced view of *strength of belief* or *conviction*, which is a more accurate gloss for subjective certainty in psychology, as distinct from the question of *uncertainty* in the context of public *risk perceptions* and assessments of a phenomenon such as climate change, and the underlying science.

These comparable Australian 2010 survey findings respecting belief, when averaged across the surveys referred to above, indicate that 77% of respondents accept or believe that climate change is occurring. While the matter of the meaning of 'climate change' for survey respondents in the context of such belief questions has routinely been raised, the reality is that in the context of these surveys, as in public discourse, media coverage, and climate change science, there was little question but that 'climate change' implied contemporary changing climate patterns reflecting some level of human causation or 'forcing'. Given that substantial numbers of respondents also indicated that they did not know or were uncertain when these response options were available, this level of acceptance or belief is very high. These Australian results are also very similar to the North American and British figures, which average out to 71.8% 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) (see Appendix N for comparisons of belief/acceptance of climate change).

This latter figure is essentially identical to that reported by a CSIRO survey undertaken in late 2010 by Ashworth and her colleagues (Ashworth et al., 2011). They reported that 78% of their respondents from a random sample of 1602 participants 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) and Griffith 2011 national survey findings (74%) (Reser et al., 2012c).

## DISBELIEF, SCEPTICISM, AND UNCERTAINTY

As indicated in the previous discussion of belief, framing the matter of acceptance or nonacceptance of climate change as an actual threat or altered condition of Earth's current climate systems as a matter of belief rather than risk perception and appraisal has a number of 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 nonbelief in the 'reality' of this threat and phenomenon can be and clearly is seen as 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, Harre, 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). Finally, the Australian public has not been receiving straightforward risk communications about climate change, or only reasonably objective environmental documentaries and media coverage of a natural or technological phenomenon, changing environmental condition, or threat. Rather the average individual has been exposed to a barrage of media coverage, often politically contextualised and biased, and in a context where there has been a well-documented and unprecedented effort by political conservatives and vested interest lobby groups to sway public opinion against acceptance of what has been in reality an unparalleled climate change science consensus on the genuineness and grave implications of this anthropogenically altered condition of the planet's atmospheric conditions and consequent changes in climate patterns (Boykoff, 2011).

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 Australian and British 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. This procedure allowed for a consideration of question framing effects, and for the reasonably unambiguous identification of respondents who could be characterised as de facto climate change disbelievers or strong sceptics. Table 1 summarises relative findings from differing questions relating to acceptance or belief in 'climate change'.

The 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 #9a or #9f (for item 9) to an 18.2% strong sceptic or disbeliever response to question #8, for the Australian sample. 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**" (#12a), 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 #8, #9, #12a, #14, and requiring a consistent disbelief or sceptical response for each of these four items, the total proportion of such respondents falls to 3.04%, or 94 individuals. When a less stringent criterion is adopted, requiring a 'no' response to question #8, and a nonbelief or sceptic response to at least two of the three questions #9, #12a, and #14, the proportion of survey respondents who could be characterised as disbelievers or strong sceptics becomes 6.5%, or 202 individuals. The comparable figures for British survey respondents were 1.4% (26 individuals, stringent criterion, i.e., answering sceptically to all four questions) and 4.0% (72 individuals, more inclusive criterion, that is, answering sceptically to three or four questions) respectively. It is noteworthy that just under two thirds (65%) of the 202 Australian respondents identified as sceptics were males, a finding 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.

Our Cardiff research collaborators have very intensively examined their own survey data with respect to what light their findings, along with several associated studies, could shed on differing types of public scepticism with respect to anthropogenic climate change (Poortinga, Spence, Whitmarsh, Capstick, & Pidgeon, 2011; Spence & Pidgeon, 2009; Whitmarsh, 2011). It would appear that scepticism is somewhat less prevalent in Britain than in Australia, and, as other studies have shown, is particularly common among individuals who hold politically conservative worldviews and traditional values. These British findings also suggest that their sceptic respondents were not likely to hold these climate change views with strong conviction, as was the case with those survey respondents holding strong self-transcendence and environmental values. While our common findings with Cardiff relating to the identification of climate sceptics are very congruent, ongoing collaborative research in Australia is only now examining interpretive communities, including sceptics and 'naysayers', following the lead of similar research in North America undertaken by Leiserowitz and colleagues (e.g., Leiserowitz et al., 2011b). The Griffith research program has been more specifically focused on establishing a research platform and database encompassing a spectrum of intra-individual change variables of particular relevance to documenting and monitoring climate change psychological adaptation and impacts.

*Table 1.* Relative findings from differing items relating to beliefs concerning 'climate change'[1]

| **Q8. As far as you know, do you personally think the world's climate is changing?** | | |
|---|---|---|
| | Australia % | Great Britain % |
| Yes | 73.9 | 78.3 |
| No | 18.2 | 15.3 |
| Don't know | 7.8 | 6.4 |

**Q12a. 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 | Australia | 30.8 | 40.6 | 12.2 | 10.1 | 4.7 | 0.3 | 1.2 |
| | UK | 24.0 | 35.0 | 12.0 | 22.0 | 6.0 | 0.8 | 0.4 |

Note. The British survey framed this item as 'uncertain' rather than 'certain', hence the scale percentages have been reversed to align with Australian results.

**Q9. Thinking about the causes of climate change, which, if any, of the following best describes your opinion?**

| | Australia % | UK % |
|---|---|---|
| a)Climate change is entirely caused by natural processes | 4.9 | 5.6 |
| b)Climate change is mainly caused by natural processes | 12.6 | 12.2 |
| c)Climate change is partly caused by natural processes and partly by human activity | 45.8 | 46.3 |
| d)Climate change is mainly caused by human activity | 27.6 | 24.3 |
| e)Climate change is entirely caused by human activity | 4.2 | 6.5 |
| f)I think there is no such thing as climate change | 2.7 | 2.2 |
| g)Don't know | 1.9 | 2.5 |
| h)No opinion | 0.4 | 0.4 |

**Q14. When, if at all, do you think Australia/Britain will start feeling the effects of climate change?**

| | Australia % | UK % |
|---|---|---|
| We are already feeling the effects | 54.0 | 41.4 |
| In the next 10 years | 9.2 | 13.5 |
| In the next 25 years | 7.5 | 13.9 |
| In the next 50 years | 4.5 | 10.9 |
| In the next 100 years | 2.3 | 4.9 |
| Beyond the next 100 years | 2.6 | 4.3 |
| Never | 5.5 | 3.6 |
| Don't know | 12.9 | 7.1 |
| No opinion | 1.5 | 0.3 |

[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 8, and selected either 'a' or 'f' to question 9, either 'strongly disagree' or 'tend to disagree' to question 12a, and selected 'never' in response to question 14. The more inclusive 6.5% figure was calculated on the basis of a no response to question 8, and 'disbeliever' or 'strong sceptic' responses to two of the three remaining belief questions (9, 12 ,14).

Question #12, a Cardiff item, examines a spectrum of considerations regarding belief, risks/benefits, intensity of emotional response, seriousness of threat, uncertainty, scientific consensus, and optimism about collective societal response. Question #12(i) asks for the extent of respondent agreement with the statement, "**Most scientists agree that humans are causing climate change**". The statement contains an unqualified and unspecified assertion respecting the extent and relative importance of a human causal contribution, which some respondents might understandably not entirely agree with. Nonetheless over one half of survey respondents either 'strongly' or 'tended to agree' with this statement, while only 19% 'strongly' or 'tended to disagree', with 23.6% neither agreeing nor disagreeing. These findings, along with those of other researchers, suggest that both trust in science and the perceived scientific consensus about the phenomenon of climate change is reasonably high. Two further questions in the present survey explored this issue. When asked, "**How much do you trust what different sources say about the environment**" (#27), scientists were viewed as far more trustworthy than were media or government sources, with 79.3% of respondents indicating that they did trust scientists. When directly asked, "**How much agreement do you think there is among scientists that climate change is happening**" (#28), over half (57.8%) again indicated strong to moderate agreement. This and the finding for item #12i are interesting in that they suggest that the public perceives more disagreement among scientists than actually exists, though there is general acknowledgement that scientists accept that contemporary climate change is happening and is the product of anthropogenic forcing. Respondents themselves, however, when asked about their own position on climate change, are in fact much stronger in their belief and acceptance of climate change and its anthropogenic character than they perceive scientists to be. These findings do not appear to directly implicate findings relating to respondents' trust of scientists when speaking about the environment ($r = .58$, $p < .001$ between #28 and #27a), but rather underscore the reality that climate change is a complex phenomenon associated with some level of understandable uncertainty, and that some measure of disagreement among scientists does not undermine their credibility (Barnett, Cooper & Senior, 2007; Brown, Harris, & Russell, 2010; Earle, 2010).

Additional items relating to climate change beliefs, risk perceptions, and understandings are shown in Appendix I (#10, #11, #12). These overall results suggest that climate change is seen as a very genuine risk domain, but one that is imbued with very mixed response associations with respect to costs and benefits, media treatment and credibility, perceived scientific consensus, and faith/trust in science and societal resources to effectively manage the climate change threat. What is perhaps most striking about these findings is their overall similarity across Australia and UK, and the wide spectrum of views represented. Among these items the largest difference was found in reported extent of agreement with the statement, **"I trust the Australian/British government to take appropriate action against climate change"** ($p < .001$) (#12g). Trust in government was clearly lower for Australian respondents. These findings with respect to trust must also be considered in the context of perceived uncertainties with respect to climate change as a phenomenon, likely impacts and severity for particular regions, and scientific consensus (e.g., CSIRO-BOM, 2007, 2009). It is noteworthy that Australian respondents expressed less uncertainty as to what the effects of

climate change will be, 55.8%, as compared with 69.5% of British respondents (#12j). Australians' experience with a visibly changing climate and continent, and the natural disasters of the past decade, have been seen and interpreted by many as clear evidence of the reality of climate change and its unfolding impacts. This issue will be further discussed in a later section of this report.

***"We are dealing with human perceptions and judgments of the nature, magnitude and possible implications and consequences of this profound threat"*** Photo: Timothy Swinson

## RISK PERCEPTION AND CLIMATE CHANGE

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 perceptions*, as what is being addressed is a seemingly profound risk and threat, and potentially planet-changing climate regime. This framing in 'risk' and 'perception' terms emphasises the clear importance and relevance of the interdisciplinary risk literature (e.g., O'Riordan, 1995; Sjöberg, 1987; Slovic, 2000, 2010) and that we are dealing with human perceptions and judgments of the nature, magnitude and possible implications and consequences of this profound threat. Unfortunately the survey research literature addressing climate change in risk perception terms is modest, and alternate framings and constructs are many, including attitudes, opinions, beliefs, perceptions, threat appraisal, subjective exposure, experienced vulnerability, and concern. An implicit distinction between risk perception and concern is that risk perception 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. Importantly, more recent conceptualisations of risk as analysis and risk as feeling do underscore the few degrees of separation between perceptual judgment and experiential response (e.g., Loewenstein, Weber, Hsee, & Welch, 2001; 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 et al., 2008), and also addressed several more applied and theoretical avenues relating to threat appraisal in 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.

### COMPOSITE MEASURE OF RISK PERCEPTION

Those survey items which directly relate to climate change risk perceptions include #10, #11, #14, #15a-d, and #59a-f. While multiple 'concern' items could be seen as relating to risk perception and vice-versa, we have treated these constructs and operationalised variables as distinct for the purpose of this survey research and in the context of comparison findings. Risk perceptions were measured using a 5-item scale adapted from Kellstedt et al's. (2008) Climate Change Risk Perception Scale (#59a-e). The original scale contained six items but one of the original items was excluded as it detracted from scale reliability. Items assessed respondents' perceived risks to their health, economic and financial situation, and environment from a personal and state perspective. Items included, for example: "**Climate change will have a noticeably negative impact on the environment in which my family and I live**", and "**In your opinion, what is the risk of climate change exerting a significant impact on economic development in your state**". Mean responses to all items were above the scale midpoint, indicating that respondents tended to agree that climate change posed a significant risk. Scores were summed (possible range 5-30), with higher scores indicating greater levels of perceived risk ($M$ = 18.94, $SD$ = 5.90). This scale achieved a Cronbach's alpha of .90.

## RISK PERCEPTION DEMOGRAPHIC ANALYSES

Female respondents perceived significantly greater risk of negative impacts from climate change ($M = 19.8$, $p < .001$) than did male respondents ($M = 18.0$). Those aged under 35 years perceived significantly greater risk ($M = 19.8$, $p < .001$) compared to those aged 35 to 54 ($M = 19.24$), and those aged 55 years and older ($M = 17.8$). Respondents with a university degree perceived significantly greater risk ($M = 19.38$, $p < .05$) than those with high school education ($M = 18.64$). Interestingly, those without children or grandchildren perceived significantly greater risk ($M = 19.31$, $p < .05$) than those with children or grandchildren ($M = 18.76$). Respondents intending to vote Green or Labor at the next Federal election perceived significantly greater risk ($M = 20.22$, $p < .001$) compared to those intending to vote for another party ($M = 17.94$). Non-home-owners perceived significantly greater risk ($M = 19.32$, $p < .05$) compared to home-owners ($M = 18.75$). Finally, respondents earning less than $60,000 perceived significantly greater risk ($M = 19.18$, $p < .05$) compared to those earning greater than $100,000 ($M = 18.52$). No significant differences were found for perceived risk to climate change across residential location, employment, or country of birth.

## RISK PERCEPTION CORRELATIONAL ANALYSES

Perceived risk with respect to climate change correlated strongly with climate change concern ($r = .73$), distress ($r = .71$), adaptation ($r = .64$), belief in climate change ($r = .60$), self efficacy ($r = .59$), and responsibility ($r = .57$). Significant but moderate correlations were found between risk and objective knowledge ($r = .44$), trust ($r = .43$), connection with nature ($r = .40$) and behaviour ($r = .37$). All correlations were significant at $p < .001$.

## SUMMARY

These risk perception findings would suggest that in addition to the Australian public's acceptance of climate change, they are also viewing this global phenomenon and its associated changes and impacts as a very real threat. This framing and consideration in terms of risk also underscores the reality that media coverage of climate change, and public awareness and education initiatives and policies, are all aspects of informal and formal risk communication. Individual and community responses and underlying psychological processes relating to this threat and risk domain include making sense of and appraising just how serious the threat is in terms of magnitude, extent, and immediacy, and what the implications and possible consequences might be, globally, locally, and personally. While framed in risk perception terms, we are of course also speaking of subjective exposure and experienced vulnerability. Again, the information environment in terms of media coverage, public discourse, and popular science and documentaries figures powerfully here, not only in the social construction and representation of the environmental problem and threat, but in assessing one's own feelings and thoughts, and coping strategies and response options (e.g., Boykoff, 2011; Carvalho, 2005; Reser et al., 2012a). The risk perception findings strongly confirm that respondents by and large accept that this is a very salient and meaningful threat, quite possibly requiring individual and household responses as well as collective and

governmental action and resolve. The correlational findings also begin to say something about associated psychological responses and impacts to this global threat and changing nature and condition of the natural environment, such as concern and distress. The strong correlations between risk perceptions and climate change concern, distress, self-efficacy, and responsibility further suggest that risk perceptions are directly related to respondent motivational responses. The next section addressing climate change concern begins to address this psychological response side of beliefs and risk perceptions (Ryghaug, Sørensen, & Naess, 2010).

***"Risk perception findings would suggest that in addition to the Australian public's acceptance of climate change, they are also viewing this global phenomenon and its associated changes and impacts as a very real threat"***

## CLIMATE CHANGE CONCERN

An important focus of the research was to measure, examine, and document *public concern* levels with respect to climate change, and their putative role in mediating adaptation and mitigation responses and the possible psychological and social impacts of the climate change threat. There is understandable but often confusing conceptual and measurement overlap between the constructs of risk perception, appraisal, response, and concern(s) in the context of an environmental threat and phenomenon such as climate change (Reser, 2010). Nonetheless an attempt was made in this research to utilise a convergent set of previously tested survey items relating to climate change concern which might form the basis for a more satisfactory approach to the measurement and monitoring of public climate change concern levels.

Environmental concern relates directly to environmental risk perceptions and sense making with respect to perceived environmental changes and threats, and media coverage of environmental risks, degradation, and hazards, but such concern is arguably better viewed as relating more to one's *psychological response and state* rather than to *risk perceptions or appraisals* per se though these are of course interacting processes (Cvetkovich & Earle, 1992; Pidgeon, Kasperson, & Slovic, 2003; Reser, 2010; Slovic, 2000; Wandersman & Hallman, 1993). An extensive literature on *environmental* concern exists, with many authors tending to treat environmental concern and environmental values almost synonymously (e.g., Schmuck & Schultz, 2002; Schultz, 2001; Schultz, Shriver, Tabanico & Khazian, 2004; Stern & Dietz, 1994). Environmental concern is a sensitive and meaningful psychological indicator in the context of psychosocial impact assessment (e.g., Reser & Bentrupperbäumer, 2001, 2005) and reflects an important dimension of broader public issue perceptions and understandings.

Concern about the threat and/or perceived physical environmental impacts of climate change is a more specific type of environmental concern, relating to the perceived nature, course, and implications of this threat and phenomenon. It has been unclear as to whether one's perception, appraisal, and psychological response to media representations or perceived instances of climate change differ from risk perceptions and psychological responses to other natural or technological environmental threats (e.g., Baum, Fleming, & Davidson, 1983; Reser & Swim, 2011). Many social scientists have used 'public concern' about climate change as a principal construct and measure in their research on public perceptions and responses to climate change, and this has been the case in this present research. This also reflects a history of social science research moving from 'global environmental change' to 'global climate change' (Chen, Boulding & Schneider, 1983; Gardner & Stern, 2002; National Research Council (NRC), 1992, 1999, 2010a, 2010b; Stern, 1992).

The initial and very direct survey question relating to public concern about climate change was, **"How concerned, if at all, are you about climate change, sometimes referred to as 'global warming'?"** (#7) (See Figure 5). This item has particular face validity, is transparent and meaningful to respondents, and comes close to the beginning of the survey, limiting the influence of further items and issues. The wording also does not presume concern, and response options allow for the selection of 'don't know' or 'no opinion'

response. As with many initial items in the survey, this item was identical to the Cardiff item. The mean responses to the question on a four-point scale were very similar for the Australian ($M$ = 2.83, $SD$ = 0.93) and British ($M$ = 2.90, $SD$ = 0.92) samples, and indicated that respondents were, on the whole, appreciably concerned about climate change, with 66.3% or two thirds of Australian respondents, for example, giving a 'very concerned' or a 'fairly concerned' rating response as compared with 71% of British respondents. Hence, notwithstanding these modest differences with respect to levels of climate change concern, both Australian and British respondents reported that they were, on the whole, quite concerned about climate change.

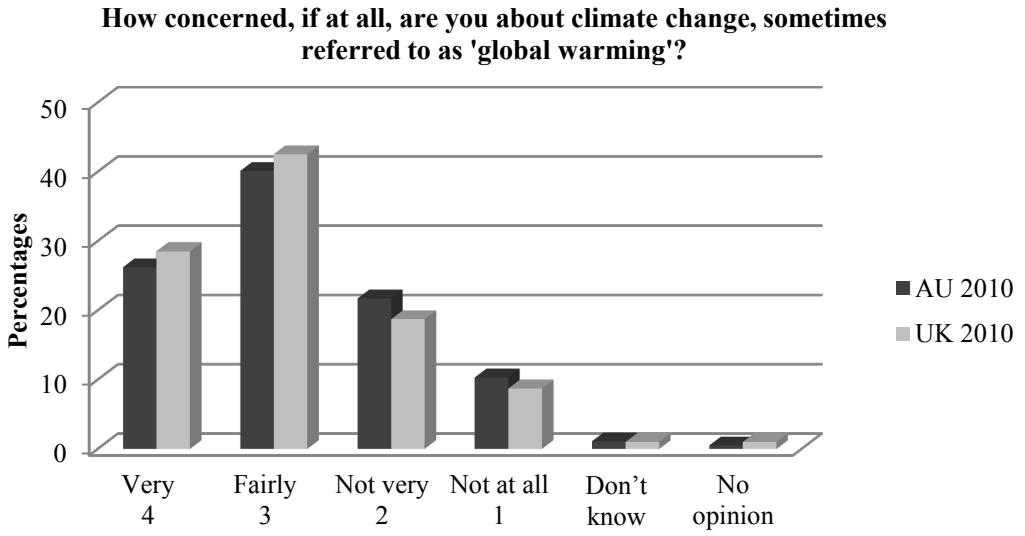


*Figure 5*. Climate change concern.

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: **"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?"** (#16, #17). (See Figures 6 & 7).

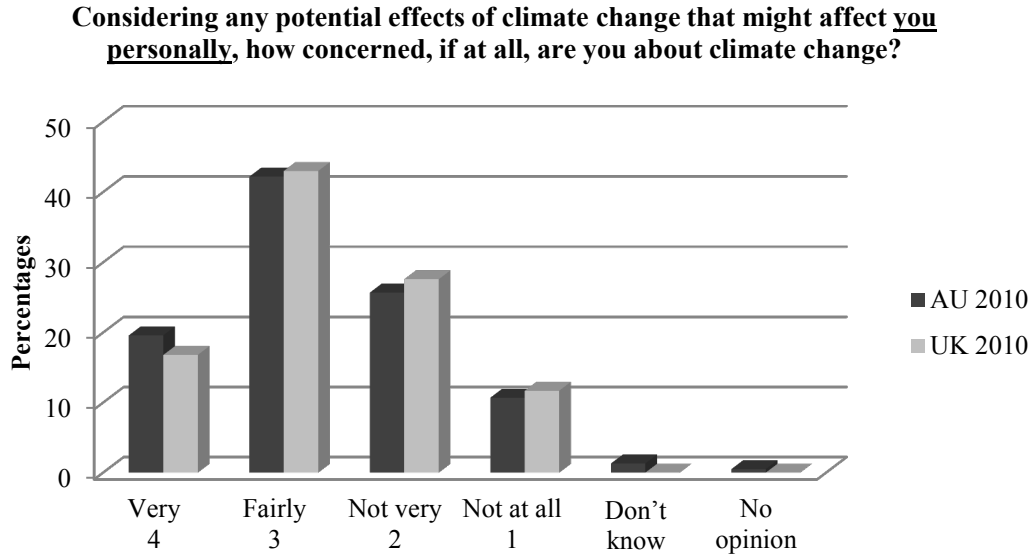


*Figure 6.* Climate change concern - personal relevance.

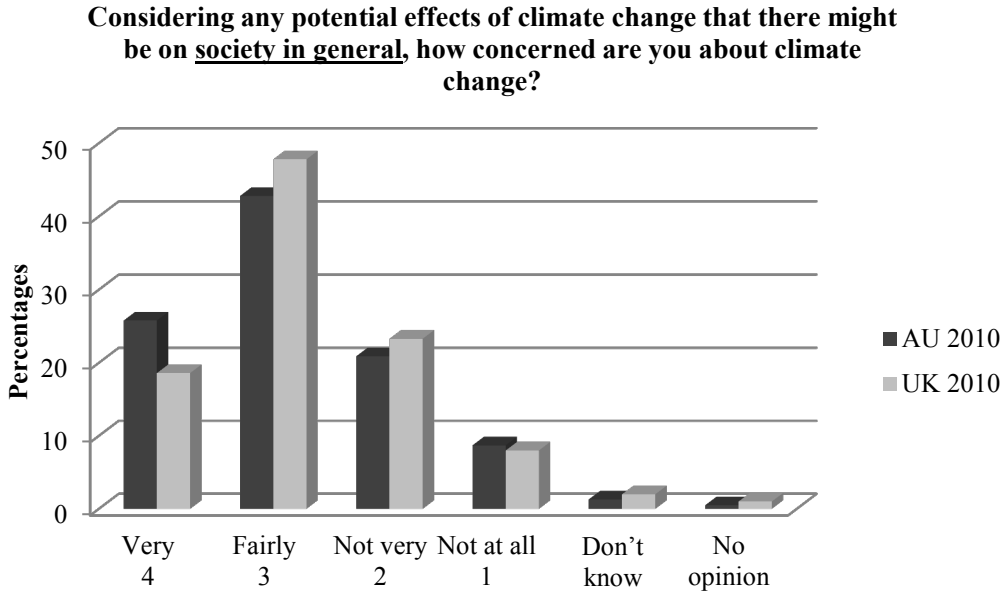


*Figure 7.* Climate change concern - societal relevance.

The mean concern ratings for Australian and British respondents to expressed concern about the personal impacts of climate change were ($M = 2.72$, $SD = 0.90$) and ($M = 2.63$, $SD = 0.89$) respectively. The mean ratings with respect to adverse impacts on society in general were ($M = 2.87$, $SD = 0.90$) and ($M = 2.77$, $SD = 0.84$). (Note: These means are based on the 4-point rating scale). In absolute terms concern levels were quite high, with 61.8% of Australian respondents and 59.8% of British respondents indicating that they felt either 'very concerned' or 'fairly concerned' about personal consequences, and 68.6% of Australians and 66.4% of British respondents indicating that they were either 'very concerned' or 'fairly concerned' about the impacts of climate change on society in general. An additional 25.7%

and 27.6% of Australian and British respondents, respectively, indicated a modest level of concern about the personal impacts of climate change, and 20.9% and 23.3% about societal impacts. It is important to note that these items were questions about the personal and societal psychosocial *impacts* of climate change, not the more abstract phenomenon of 'climate change'. These findings may also reflect the pervasive risk appraisal finding that individuals tend to exhibit a measure of optimism bias with respect to personal adverse consequences in the context of risks generally (e.g., Pohl, 2004; Weinstein, 1980), as well as a more nuanced psychological distancing in terms of local and personal threats or events which are more immediate geographically and temporally as contrasted with global and societal threats and events (e.g., Liberman, Trope & Stephan, 2007; Spence, Poortinga, & Pidgeon, 2011b; Uzzell, 2000, 2004).

A further way to assess concern levels among respondents was to ask about the seriousness of climate change, **"If nothing is done to reduce climate change in the future, how serious a problem do you think it will be for Australia/the world"?** Respondents were initially asked about the seriousness of climate change for Australia (#10), then for the world (#11). (Corresponding questions were not included in the British survey). See Figure 8. A large proportion of respondents indicated that climate change will be a 'very' or 'somewhat serious' problem for the **world** if nothing is done (81.8%), with a similar percentage (77.9%) endorsing the seriousness of the problem for **Australia**. Many studies addressing climate change risk perceptions and concerns in the context of such questions canvas both local and known environments and countries as well as geographically distant regions of the world (e.g., Leiserowitz et al., 2010a, 2010b, 2011a, 2011b; Spence, Poortinga, & Pidgeon, 2011b; Uzzell, 2000, 2004).

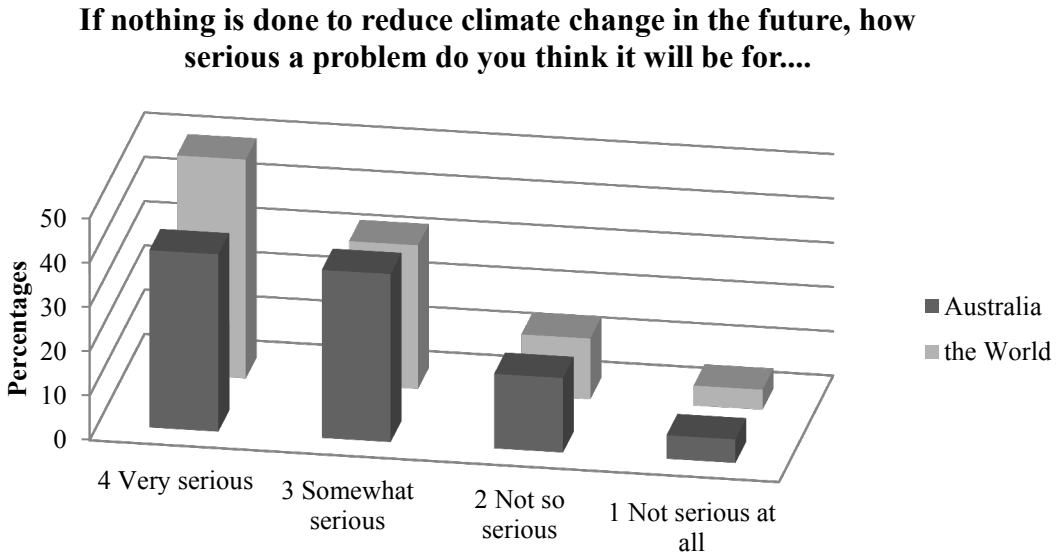


*Figure 8*. Seriousness of climate change for Australia and the world.

## CLIMATE CHANGE CONCERN ACROSS AUSTRALIA

When comparing climate change concern across Australia, respondents from Victoria and Western Australia indicated the highest levels of concern (climate change concern was

based on a response to item #7, of either ‘very’ or ‘fairly concerned’), 72.5%, 72.3% respectively, with these state findings being somewhat different from Queensland and New South Wales, where respondents reported the lowest (but still strong) levels of concern (62.1% reported in both states). Refer to Figure 9. If we compare these results to findings released by the Australian Bureau of Statistics (2008), the Australian Capital Territory reported the highest level of climate change concern (in 2007-2008), as contrasted with the lowest levels of concern reported in the Northern Territory. See Figure 10. These single item findings are replicated by regional comparisons using the composite measure of concern, discussed in the next section of the report.

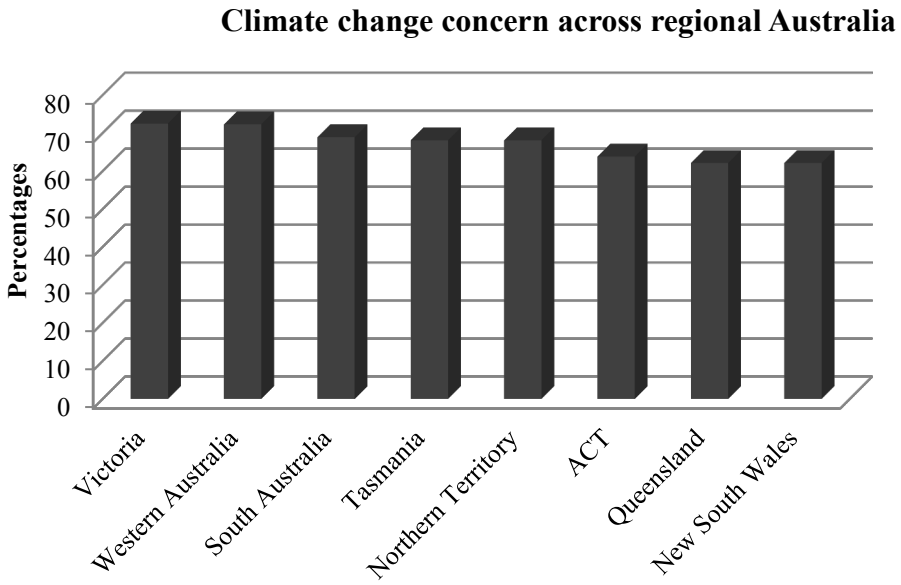


*Figure 9*. Percentage of respondents reporting climate change concern, based on item #7 'very' or 'fairly' concerned

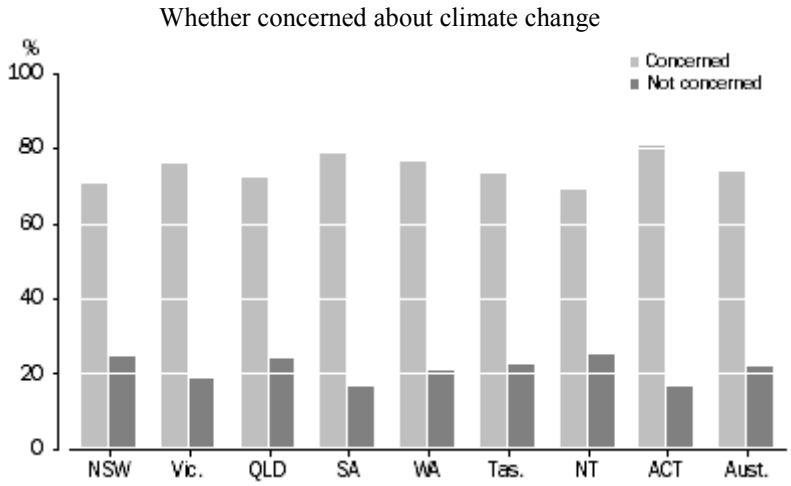


*Figure 10*. Percentage of respondents reporting climate change concern in 2007-2008 as indicated by the Australian Bureau of Statistics.

## COMPOSITE MEASURE OF CLIMATE CHANGE CONCERN

The results relating to item #7 are very consistent with other survey items related to concern, such as the perceived seriousness of the problem (# 10, #11), the immediacy of impacts (# 14, #32), and the personal and societal consequences of climate change (#16, #17, #22). The results are also similar to other recent social science-based surveys addressing climate change in Australia (e.g., Ashworth et al., 2011; ABS, 2008; Ipsos-Eureka, 2010; Lamberts, Grant, & Martin, 2010; The Climate Institute, 2008, 2010). These findings give further credence to preceding belief and risk perception results, and are notably different from many media reports suggesting that the Australian public is relatively unconcerned about and dismissive of the threat and implications of climate change (e.g., Reser, 2011a, 2011b).

In view of the nature of the parametric and structural equation modeling analyses planned for this research, a composite measure of climate change concern was developed. The seven-item measure included items relating to general levels of concern, as well as more specific concerns as to the consequences of climate change (#7, #10, #11, #16, #17, #23m, #32). The measure included items relating to the perceived seriousness of the problem at local, global, personal and societal levels. The scale contained items such as, "**Considering any potential effects of climate change that might affect <u>you personally</u>, how concerned, it at all, are you about climate change?**" Scores were summed (possible range 7-32), with higher scores indicating greater levels of concern ($M$ = 23.34, $SD$ = 6.61). This scale achieved a Cronbach's alpha of .95.

## CLIMATE CHANGE CONCERN DEMOGRAPHIC ANALYSES

Female respondents indicated significantly greater levels of concern ($M$ = 24.5, $p <$ .001) than did male respondents ($M$ = 22.0), consistent with previous Australian research findings (ABS, 2008; Ashworth et al., 2011; Searle and Gow, 2010; Sweeney Research, 2010; The Climate Institute, 2008). Young adults (less than 35 years) evidenced significantly higher levels of concern ($M$ = 24.3, $p <$ .001) than did respondents aged over 55 years ($M$ = 22.0), which is also consistent with other survey research undertaken in Australia (e.g., ABS, 2008; Sweeney Research, 2010). Respondents with a university degree had significantly higher levels of concern ($M$ = 24.2, $p <$ .001) than did those with a certificate/trade ($M$ = 23.1) or high school education ($M$ = 22.0). Respondents without children or grandchildren had greater levels of concern ($M$ = 24.1, $p <$ .001) than did those who were parents and/or grandparents ($M$ = 23.0). Urban respondents evidenced slightly higher levels of concern ($M$ = 23.5, $p <$ .001) than did rural respondents ($M$ = 22.9), with non-home-owners also indicating greater levels of concern ($M$ = 23.8, $p <$ .001) than did home-owners ($M$ = 23.1). Respondents intending to vote Green or Labor at the next Federal election evidenced significantly greater levels of concern ($M$ = 25.5, $p <$ .001) than did those intending to vote for another party ($M$ = 21.7). No significant differences were found for climate change concern across groups of respondents differentiated by income, employment status, or country of birth. In general the between-group differences in concern were similar to those previously reported in relation to acceptance or belief in climate change. (See Appendix L).

## CLIMATE CHANGE CONCERN CORRELATIONAL ANALYSES

The more general picture of how climate change concern relates to other salient survey variables is found in Appendix K. Not surprisingly climate change concern correlates strongly with belief or acceptance of climate change ($r$ = .82), risk perception ($r$ = .73), responsibility and willingness to act ($r$ = .76), climate change distress ($r$ = .78), psychological adaptation to climate change ($r$ = .73), climate change-specific self-efficacy ($r$ = .73), and behaviour ($r$ = .44). A significant, but quite modest association was found between concern and previous exposure and experience with natural disasters ($r$ = .12). All correlations were significant at $p < .001$. The findings indicated a very strong correlation between risk perception and climate change concern, operationalised as two independent composite scales, notwithstanding the fact that *risk perception* and *appraisal* processes are conceptually distinct from resultant climate change *concern* (e.g., Reser, 2010). Again, risk perception and risk appraisal are arguably based on an evaluation of an external threat, whereas climate change or environmental concerns are psychological responses to this risk perception/appraisal which in turn reflect the psychological impact of the risk as mediated by risk appraisal (Doherty, & Clayton, 2011; Reser, Morrissey & Ellul, 2011).

There is substantial consistency and coherence in these correlational findings. It 'makes sense' that the Australian public, by and large, accept and appreciate the implications of climate change across a spectrum of psychological responses. It is worth noting that the correlations between concern and other core variables are particularly strong, accounting for between half and two thirds of the variance in most instances. Australian respondents are concerned about and motivated to address this issue. They are experiencing some distress at what is at stake and the seeming national and global lack of action in the face of this arguably profound threat, as will be discussed, and they are changing how they are thinking and feeling about climate change, as well as some aspects of their daily lives that have carbon footprint implications.

## COMPARATIVE FINDINGS OF CLIMATE CHANGE CONCERN

How do the results found in the current study relating to public levels of climate change concern compare to other Australian and overseas findings? Figure 11 provides an example of two additional national representative surveys, one conducted in Australia by the CSIRO and the other in America, undertaken by the Yale Project on Climate Change (Leiserowitz, Smith, et al., 2010; Leviston & Walker, 2010). Whilst the wording of the question and response format is slightly different from the current survey, (i.e., replacing 'concerned' with 'worried'), overall, the results suggest a large proportion of respondents were on the whole, 'very' or 'somewhat' worried about climate change, with somewhat lower levels of concern found in the U.S. as compared with Australia and Britain (65% CSIRO, 55% Yale University). Overall, public levels of climate change concern remain quite high. These results are consistent with Neilsen's 2011 Global Online Environment & Sustainability Survey, which included more than 25,000 respondents from 51 countries (Nielsen, 2011). Whilst the findings from the Nielsen survey suggest climate change concern has decreased in recent years, a large majority of respondents indicated they were 'very' or 'quite concerned'

about climate change (69%). This was down from (72%) in 2007. The Nielsen report (2011) suggests one of the reasons for the drop in concern is a focus on other environmental issues (i.e., air and water pollution, pesticides, packaging waste, and water shortages). Daily worries such as job security, crime, and economic well-being, and a decrease in the climate change media coverage, may all be contributing to this slight decrease in public concern levels. Interestingly, a recent CSIRO survey (2010) asked respondents what they thought were the three most important environmental issues facing Australia today. Climate change issues accounted for almost 25% of responses and were clearly the most important environmental issue in this recent and in-depth survey (Ashworth et al., 2011).

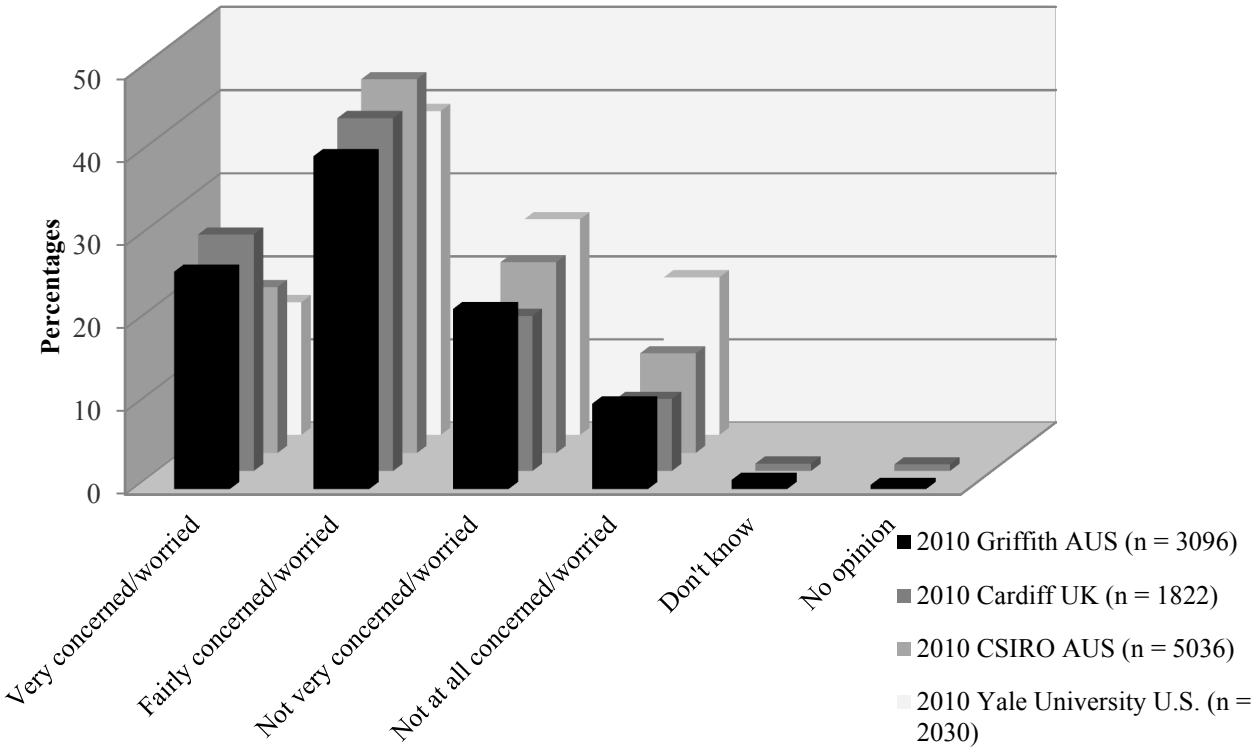


*Figure 11*. Public concern levels.

Note: The percentage figures for the CSIRO have been estimated from graphs included in their 2011 report (Leviston & Walker, 2011).

## GENERAL ENVIRONMENTAL CONCERN

A number of items were included in the current survey to address *general* environmental concern. A single question asked respondents to indicate their extent of agreement with the statement, "**I think of myself as someone who is very concerned with environmental issues**," (#21) (see Appendix I). Clearly the focus of concern changes here, in part because this becomes, in effect, a self-perception judgment, and in part because the focal reference is 'environmental issues' rather than 'climate change'. The respective mean ratings for this self-ascription scale were essentially identical for Australian ($M$ = 3.50, $SD$ = 0.99) and for British respondents ($M$ = 3.49, $SD$ = 1.07) on the 5-point scale. Respondents

from Britain on the other hand more strongly identified with the aims of environmental groups such as Greenpeace and Friends of the Earth ($M = 3.37$, $SD = 1.14$) than did Australian respondents ($M = 3.17$, $SD = 1.15$), $p < .001$.

## SUMMARY

These findings relating to climate change concern, taken together, both validate and inform our general finding from Australia and Britain that survey respondent climate change concern levels are, contrary to widespread media reports of public concern, very high. It would appear to be the case that such measures of climate change concern provide a very useful and sensitive index of public risk perceptions and understandings, as well as psychological responses and impacts of the threat of climate change. The research literature would suggest that these concern levels and psychological impacts may be more immediately and directly the product of multi-media coverage and treatment of the *threat* and unfolding *global* impacts of climate change (e.g., Boykoff & Boykoff, 2007: Carvalho & Burgess, 2005; Eckersley, 2008; Graumann & Kruse, 1990; Smith & Joffe, 2009), although current findings suggest that direct personal encounters with what are perceived to be climate change events and environmental impacts are clearly ubiquitous and of particular salience.

*"Australian and British respondents reported that they were, on the whole, quite concerned about climate change"*

## PERCEIVED CAUSES OF CLIMATE CHANGE

Public perceptions of the causes of climate change relate to perceptions and understandings of the anthropogenic forcing of climate change. Figure 12 indicates the comparison percentages to each of the response options, "**Thinking about the causes of climate change, which of the following best describes your opinion?**" (#9). A remarkable similarity in causal perceptions is evident, with 45.8% and 46.3% of Australian and British respondents choosing the option, "Climate change is partly caused by natural processes and partly caused by human activity", and a further 27.6% and 24.3% selecting the response option, "Climate change is mainly caused by human activity". In contrast to this predominant view, approximately 18% of both Australian respondents and British respondents selected one of the following response options: "Climate change is entirely caused by natural processes" or, **"**Climate change is mainly caused by natural processes" with this latter response option nonetheless acknowledging some human causal contribution. These findings again indicate strong similarities across the two national samples, and a shared perception by an overwhelming majority of respondents (90% and 89%) that human activities are a causal factor in contemporary climate change. It is interesting that the response option, "I think there is no such thing as climate change" attracted only 2.7 and 2.2 percent of responses, and the response option "climate change is entirely caused by natural process'' attracted only 4.9 and 5.6 percent of responses respectively, suggesting that strong scepticism and actual disbelief in climate change characterise very small proportions of Australian and British respondents (in the context of this item, 7.6% and 7.8%), much less than media coverage might lead one to believe.

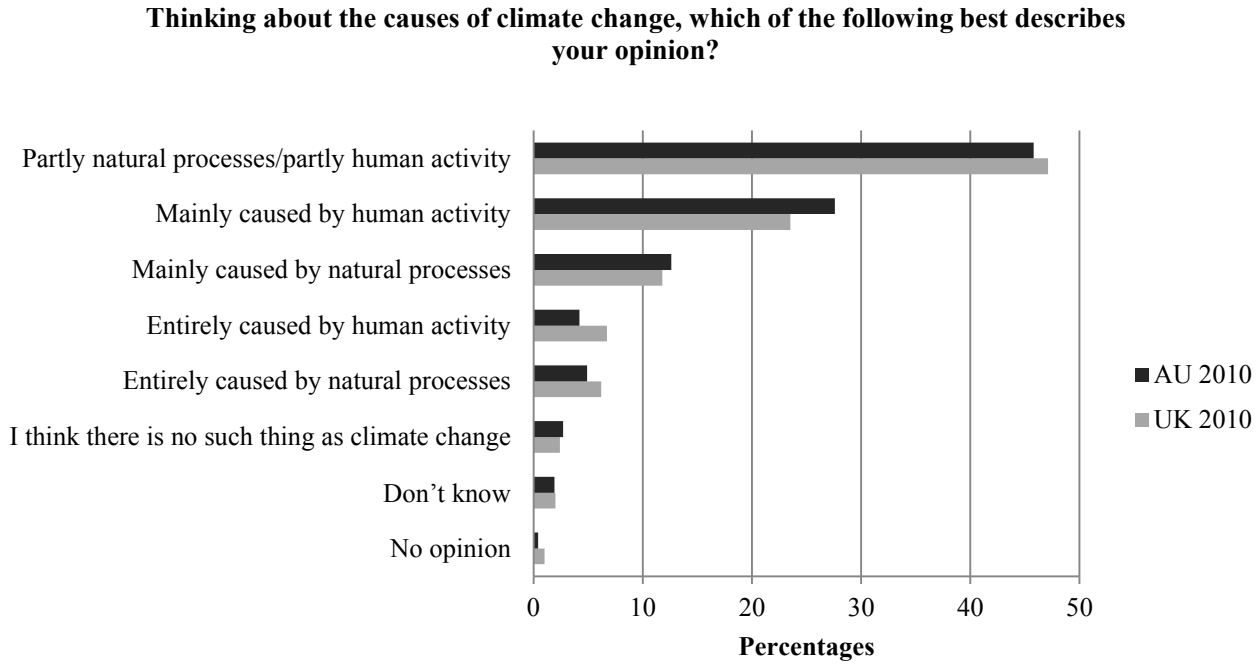


*Figure 12*. Causes of climate change

Again, it is instructive to compare these findings with the 2010 US survey cited previously (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 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 O 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 13, and Appendix O).

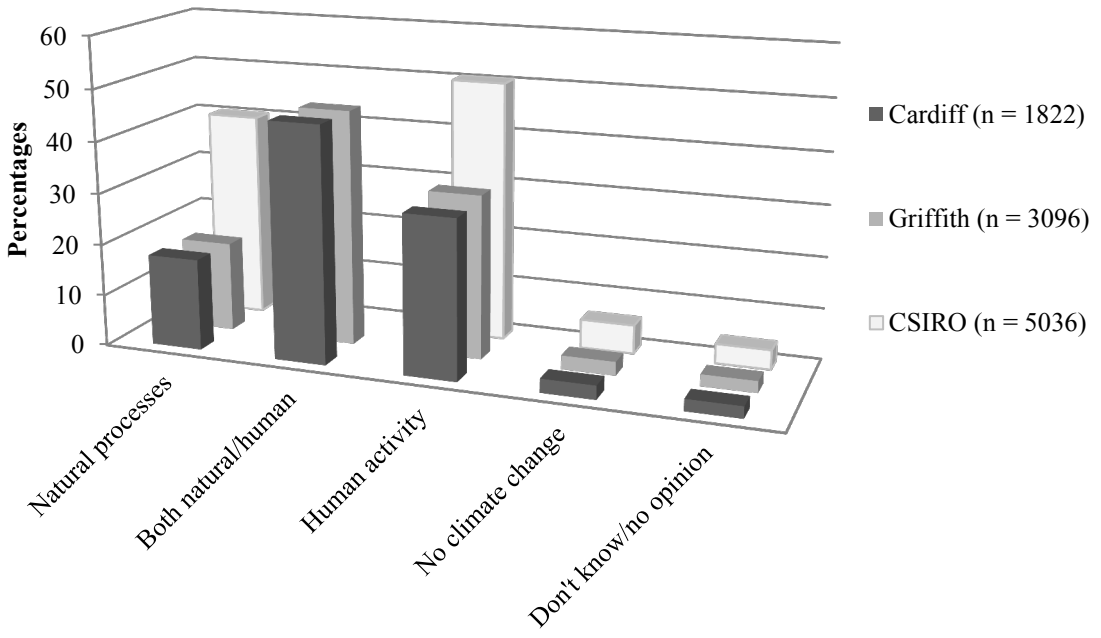


*Figure 13*. Framing effects

In the case of the 2010 CSIRO national survey results (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 O, 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, 2012b).

Most of the survey findings in Appendix O 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, Bradley, Glendon, Ellul, & Callaghan, 2012c). 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.

## RESPONSIBILITY

The acceptance of some level of human causality with respect to contemporary climate change of course implicates individual and collective responsibility, as well as possible associated emotional and self perception responses, such as guilt, pessimism, and lessened self-esteem. The more *important* the issue of climate change is to an individual (#25), the more salient these responsibility implications are likely to be. As well, of course, attribution of human causality also carries the possibility of a collective human redressing of the problem, with corresponding self and collective efficacy implications, and possibly optimism as well as felt responsibility and guilt (e.g., Ferguson & Branscombe, 2010). Item #25 asked respondents, "**How important is the issue of climate change to you personally?**" on a 6-point rating scale (1 = *Not at all important* to 6 = *Extremely important*). Results from this item found the large majority of respondents found the issue of climate change to be quite important ($M$ = 4.47, $SD$ = 1.47). The Australian survey included several items relating to felt responsibility in the context of climate change, #13, #18, #35, and #36, with #37 constituting an often cited 'self-efficacy' scale (Kellstedt et al., 2008) containing two items of arguable direct relevance to felt responsibility e.g., "**Human beings are responsible for global warming and climate change**", on a 6-point rating scale (1 = *Strongly agree* to 6 = *Strongly disagree*). Items #35 and #36 were also noteworthy as these questions addressed respondents' reasons for being engaged or not in particular pro-environmental behaviours relating to environmental sustainability and a reduced carbon footprint.

## COMPOSITE MEASURE OF RESPONSIBILITY

Following item analyses for all survey scales, a composite responsibility scale was operationalised as a 4-item measure which included a willingness to act, as well as felt personal responsibility (#13e, f, #20a, b). The scale included items such as, "**It is my responsibility to help to do something about climate change**". Scores were summed (possible range 4-24), with higher scores indicating a stronger endorsement of personal responsibility ($M$ = 12.69, $SD$ = 3.54). This scale achieved a Cronbach's alpha of .82.

## RESPONSIBILITY DEMOGRAPHIC ANALYSES

Female respondents indicated significantly greater levels of felt responsibility and willingness to act ($M$ = 13.3, $p < .001$) than did male respondents ($M$ = 12.1). Young adults (<35) evidenced higher scores on responsibility ($M$ = 13.1, $p < .001$) than respondents aged 35-54 ($M$ = 12.8), or those aged over 55 ($M$ = 12.2). Participants with a university degree had higher felt responsibility scores ($M$ = 13.2, $p < .001$) than those with a certificate/trade ($M$ = 12.6), or high school education ($M$ = 12.0). Surprisingly, respondents without children/grandchildren indicated higher levels of responsibility ($M$ = 13.0, $p < .001$) than those with children/grandchildren ($M$ = 12.0). Finally, respondents intending to vote Green or Labor at the next Federal election indicated higher levels of felt responsibility ($M$ = 13.8, $p < .001$) than those intending to vote for another party ($M$ = 11.9). No significant differences were found for responsibility scores between comparison groups formed on the basis of income, home ownership, country of birth, residential or employment status.

## RESPONSIBILITY CORRELATIONAL ANALYSES

Correlational analyses indicated that felt responsibility was strongly and positively associated with behavioural engagement ($r$ = .48), psychological adaptation ($r$ = .69), trust ($r$ = .48), connection to nature ($r$ = .45), and objective knowledge ($r$ = .43), and more moderately related to other variables such as residential exposure ($r$ = .36), direct experience of climate change ($r$ = .35), media exposure ($r$ = .23), and subjective knowledge ($r$ = .22). All of these correlations were significant at $p < .001$. These findings suggest that the issues of climate change belief or acceptance are complex and nuanced, and that acceptance of anthropogenic climate change implies not only a level of human causality but also human responsibility, with individuals differing on the extent to which such notional responsibility is individually and personally felt.

## ATTRIBUTION OF RESPONSIBILITY FOR TAKING ACTION ON CLIMATE CHANGE

Multiple theoretical and research literatures address causal and responsibility attributions in the context of environmental threat, and more recently climate change, and how these attributions relate to public understandings with respect to anthropogenic forcing, self-efficacy and perceived control, local versus global considerations, and motivational processes, including protection motivation and psychological distancing (e.g., Lavergne, Sharp, Pelletier, & Holtby, 2010; Malka, Krosnick, & Langer, 2009). Additional items and sections of the Australian survey address these matters further. Respondents were asked, for example, to indicate who they perceived as having principal responsibility for taking action to combat climate change, "**Which of the following do you think should be mainly responsible for taking action against climate change?"** (#18). These findings are not directly comparable to those for Britain because of differing instructions (Australian respondents were advised that they could tick multiple responses whereas British respondents was asked to indicate a single option) (See Figures 14 and 15).

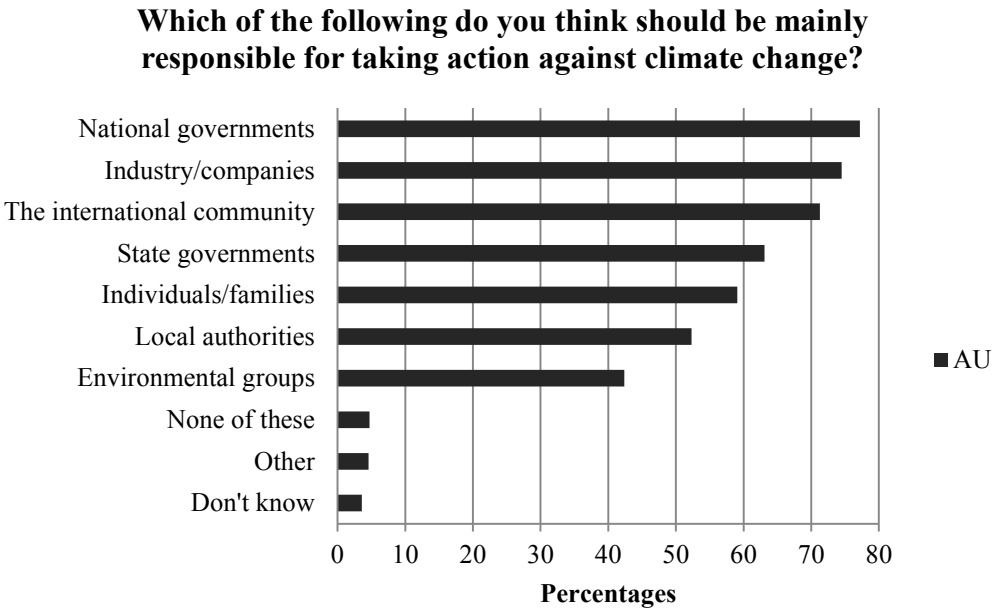


*Figure 14*. Perceived responsibility for action to combat climate change: Australian sample

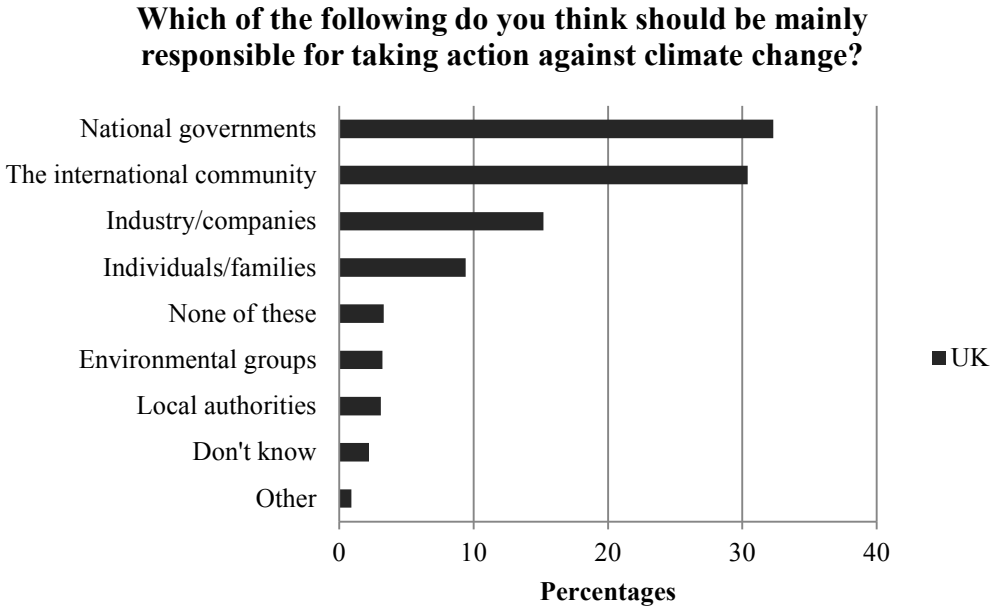


*Figure 15*. Perceived responsibility for action to combat climate change: UK sample

The overall distribution of responses is quite similar, notwithstanding that Australians could select more than one item. Certainly the initial three response options are highly similar. It is clear that respondents believe that national governments, the international community, and the industrial corporate sector bear a strong responsibility for taking action to combat climate change. But the Australian multiple response data would suggest that individuals and families are viewed as having almost equal responsibility to take action in the context of climate change. This may be as true of British respondents, but the single response format provided effectively precluded respondents from endorsing what might have been an

almost equally important responsibility attribution relating to individuals and families, and possibly local authorities and environmental groups. Similarly, in the case of local authorities, it is likely that multiple option instructions might have provided more similar findings, notwithstanding the decentralised levels of responsibility that characterise the Australian State and local government systems.

It is noteworthy that in response to item #13e British respondents were more likely than Australian respondents to 'strongly agree' or to 'tend to agree' with the statement, "**I feel a sense of urgency to change my behaviours to help to reduce climate change**" (UK 41.9%, AU 35.6%). This finding must be understood in a context in which many Australians have already been changing their behaviours in the face of a more palpable and immediate climate change threat. Extent of agreement with item #13f, **"It is my responsibility to help to do something about climate change"** is of particular interest as over 50% of both Australian (60.1%) and UK (70.5%) respondents indicated that they either 'strongly agreed' or 'tended to agree' with the statement.

# SELF-EFFICACY

An important dimension of public response to the threat of climate change in the survey was perceived self-efficacy with respect to this, for many, daunting and global problem, i.e., the extent to which people feel they can engage in actions that could make a difference either in their local or global environment (Bandura, 1997, 2006; Tabernero & Hernández, 2010). Respondents were asked to indicate their extent of agreement with a number of statements (#13, #37) (see Appendix I). Results indicate that respondents by and large felt that it was possible for them to take effective action in their personal lives to counter climate change. These findings suggest that the common stereotype that the public feels overwhelmed and helpless in the face of climate change is far from the case, at least in these two countries. While the similarities between Australian and British responses are, again, much more noteworthy than the differences, the findings suggest that compared with their British counterparts, Australian respondents reported feeling somewhat more able to make changes that could make a difference with respect to climate change, and somewhat less likely to agree that, "**It is hard to take action against climate change**".

## COMPOSITE MEASURE OF SELF-EFFICACY

A composite measure of self-efficacy was developed to assist with parametric and structural equation modeling analyses. This five-item composite measure included two items (#13a, d) from Kellstedt et al.'s personal efficacy for global warming scale (Kellstedt et al., 2008) and three items developed by Cardiff and Griffith University,( #37a, b, c). 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**". Scores were summed (possible range 5-30), with higher scores indicating greater levels of personal self-efficacy ($M$ = 18.38, $SD$ = 5.13). This scale achieved a Cronbach's alpha of .89.

## SELF-EFFICACY CORRELATIONAL ANALYSES

Correlational analyses indicated self-efficacy was strongly and positively associated with responsibility ($r$ = .79), climate change concern ($r$ = .73), psychological adaptation ($r$ = .69), distress ($r$ = .66), green self-identity ($r$ = .61), belief in climate change ($r$ = .60), risk appraisal ($r$ = .59), behaviour ($r$ = .50), trust ($r$ = .49), and objective knowledge ($r$ = .40). Self-efficacy was found to be more moderately correlated with residential exposure ($r$ = .38), subjective knowledge ($r$ = .24), media exposure ($r$ = .20), and prior disaster exposure ($r$ = .14). The correlations were all significant at $p < .001$ (See Appendix K).

## SELF-EFFICACY DEMOGRAPHIC ANALYSES

Female respondents reported higher levels of self-efficacy ($M$ = 19.2, $p < .001$) than did male respondents ($M$ = 17.4). Younger participants (<35) evidenced higher levels of self-efficacy ($M$ = 18.8, $p < .001$) than respondents aged over 55 ($M$ = 17.7). Higher levels of self-efficacy were found for those respondents with tertiary education ($M$ = 18.9, $p < .001$) as

compared to those with a high school education ($M = 17.9$). Respondents intending to vote Green or Labor at the next Federal Election evidenced higher levels of self-efficacy ($M = 19.7$, $p < .001$) than those intending to vote for another party ($M = 17.4$). Modest yet significant differences were also found for parental, and employment status. Respondents without children/grandchildren and those working had slightly higher levels of self-efficacy than parents and unemployed respondents.

## SUMMARY

It is difficult to overstate the importance of perceived self efficacy, control, and human agency and responsibility, in the context of an environmental issue such as climate change and adaptation and mitigation responses. Nonetheless, a considerable challenge in the context of climate change is to overcome a common risk perception and secondary threat appraisal that there is very little than an individual can do about this complex and global problem. Indeed some researchers addressing the issue of coping with climate change have concluded that collective efficacy is perhaps a more potent and efficacious coping option than self-efficacy (e.g., Grothman & Patt, 2005; Homberg & Stolberg, 2006; Van Zomeren, Spears & Leach, 2011). The arguments advanced are understandable, but problematic in some respects, as efficacy appraisals and judgments involve not only the undertaking of an action but judgments of likely effectiveness and the perceived motivations, actions and efficacy of others (e.g., Bandura 1997, 2006). In any case there is little question but that perceived self efficacy, collective efficacy, and an understanding and appreciation of the role of human agency in contemporary climate change are important and strategic factors in human responses to the threat of climate change, including motivations, coping and adaptation strategies, behavioural engagement, and psychological impacts (e.g., Reser, et al., 2012a). Current survey findings clearly indicate that perceived self-efficacy for Australian respondents is important, and strongly associated with other core variables.

## UNFOLDING IMPACTS AND IMMEDIACY OF CLIMATE CHANGE: TEMPORAL, SPATIAL AND PSYCHOLOGICAL DISTANCE

An important item in the survey related to the immediacy of the climate change threat and unfolding impacts. Respondents were asked: "**When, if at all, do you think Australia [Britain] will start feeling the effects of climate change?**" (#14) Figure 16 provides relative percentages across response options.

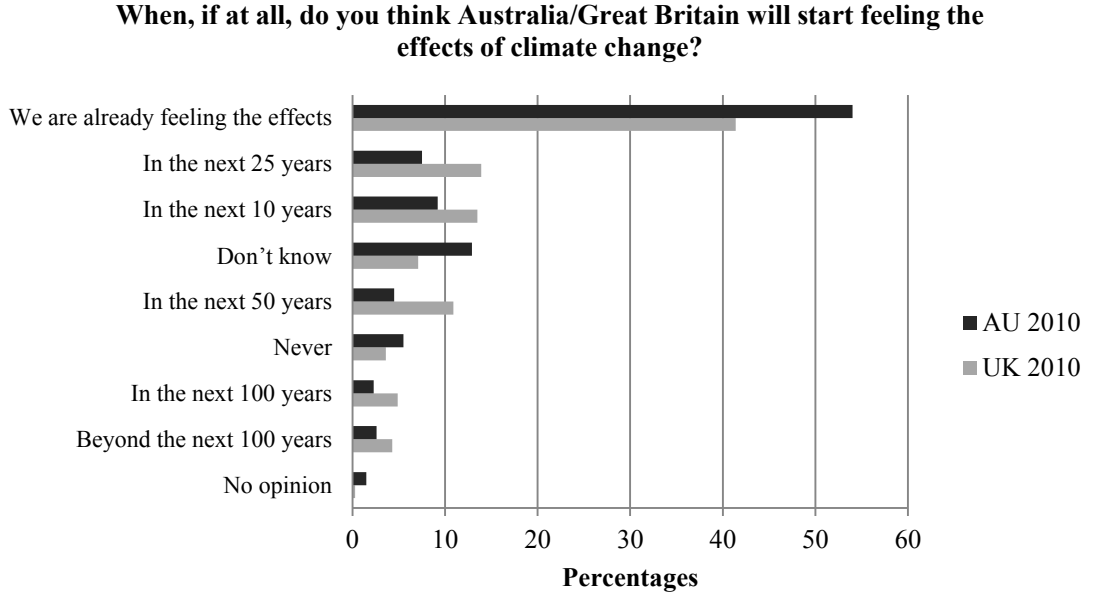


*Figure 16.* Temporal immediacy of climate threat and impacts

The response distribution indicates that Australian 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 British respondents. Thus 54% (AU) and 41% (UK) of respondents believed that they were already feeling the effects of climate change, while a further 17% and 27% of 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 noteworthy that 5.5% of Australian respondents opted for the 'Never' response option compared with 3.6% of British respondents. This might suggest that a small but proportionately larger core group of climate change disbelievers and/or sceptics exists in Australia. The contrast between Australian and British respondents in endorsing the 'Don't know' option to this question is also worth mention, with the respective 12.9% versus 7.1% figures indicating that a greater proportion of Australian respondents reported not knowing when the effects of climate change were likely to commence. This could reflect the confusing picture presented by the extreme natural disaster events in Australia over the past few years, including a crippling drought which lasted more than a decade across extensive areas of Australia, and only ending in late 2009 and early 2010, when much of Northeastern Australia was extensively flooded.

## SPATIAL AND TEMPORAL DISTANCING: THE LOCAL AND THE GLOBAL

Several survey questions examined aspects of the local/global continuum in terms of risk perceptions, appraisal, perceived exposure and psychological distance (e.g., Spence et al., 2011b; Uzzell, 2000, 2004). These and similar items have been used to explore and document the extent to which people tend to view climate change as a global phenomenon, distant in space as well as time from their own life circumstances (Lima & Castro, 2005; Uzzell, 2000). In the context of this comparative research it was thought that Australian respondents would be less prone to 'distance' the threat and impacts of climate change. This is one of the few areas of the joint surveys where clear and consistent differences between Australian and British respondents were evident. In each relevant instance the direction of the differences indicated that climate change was seen as a more immediate, proximal threat in Australia than it was in Britain ($p < .01$).

A number of 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 one's local and national region, but with one's '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. 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 survey, would reduce protective 'farsightedness' or 'hyperopia' with respect to the local Australian context. Australian survey findings do show a modest but clear hyperopia effect with respect to the threat and seriousness of climate change, and again, evidence some interesting similarities and differences between Australian and British respondents. The initial two survey items relating to this matter, which only Australian respondents completed, were questions #10 and #11. 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'. Hence Australian respondents appear to be viewing their own exposure to the threat of climate change as very serious, but somewhat less serious than 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; DCC, 2010; Steffen, 2009).

All four items in question #15 can 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 Australian and British respondents were dramatic,

with only 8.5% of Australian respondents, as compared with 32.1% of British respondents, either 'strongly agreeing' or 'tending to agree' that "**Climate change will mostly affect areas that are far way from here**". Similarly only 22.7% of Australian respondents as compared with 45.8% of British respondents either 'strongly agreed' or 'tended to agree' that "**Climate change will most affect developing countries**". (See Figures 17 and 18). That is, Australian respondents were much less likely to underestimate the risk of the climate change threat to their own country. Differences were somewhat less marked for the remaining two items (#15c, d) relating to threatened local consequences of climate change. Sixty-one percent of Australian respondents as compared with 52.6% of British respondents either 'strongly agreed' or 'tended to agree' that "**My local area is likely to be affected by climate change".** In the case of the statement "**Climate change is likely to have a big impact on people like me**", 45.6 % of Australian respondents and 44.6% of British respondents either 'strongly agreed' or 'tended to agree', an almost identical finding.

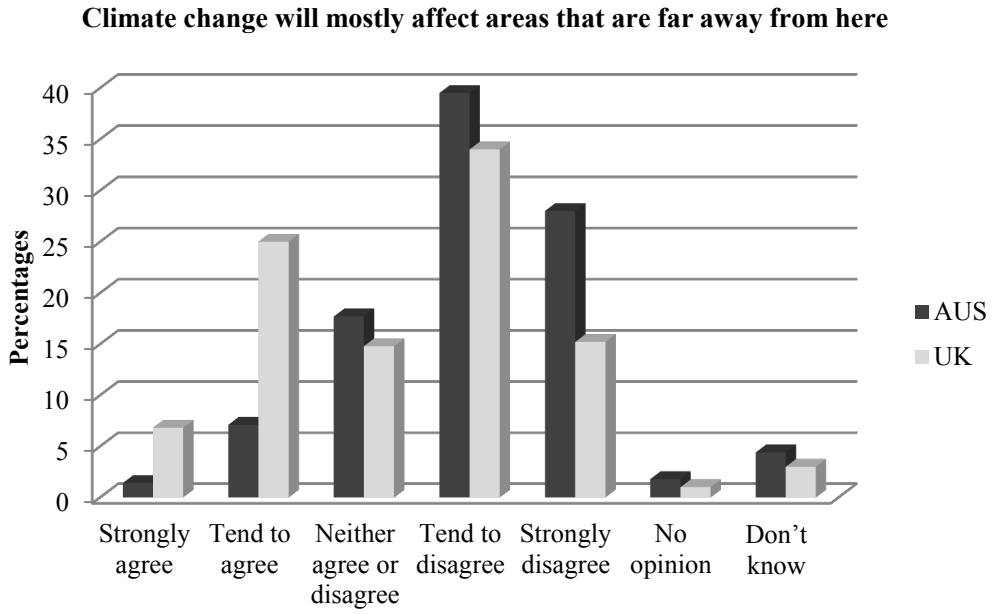


*Figure 17*. Spatial distancing of climate change effects: far away areas

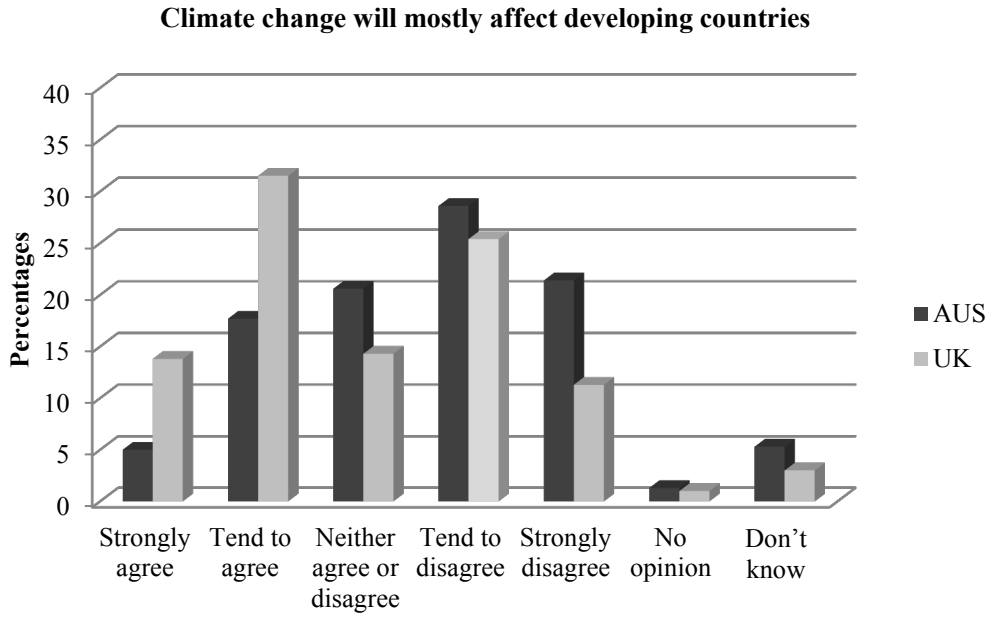


*Figure 18*. Spatial distancing of climate change effects: developing countries

These findings suggest that levels of personal concern about climate change are quite high in both countries, notwithstanding the somewhat easier to maintain relative distancing effect for British respondents who are more prone to view climate change as a very serious but distant threat, relative to the UK and adjacent countries, than are Australian respondents. On the other hand, Australian respondents are only slightly more likely to agree that their local area and people similar to themselves are likely to be affected appreciably by climate change. It could be concluded that neither Australian nor British respondents were entirely clear sighted when focusing on the local situation, but Australian respondents,though dint of circumstance and recent experience, are viewing their climate change exposure and vulnerability as more serious than British respondents.

## TRUST

A further comparison relates to relative extent of respondent agreement with the statement **"I trust the Australian/British government to take appropriate action against climate change"** (#12g). Only 15.7% of Australian respondents as compared with 30.7% of British respondents 'agreed strongly' or 'tended to agree' with this statement. There is little doubt that the acrimonious political issue status of climate change policies in Australia has eroded public confidence and trust that appropriate actions will be taken. These findings, along with the strong results supporting a widespread belief that human activities are substantially contributing to climate change, shed light on and raise questions with respect to when and how perceived anthropogenic causation is associated with personal responsibility attributions in the case of global climate change.

The Australian-specific item #27 addressed the matter of trust in the context of what different sources have to say about the environment, in this case 'scientists', 'media', and 'government'. The matter of public trust has been viewed as an important consideration in its own right and also indirectly addresses the issue of source credibility (e.g., Earle, 2010; Siegrist, Earle & Gutscher, 2007). The survey results indicate that public trust in what *scientists* say about the environment is relatively high, with a mean rating of 4.25 (based on a 6-point scale, 1 = *Not at all* to 6 = *Completely*), but that levels of trust in what the *media* and *government* say about the environment is notably low, with mean ratings of 2.64 and 2.90 respectively. These findings are broadly consistent with CSIRO's 2010 national survey findings in response to their group and organization specific question, "**How much do you trust the following organisations or people to tell you the truth about climate change?**" University scientists and environmental scientists and organisations received the highest trust ratings (Leviston & Walker, 2010).

While these findings would appear to be robust, it is the case that most people do not obtain their information about climate change or the environment directly from scientists or the government, but through media reporting of and interpretation of what scientists and government officials are saying (Boykoff & Smith, 2010; Brulle, Carmichael, & Jenkins, 2012; Malka et al., 2009). Nonetheless it is arguable that, in Australia, scientists still retain quite strong credibility when speaking about the environment and what they say presumably influences both public understandings and confidence levels in science generally.

## COMPOSITE VARIABLE OF TRUST

A composite scale of trust was developed from existing survey items (##12g, #27a, b, c). The four-item measure included a modified question from Krosnick, which was used in the ABC news/planet green/Stanford University poll (ABC News, 2007). The scale included items such as, "**How much do you trust what different sources say about the environment**". Scores were summed (possible range 4-23), with higher scores indicating greater trust ($M$ = 12.03, $SD$ = 3.45). Cronbach's alpha was .73 indicating a reliable measure.

## TRUST CORRELATIONAL ANALYSES

Strong, positive, and significant relationships ($p < .001$) were observed between trust and climate change concern ($r = .55$), distress ($r = .49$), self-efficacy ($r = .49$), responsibility ($r = .48$), belief in climate change ($r = .48$), responsibility ($r = .48$), and risk appraisal ($r = .43$). Further, moderate, positive correlations were found between trust and green self-identity ($r = .34$), objective knowledge ($r = .31$), connection to nature ($r = .25$), behaviour ($r = .24$), direct exposure to climate change impacts ($r = .24$), and residential exposure ($r = .23$).

## TRUST DEMOGRAPHIC ANALYSES

Female respondents indicated higher levels of trust ($M = 12.4$, $p < .001$) than did male respondents ($M = 11.6$). Respondents aged less than 35 reported significantly higher levels of trust ($M = 12.8$, $p < .001$) than did respondents aged 35-54 years ($M = 12.0$), and those over 55 years of age ($M = 11.5$). Respondents without children or grandchildren reported significantly greater levels of trust ($M = 12.5$, $p < .001$) than those with children or grandchildren ($M = 11.8$). Urban respondents were significantly more trusting ($M = 12.2$, $p < .001$) than rural respondents ($M = 11.7$). Respondents intending to vote Green or Labor at the next Federal election demonstrated greater levels of trust ($M = 13.0$, $p < .001$) than those intending to vote for another party ($M = 11.2$). There were no significant differences found between groups formed on the basis of educational attainment levels, employment status, or income levels.

## SUMMARY

These findings relating to trust are interesting on a number of counts. They clearly show that these Australian respondents do, by and large, credit what scientists say about the environment and believe that scientists as a collective group will take appropriate actions against climate change to the extent possible. But at the same time it is evident that trust in government to take appropriate measures, or in the media to accurately present the climate change case is quite low. These findings are comparable with findings reported by Ashworth and colleagues, where Australian respondents rated scientific sources as the most trusted and government correspondence (e.g., mail outs), and media (e.g., radio, newspapers, magazines) as less trustworthy (Ashworth et al., 2011) This is perhaps not surprising given the polarised and acrimonious political context and climate over the 12 month period to July-August 2011, and ultimately Labor's back flip on pursuing effective carbon emission control legislation, despite arguably strong public support. As well, trust in science in the context of climate change is a two-edged sword, as scientific forecasts for the remainder of the millennium are in fact quite bleak and confronting, and there is a comforting and self-serving protection motivation benefit in minimising the risk which is being communicated by the scientific community by disparaging or dismissing these messengers and their source credibility and trustworthiness. The situation in Australia as contrasted with Britain over this period prior to the respective national surveys, along with more enduring socio-political differences with respect to faith in governing institutions, provide a cogent explanation for the differences found in levels of trust. The overall endorsement of trust in science and scientists is

consistent with documented high levels of concern, along with faith and optimism that measures can be taken to address the problem. As with other findings, female respondents and younger respondents indicated higher levels of trust, as did those respondents indicating Green and Labor voting intentions, but no significant differences in levels of trust were found across educational level, income, or employment status.

## AUSTRALIAN SPECIFIC SURVEY FINDINGS

### KNOWLEDGE ABOUT CLIMATE CHANGE

A starting premise in the current research was that public 'understandings' of climate change were unlikely to overlap substantially 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, Biel, & Gärling, 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 Griffith survey included both a single-item self-reported climate change knowledge item (#26) and a 10 item, true/false/don't know, objective measure of knowledge about climate change science (#41). Very few Australian surveys of public responses to climate change have used a similar objective measure of climate change knowledge, with several exceptions (e.g., Ashworth et al., 2011; Fielding, 2009).

### COMPOSITE MEASURE OF OBJECTIVE KNOWLEDGE

Knowledge is seen to be 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 et al., 2009). The pragmatic constraints of a national survey required a straightforward 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 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. These statements were based on the work of Sundblad et al. (2009). 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 ($M$ = 2.69, $SD$ = 2.91). (See Table 2).

*Table 2.* Objective knowledge questions and distribution of responses

| | True % | False % | Don't know % |
|---|---|---|---|
| The projected average sea level rise provided by the IPCC for the remainder of this century (2010-2099) is between 18-59 cm's | 35.5 | 10.2 | 54.3 |
| Australia is one of the most exposed nations with respect to projected impacts of climate change | 44.3 | 24.1 | 31.6 |
| Climate change will increase the risk in Australia for diseases transmitted by water and mosquitoes over the next 100 years | 39.8 | 23.3 | 37.0 |
| Globally, the current burning of fossil fuels accounts for 80-85% (Co2) emissions added to the atmosphere | 47.1 | 15.0 | 37.9 |
| Methane is emitted mainly from fossil fuels | 16.9 | 49.8 | 33.3 |
| Climate change is mainly caused by the hole in the ozone layer | 20.6 | 57.8 | 21.6 |
| Australia produces about 5.5% of the planet's carbon emissions | 23.4 | 17.8 | 58.7 |
| Australia's average temperature has increased by approximately 1°C from 1910 to 2002 | 59.4 | 12.9 | 27.6 |
| The change in global temperature for the last 100 years is greater than for the last 1000 years | 46.8 | 14.9 | 38.3 |
| The number of weather-related disasters around the world has doubled since the mid 1990s | 47.4 | 15.6 | 37.0 |

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

What do these findings tell us and not tell us? The overall knowledge 'score' is not directly interpretable as the differing items and scoring methods of these few studies using objective measures make comparisons difficult. Nonetheless the scale provides a relatively sensitive and quantitative index of specific knowledge for examining associations with other variables as well as change over time. It would appear, though, that objective knowledge of a climate change science-based account of climate change on the part of respondents is fairly modest. While 59.4% of respondents correctly confirmed that Australia's average temperature had increased by approximately 1°C from 1910 to 2002, for example, and 57% correctly noted that climate change is not caused by the hole in the ozone layer, the percentage of correct responses for the other 8 items was less than 50%. Just over one third of respondents correctly confirmed that the projected average sea level rise provided by the IPCC (2007) for the remainder of this century is between 18 to 59 centimetres.

Results from the 10 objective knowledge statements demonstrate that Australian respondents have a high degree of uncertainty when it comes to climate change science. This is reflected in part by the high percentage (between 21% and 54%) of respondents who reported 'don't know' when answering the ten knowledge statements. Ashworth et al. (2011) also found, on average, 30% of respondents indicating 'don't know', when asked a series of true/false questions to test knowledge of climate change related topics. This suggests that the public has a particularly narrow understanding of the physical processes and causal drivers that contribute to climate change (Reynolds et al., 2010). For example many people still do not understand and confuse the issue of climate change and the depletion of the ozone layer (Bord, O'Connor, & Fisher, 2000: Nisbet & Myers, 2007). This was certainly the case in recent studies conducted in Australia. When the findings from this report are compared with a widely-used knowledge question, **"Climate change is mainly caused by the hole in the**

**ozone layer**", the majority of respondents answered this item correctly (58%), 20% answered incorrectly, and 22% selected the 'do not know' option, indicating that a large percentage of respondents are uncertain or indeed answering incorrectly. Fielding (2009) used the same question and response format in a research study on youth and the environment, finding that 42% of 12-17 year olds, and 47% of respondents aged 18-24 answered this question correctly. In contrast, a similar question posed by Ashworth et al. (2011). "**The hole in the ozone layer contributes to climate change"**, found the majority of respondents answered this question incorrectly (59%), with 16% selecting the correct response, and 25% percent reporting that they didn't know. Uncertainty was also apparent in a qualitative research study undertaken by Bulkeley (2000) in Newcastle, Australia, where focus groups also reported being somewhat confused about this particular issue.

> "I get a little bit confused between them, the global warming, the hole in the ozone layer, and the greenhouse effect, I am not exactly sure what all of these are, but I know that it's bad...for the environment" (Bulkeley, 2000, p. 4).

Such qualitative research has proven to be particularly valuable in providing a more informed window on public understandings (e.g., Wolf & Moser, 2011).

The current findings are noteworthy given the above certainty of correctness findings, and given that many quite knowledgeable individuals are likely to judge their own knowledge level as relatively modest. In the case of the current survey and following the ten objective knowledge questions, participants were asked to rate their level of certainty with respect to the correctness of the answers they had given (#42). A number of researchers have examined such confidence levels in the context of climate change (Sundblad et al., 2009; Malka et al., 2009). Thirty-five percent of respondents gave a certainty rating of 5 or 6 on a six point scale (1 = *uncertain* to 6 = *certain*), with the mean certainty rating ($M$ = 3.82, $SD$ = 1.39), being very close to that found by Sundblad et al. (2009) on a very similar six point scale, ($M$ = 3.73, $SD$ = 0.88). Unfortunately there are not many comparison findings that can be used to benchmark this current level of objective knowledge (e.g., Reynolds et al., 2010). What is clear is that such measures cannot easily capture the nature and complexity of those risk as analysis and risk as feeling appraisal considerations that go into one's personal understandings of, and psychological responses to, the phenomenon and threat of climate change (e.g., Slovic, 2010). Yet engagement with the public about climate change and public education initiatives need to be informed by just such understandings of *public understandings.*

## KNOWLEDGE CORRELATIONAL ANALYSES

Objective knowledge was strongly and positively associated with climate change concern ($r$ = .53), belief ($r$ = .52), distress ($r$ = .47), adaptation ($r$ = .46), risk appraisal ($r$ = .44), responsibility ($r$ = .43), and self-efficacy ($r$ = .40), and more moderately correlated with green self-identity ($r$ = .36), direct experience with climate change ($r$ = .31), residential exposure ($r$ = .31), trust ($r$ = .31), behavioural engagement ($r$ = .30), and media exposure ($r$ = .19). Correlations were all significant at $p < .001$. The correlation between objective knowledge and certainty of the correctness of the answers given, often used as a corrective to

self reported knowledge, was ($r$ = .04, $p$ < .05). Self-reported knowledge, which was a single item measure, and objective knowledge evidenced a very modest correlation of ($r$ = .19, $p$ < .001). This would suggest that it is reasonably hazardous to rely solely on self-reported knowledge levels when examining knowledge of climate change science or consequences and how this might relate to public understandings or behaviour change. Previous research also suggests individuals are overly confident (Budescu, Wallsten, & Au, 1997). If confidence levels are high, but knowledge levels are low, individuals may not be willing to seek out new information (Sundblad et al., 2009).

Kellstedt et al. (2008) argue that the more informed respondents are, the less personally responsible they will feel towards global warming, and the less concerned they will be. This rather surprising and anomalous finding does not appear to be the case with the findings from the present study. Kellstedt's measure of knowledge was based on a single-item measure, "How informed do you consider yourself to be about global warming and climate change?" The response format was an 11-point scale, with higher numbers indicating a greater level of subjective knowledge ($M$ = 6.32, $SD$ = 2.33) (Kellstedt et al.). When correlations between subjective knowledge and felt responsibility were examined in the present study, a moderate, positive relationship is found ($r$ = .22), contrasted with the case of objective knowledge which evidences a much stronger association with responsibility, ($r$ = .43). Self-efficacy follows a similar pattern with a stronger relationship for objective knowledge ($r$ = .40) and a weaker correlation with self-reported knowledge ($r$ = .24). Climate change concern has a strong, positive relationship with objective knowledge ($r$ = .53) and a much weaker relationship with subjective knowledge ($r$ = .21).

Overall the results of the present study are at substantial odds with the research of Kellstedt and colleagues when considering and comparing subjective knowledge, responsibility, self-efficacy and concern. Kellstedt and colleagues note that one of the limitations of their study is that they based their knowledge measure on self-report, and that objective and self-report measures may not even be correlated; indeed they go on to say that they may work in opposite directions. This latter suggestion was not supported in the current study, but their concern about their self-report measure of knowledge was certainly validated. Overall, current findings suggest the more people actually know, and to a lesser extent, the more they think they know, the more likely that they will be concerned about climate change and feel some responsibility to act in response to it. This conclusion holds even when analyses of our current data were restricted to just the 6.5% of respondents identified as climate change sceptics. Contrary to Kellsted et al., even among this sub-sample, objective knowledge was positively correlated with concern ($r$ = .26), felt responsibility to act ($r$ = .11), and actual behavioural engagement ($r$ = .17). In this group, however, self-reported knowledge was negatively correlated with these other variables ($r$ = -.23, -.16, and -.08) respectively.

A recent published study of public understandings of climate change is that of Leiserowitz, Smith et al. (2010), based on a survey of 2030 American adults undertaken between 24 June and 22 July, 2010. The survey focused on public understandings of how the climate system works, and on the causes, impacts, and potential solutions to climate change. The study included measures of both objective and self-reported knowledge. The findings

suggest a moderate level of general understanding of climate change science, important gaps in knowledge, and common misconceptions. Overall, 63% of this North American survey sample reported believing that climate change is happening, but with many not clearly understanding why. This U.S. study appears to have included no other parameters; it is therefore difficult to assess correlates of climate change systems knowledge. There was also no provision in the study for exploring climate change *understandings,* or risk perceptions premised on cultural constructions and understandings of the climate change risk domain, or symbolic meanings and associations (e.g., Bohm, 2003; Oltedal, Moen, Klempe, & Rundmo, 2004), though these avenues have been explored previously by this Yale research group (e.g., Leiserowitz, 2006).

The consistent and strong positive correlations found across these disparate variables suggest that knowledge of climate change science is strongly associated with concern levels, psychosocial impacts, and adjustments in psychological and behavioural responses. This argument is strengthened by the fact that many climate change sceptics actually appear to be very knowledgeable in some ways about climate change science, as this is necessary to discuss and argue one's case in conversation and/or when challenged. A cogent theoretical model in social psychology is that of motivated reasoning, which provides a persuasive explanation for why climate change sceptics expend considerable time and energy in bolstering their own stance in terms of selective information search (e.g., Kunda, 1990; Slothuus & de Vreese, 2010). While these current knowledge findings overall make considerable sense, they are, again, at odds with the widely covered but actually very weak findings of a negative correlation found between self-reported climate change knowledge on the one hand and environmental concern and behavioural engagement on the other (e.g., Kellstedt et al., 2008).

## KNOWLEDGE DEMOGRAPHIC ANALYSES

Objective knowledge was significantly higher among female respondents ($M = 2.8$, $p < .05$) than it was for males ($M = 2.6$). Interestingly, subjective knowledge was significantly higher for males ($M = 4.2$, $p < .001$) than it was for females ($M = 4.0$). This is consistent with previous research findings (e.g., McCright, 2010; Wolf & Moser, 2011). Younger respondents (<35) evidenced significantly higher scores on objective knowledge ($M = 3.1$, $p < .001$) than did respondents aged 35-54 years ($M = 2.7$), and those aged over 55 ($M = 2.4$). Again, it is worth mentioning that older respondents (55+) had significantly higher levels of self-reported knowledge ($M = 4.2$, $p < .001$) than did younger participants (<35) ($M = 4.0$). Respondents with a university degree had significantly higher levels of both objective ($M = 3.1$, $p < .001$) and subjective knowledge ($M = 4.2$, $p < .001$) than did respondents with certificate/trade qualification ($M = 2.6$, $M = 2.4$ respectively), or those with a high school education only ($M = 2.4$, $M = 3.9$). Respondents without children or grandchildren had significantly higher levels of objective knowledge ($M = 3.0$, $p = .001$) than respondents with children ($M = 2.6$). Respondents intending to vote Green or Labor at the next Federal Election evidenced significantly higher levels of both objective ($M = 3.3$, $p < .001$) and subjective knowledge ($M = 4.2$, $p < .001$) than did respondents who indicated that they would

vote for other parties ($M$ = 2.2, $M$ = 4.0 respectively). No significant differences were found between urban and rural respondents with respect to objective knowledge.

## SUMMARY

It is important to emphasise that public understandings about climate change can be in many ways distinct from and encompass much more than factual knowledge about climate change science; the political, environmental, and social issues concerning climate change; and/or the projected consequences of climate change. The psychological and social realities are that public understandings of climate change reflect and acknowledge the nature and composition of risk as feeling as well as risk as analysis with respect to individual risk appraisal and sense making (e.g., Slovic et al., 2004; Slovic, 2010), and the importance of such a profound global threat in the context of cultural meaning systems, and as a culturally elaborated and represented risk domain (e.g., Bauer & Gaskell, 2002; Pidgeon et al., 2003; Shore, 1996). The Griffith survey nonetheless did examine public understandings in multiple albeit less direct ways. Public risk perceptions, beliefs, causal attributions, anticipations, and concerns about climate change are all important aspects of public understandings, as are experienced distress, sense making, myriad motivational processes, and psychological adaptation itself. Together these convergent factors and processes provide a more adequate and multi-faceted picture of public understandings, hopes, and fears.

## VOTING INTENTION AND POLITICAL AFFILIATION

The survey item relating to voting intention, and, indirectly, to political party affiliation and identification, item #75 was, "**How would you vote if there was a Federal election tomorrow?**" It must be remembered that this question was asked at a particular point in time in Australia, in the context of a highly contested and polarised environmental, social, and political issue, as well as in the immediate context of this survey with a strong climate change focus. While voting intention is arguably an indirect measure of party affiliation or group identity, it nonetheless allows for a grouping of respondents along political lines. An examination of selected key variables by party and notional policy preference in the context of climate change is presented in the following tables.

Table 3 presents the results for item #7, **"How concerned, if at all, are you about climate change, sometimes referred to as global warming?"** Table 4 is based on item #8, **"As far as you know, do you personally think that the world's climate is changing?"**

*Table 3*. Extent of concern by voting intention

| Voting intention | Not at all concerned | Not very concerned | Fairly concerned | Very concerned | Don't know | No opinion | Total |
|---|---|---|---|---|---|---|---|
| Labor | 49 (5.4%) | 180 (19.7%) | 394 43.0%) | 277 (30.3%) | 9 (1.0%) | 4 (.4%) | 913 |
| Liberal | 170 (16.4%) | 294 (28.4%) | 406 (39.2%) | 152 (14.7%) | 6 (.6%) | 8 (.8%) | 1036 |
| National | 25 (24.3%) | 26 (25.2%) | 28 (27.2%) | 22 (21.4%) | 1 (1.0%) | 1 (1.0%) | 103 |
| Greens | 12 (2.7%) | 39 (8.7%) | 161 (36.0%) | 232 (51.9%) | 2 (.4%) | 1 (.2%) | 447 |
| Independent | 28 (11.5%) | 62 (25.5%) | 105 (43.2%) | 46 (18.9%) | 1 (.4%) | 1 (.4%) | 243 |
| Other | 36 (10.6%) | 69 (20.3%) | 141 (41.5%) | 78 (22.9%) | 14 (4.1%) | 2 (.6%) | 340 |

*Table 4*. Belief in climate change by voting intention

| Voting intention | Yes | No | Don't know | Total |
|---|---|---|---|---|
| Labor | 744 (81.5%) | 109 (11.9%) | 60 (6.6%) | 913 |
| Liberal | 663 (64%) | 277 (26.7%) | 96 (9.3%) | 1036 |
| National | 61 (59.2%) | 34 (33.0%) | 8 (7.8%) | 103 |
| Greens | 402 (89.9%) | 27 (6.0%) | 18 (4.0%) | 447 |
| Independent | 163 (67.1%) | 57 (23.5%) | 23 (9.5%) | 243 |
| Other | 241 (70.9%) | 61 (17.9%) | 38 (11.2%) | 340 |

Figure 19 demonstrates political orientation and climate change causation as per item #9 **"Thinking about the causes of climate change, which of the following best describes your opinion?"**

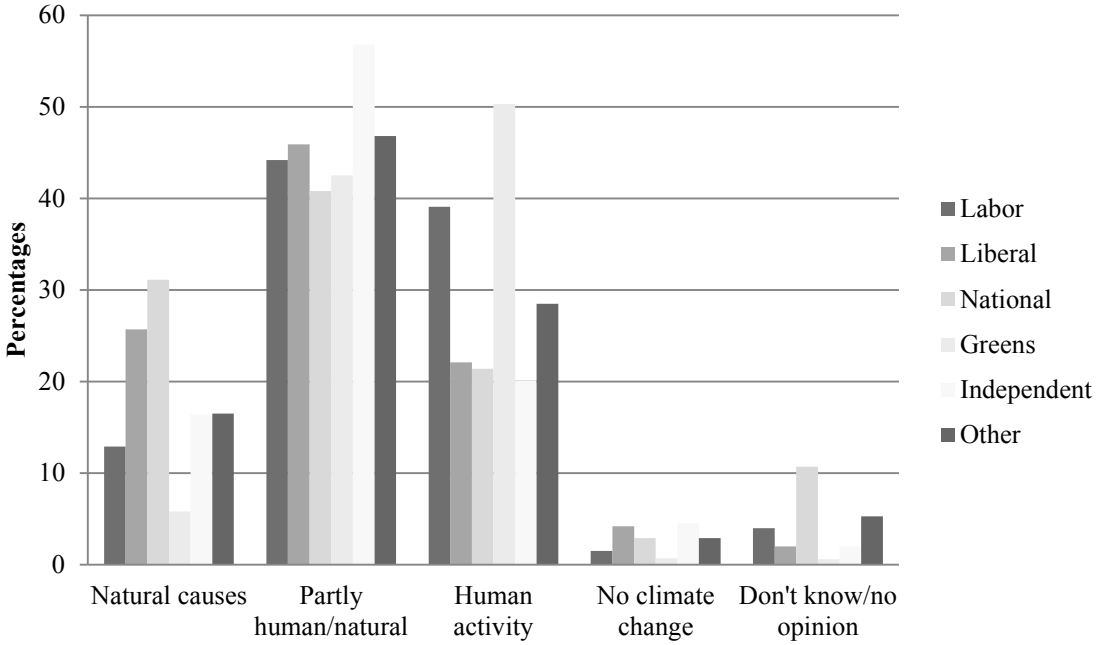


*Figure 19*. Causes of climate change by voting intention and political orientation

Relative levels of belief, concern, and acceptance of some level of human causality were actually very high across all voting intention groups. With respect to the most direct concern item, (#7), 53.9% of 'Liberal' respondents reporting being 'very' or 'fairly concerned', trailed by 48.6% of 'National' respondents . Comparison figures for Labor and Green respondents are high as might be expected, 73.3% and 87.9%; and 'Independent' and 'Other' respondents fall in between at 62.1% and 64.4% respectively.

Findings appear to play out similarly for belief and acceptance of some level of causality, with the Liberal and National respondents being the modest outliers. It is noteworthy that *the lowest* figure for acceptance of some level of human causality is 62.2% (National respondents) and the highest is 93.1% (Greens) followed by Labor respondents at 83.3%.

A recent Australian study conducted by the University of Queensland found respondents affiliated with either the Green or Labor party were much more likely to 'agree' or 'strongly agree' with the statement, "The planet is warming because of human activity producing greenhouse gases", as compared with 38% of Liberal/National affiliates (Fielding, Head, Laffan, Western, & Hoegh-Guldberg, 2012; Hoegh-Guldberg, Fielding, Head, Laffan, & Western, 2010). Overall, Hoegh-Guldberg et al. (2010) found Green respondents reported higher levels of belief, followed by the Labor party respondents and non-aligned respondents, with Liberal/National respondents reporting the lowest levels. These findings are consistent with the results found in this present study.

These figures suggest that while party affiliation and more accurately voting intention during June/July 2010 were clearly related to belief, concern, and causal attributions, this does not counter the more general finding that the great majority of these survey respondents accept the reality of anthropogenically-forced climate change and are very concerned about this phenomenon, threat, and issue.

# PSYCHOLOGICAL IMPACTS

A number of items and scales were incorporated in the survey to specifically address the possible psychological impacts of the threat and perceived physical environmental consequences of climate change. While the principal emphasis was on 'climate change', the associated threat and impacts of extreme weather events and disasters constituted a shared focus of the survey. Survey findings overall indicated that the threat of climate change and the threat of natural disasters were strongly interrelated for respondents. This is an important consideration, as Australia was buffeted by a series of dramatic natural disasters and extreme weather events over the 2009 to 2011 period, and over the preceding decade in terms of an unrelenting drought arguably heightening the saliency of climate change.

The matter of the *psychological and social impacts* of climate change has been a central consideration and focus of the 'human dimensions' of global change, and more specifically climate change, for the past several decades. However the importance of these human consequences considerations have been so obvious and taken for granted that they are often not formally stated or operationalised, and/or are assumed under the rubrics of '*societal* consequences' or '*health* impacts'. Yet the *psychological* impacts of climate change are far more encompassing, including more individual and personal psychological responses, adjustments, and adaptations to this global phenomenon and threat at individual and social process levels. These in turn mediate adaptation responses at behavioural, community and system levels, and longer term health and societal impacts (e.g., Luginaah, Taylor, Elliot, & Eyles, 2002). As well, and very importantly, the psychological impacts of climate change in most regions of the world currently relate to the impacts of *the threat* of climate change and perceived future consequences and implications, typically communicated and socially represented through our contemporary, multimedia, and virtual *information environment* (e.g., Gifford, Steg, & Reser, 2011).

Hence there is considerable wisdom in more clearly conceptualising the psychological impacts of climate change as individual level responses to, and the associated consequences of, what are effective risk communications about this global threat, *mediated* through myriad media channels as well as informal and formal social interactions and communications. Community and societal impacts of the threat of climate change constitute further levels of analysis and dynamic social processes, but these ultimately reflect aggregated individual level responses to personal exposures, perceptions, and experiences of the threat of climate change. Finally, there is both wisdom and clarity in framing and thinking about human responses to and the impacts of the threat of climate change in *psychosocial environmental impact assessment* (PSIA) terms. Such framing underscores the importance of measuring, monitoring, and addressing changes and adaptations taking place in the human landscape in conjunction with unfolding climate change (e.g., Reser & Bentrupperbäumer, 2001; 2008). As well, an extensive literature exists which considers just such psychological impacts in the context of regional disasters and dramatic natural environmental change and impacts (e.g., Grattan, Roberts, Mahan, McLaughlin, Otwell, & Morris, 2011; Matthies, Höger, & Guski, 2000; Palinkas, Downs, Petterson, & Russell, 1993; Picou, Gill, & Cohen, 1997).

While the scope of what might constitute 'psychological impacts' is daunting, the reality is that this is a much more delimited domain of emergent variables and indicators in the social and health sciences, and in risk, emergency, and disaster research and practice arenas. Figure 20 presents a selective sample of psychological impact considerations, i.e., areas of psychological functioning and response, which might be adversely affected by the ongoing threat and or physical environmental impacts of climate change. The decision was made to measure and monitor a limited number of theoretically and practically important psychological impact variables which would be not only sensitive to the impacts of the threat of climate change and extreme weather events, and meaningful and 'available' (Tversky & Kahneman, 1973) to survey respondents, but of theoretical and strategic interest and importance to climate change adaptation, and human health and well being, as well as associated disaster preparedness and response, and policy considerations. The more important of these variables, repeatedly referenced or alluded to in contemporary considerations of climate change adaptation are climate change *concern*, climate change *distress*, and *psychological adaptation* to climate change. Unfortunately there did not exist available and formal climate change-specific measures for these variables, and hence these needed to be developed for the purpose of this research, albeit informed by extensive related research and existing measures and indicators. See Appendix J for specific details on survey constructs and operational measures.


*Figure 20*. Selective compilation of differing psychological impact domains.

The constructs of *climate change* concern and the broader construct of general *environmental* concern were addressed earlier. Certainly many psychologists and social scientists would argue that such concern measures constitute sensitive indicators of current psychological impacts, notwithstanding the largely anticipatory nature of the climate change threat (Reser & Bentrupperbäumer, 2001). Such concern measures are also integrally related to values, and indeed identical measures are often equally treated and referred to as measures of 'environmental concern' or 'environmental values' (Schmuck & Schultz, 2002; Schultz, 2000). A logically related measure in terms of increasing anxiety and psychological health impact is that of *climate change distress*, that is, experienced distress in the context of thinking about, worrying about, and the experiencing of other adverse emotional responses to multi-media coverage of climate change and its implications or perceived direct experience of climate change (e.g., Reser et al., 2011). As there were no available and suitable measures of climate change distress, a provisional 7-item scale was developed to assess such self-reported distress.

## EXPERIENCED DISTRESS IN THE CONTEXT OF CLIMATE CHANGE

The survey items for the psychological impacts/experienced distress section address a much neglected area in the context of climate change research, and indeed with respect to the stress of environmental change (e.g., Aldwin & Stokols, 1988; Stokols, Misra, Runnerstrom, & Hipp, 2009). There are few extant measures which 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 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). A frequently cited 'environmental distress' scale does exist, developed in the Australian context with respect to a spectrum of adverse psychosocial impacts of mining in the Upper Hunter Valley region of New South Wales (Higginbotham, Connor, Albrecht, Freeman, & Agho, 2007). Though careful consideration was given to the use of this scale in the present context, and while a 'solastalgia' subscale has been used in previous related research (Ellul, 2009), the scale items were not specific enough or in other respects deemed sufficiently sensitive or appropriate to the climate change and natural disaster focus of the present survey exercise. Another Australian study undertaken by Searle and Gow (2010) employed a 12-item measure of climate change distress, asking participants to rate how they feel when 'thinking about climate change'. Respondents rated response options such as depressed, worried, or sad on a three point scale. This psychology-based scale which has also been used in the Australian context (Searle & Gow, 2010) was not available at the time of designing our research survey, nor were the items, which were themselves based on other scales (e.g., trait anxiety, Y2K anxiety, stress, depression), sufficiently congruent with our own conception of distress in the face of climate change and its implications for the average person.

Hence seven items were developed and pilot-tested which address the increasingly discussed mental health and quality of life impacts of both the threat of climate change, and directly experienced and salient environmental alteration and change attributed to climate change. These distress scale items attempt to capture a number of the dimensions of the experienced distress and other psychological responses and reactions to the threat of and/or directly experienced environmental impacts of climate change, such as worry, felt powerlessness, experienced guilt, loss, and diminution of quality of life and environment.

In the following two sections covering psychological distress and psychological adaptation in the context of climate change, an extended consideration of findings is provided, given the importance of these constructs and their respective measures, and more general considerations of climate change adaptation

## 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 impacting communities around the world for several decades (e.g., APA Taskforce on Climate Change, 2009; Berry et al., 2008; Costello 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 multimedia 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 one's daily functioning and well-being. We would view the distress which is captured in our provisional scale as relating to the mid range of such a continuum.

## COMPOSITE 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 the seven-item measure mentioned previously (#43). Participants were asked to rate their extent of agreement with statements on a 6-point Likert 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 J). The items were designed to be particularly sensitive to subclinical levels of distress at the prospect and implications of global climate change. Scores reflected summed ratings (possible range 7-42), with higher scores indicating greater experienced distress ($M$ = 21.90, $SD$ = 8.31). This scale achieved a Cronbach's alpha of .93 indicating high reliability.

Averaged results across all respondents indicate moderate levels of reported distress when thinking about and otherwise responding to the threat and implications of climate change. More specifically, and when examining each of the items individually, it is clear that a substantial proportion of respondents at times experienced genuine distress relating to particular aspects of the climate change threat. A large number of respondents (38%), for example, were worried about what the world will really be like for future generations because of climate change, with a further 24% experiencing some distress each time they see or read

media coverage as to the likely impacts and consequences of climate change. Many respondents (23%) were upset that there seemed to be so little that they could do to address environmental problems such as climate change. Respondents were less likely to endorse items such as "**climate change is affecting my quality of life and my assessment of environmental quality more generally**" (9%), or "**I feel some sense of loss because of the climate change impacts that are becoming apparent in my area**" (12%).

## PSYCHOLOGICAL DISTRESS DEMOGRAPHIC ANALYSES

Experience of distress in the context of climate change is not uniformly distributed in the respondent sample (See Appendix L). For example, female respondents evidenced significantly and appreciably greater distress scores ($M = 23.0$, $p < .001$) than did male respondents ($M = 20.7$). These results are consistent with considerable previous research which suggests females tend to be more concerned about the issue of climate change than males (e.g., Ashworth et al., 2011, McCright, 2010; Searle & Gow, 2010). With respect to age, respondents under the age of 35 evidenced significantly greater distress scores ($M = 23.2$, $p < .001$) than the 35-54 ($M = 22.3$) and 55+ age cohorts ($M = 20.3$), for whom climate change distress appeared to diminish moderately with age. Respondents with a university degree had significantly higher distress scores ($M = 22.8$, $p < .001$) than respondents with a trade/certificate qualification ($M = 21.7$), or high school education ($M = 21.3$). The findings suggest that respondents with a university education are more likely to be distressed and worried about the threat and implications of climate change than those with a school or post-school certificate or trade qualification. Those intending to vote Green at the next Federal election evidenced significantly greater distress scores ($M = 24.1$, $p < .001$) than did those intending to vote for other parties ($M = 20.2$). Non-homeowners evidenced significantly greater levels of distress ($M = 22.7$, $p < .001$) than did home owners ($M = 21.5$, $p < .001$). Actual mean score differences are in most instances modest, notwithstanding high significance levels, and clearly a number of these differences and trends suggest a general picture of experienced distress being more frequent and salient for younger respondents, for women, and for those with greater education.

## PSYCHOLOGICAL DISTRESS CORRELATIONAL ANALYSES

Survey results overall suggest appreciable levels of both genuine concern and distress at the nature and implications of the threat of climate change for many respondents. Appendix K includes pertinent correlational findings for climate change distress. Analyses indicate that psychological distress in the context of climate change is strongly and positively associated with climate change concern ($r = .78$), psychological adaptation ($r = .78$), risk perception ($r = .71$), responsibility ($r = .68$), self-efficacy ($r = .66$), belief in climate change ($r = .62$), green self-identity ($r = .59$), and trust ($r = .49$), further suggesting important mediating roles and outcomes with respect to climate change distress. Correlations were significant $p < .001$.

## COMPARISONS ACROSS LOW, MEDIUM AND HIGH DISTRESS GROUPS

Correlational analyses were complemented by selected group comparisons based on levels of distress. Respondents were divided into three groups reflecting their self-reported extent of distress in the context of climate change. Those scoring between 7 and 18 inclusive were considered as 'low distress' respondents (n = 1047), those scoring between 19 and 30 were considered 'medium distress' (n = 1568), and those scoring 31 to 42 were judged to be 'higher distress' respondents (n = 481). It is important to note that the items in this provisional scale were particularly focused on experienced distress in the context of the threat of climate change, its media coverage, and its implications. These cohort comparisons allow for a closer examination of those individuals who could be characterized as reporting salient and genuine distress at the threat and implications of climate change.

Chi-square analyses and analyses of variance (ANOVA) were undertaken in comparing the three distress groups across a number of composite variables and single items. A significant association was found across attributed human causation and the distress groups in response to (#9), $\chi^2(8) = 731.84$, $p < .001$. An overrepresentation of respondents who selected the response "climate change is entirely/mainly caused by natural processes" was found in the low distress group, with these respondents correspondingly underrepresented of respondents in the medium and higher distress groups. This is in contrast to the underrepresentation found in the low distress group of respondents who endorsed the response "climate change is mainly/entirely caused by human activity", as opposed to the overrepresentation of respondents found in the higher distress group (see Figure 21). The results indicate that a large proportion of respondents in the high distress group attributed climate change to human agency and activities, whereas respondents in the low distress group were more likely to believe climate change is largely due to natural processes or partly natural/partly human processes.

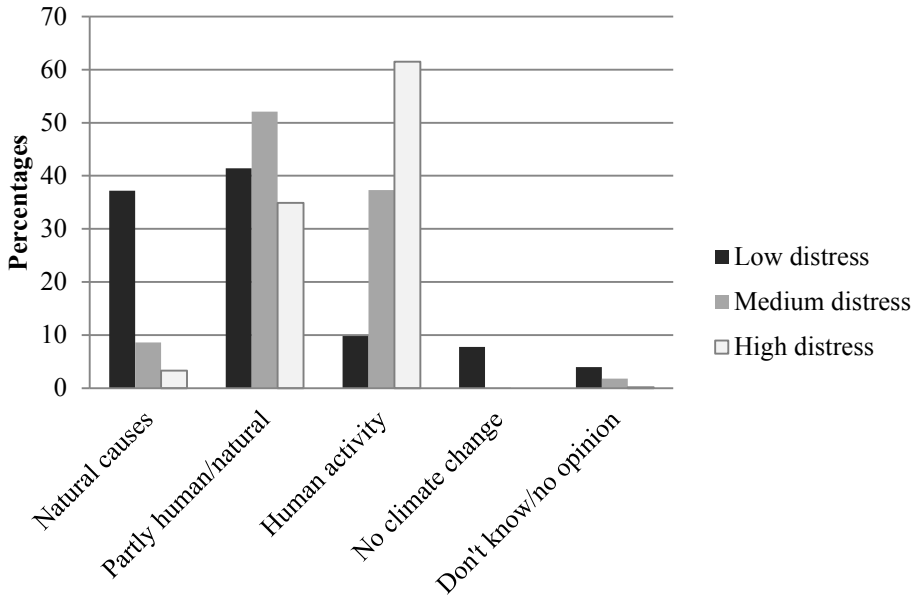


*Figure 21.* Causality and psychological distress

These results relating to human causal attribution and agency are interesting and provide some possibilities with respect to convergent underlying reasons for this experienced distress. It is possible, for example, that acceptance of human causality also implies some measure of collective guilt, and the human agency implied in acceptance of anthropogenic forcing also implies both blame and accountability, as well as human efficacy (e.g., Hilton, 2007; Weiner, 1995). It is also the case that the role of human agency brings the risk domain of climate change into the realm of technological risk, with accompanying dread risk, and human interference with natural systems, associations and apprehensions (e.g., Slovic, 2000, 2010). Whatever the cogency of such explanations, it would seem to be the case that a disproportionate number of respondents scoring higher on this climate change distress measure are aware of the importance and significance of this human 'forcing' factor which in turn would appear to be influencing their general climate change perceptions, understandings, and responses, and the overall psychological impact of climate change.

A significant association was found between temporal distancing and the distress groups in response to item (#14) "**When, if at all, do you think Australia will start feeling the effects of climate change**", $\chi^2(12) = 709.93$, $p < .001$ (See Figure 22). Low distress respondents were underrepresented for those who selected the response, "we are already feeling the effects", whilst medium and high distress respondents were overrepresented. An overrepresentation was observed for respondents in the medium distress group, with respect to the response category, 'in the next 10 years", with an underrepresentation in the low, and high groups. A similar pattern was found for the final four response options "in the next 50 years, in next 100 years, beyond the next 100 years, and never", with an overrepresentation of respondents in the low distress group, and an underrepresentation in the medium, and high distress groups. It is important to note that not one respondent from the high distress group endorsed 'never' as a response category. The results indicate that the vast majority of respondents in the medium and high distress groups believe Australia is already feeling the impacts of climate change. However, a striking 15.7% of respondents in the low distress group indicated the Australia would *never* feel the effects of climate change, suggesting that this had become a matter of conviction, tightly held.

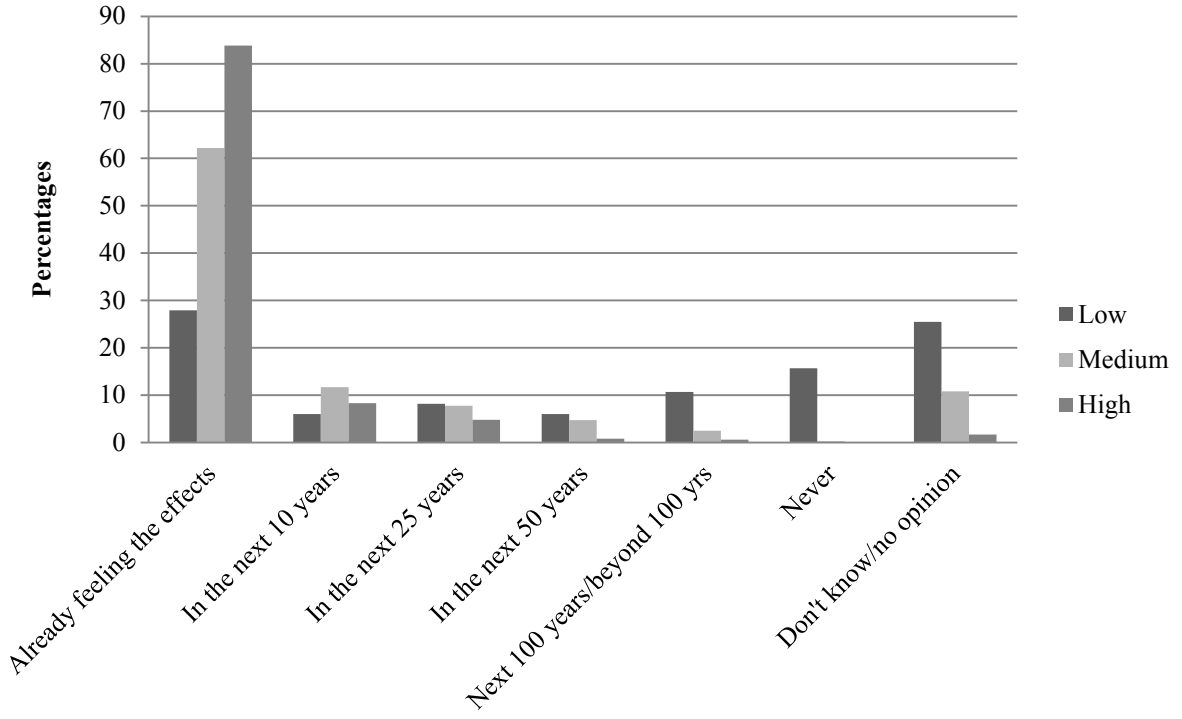


*Figure 22*. Immediacy of the climate change threat by psychological distress

A significant association was found between direct experience and exposure to the perceived impacts of climate change across the three distress groups, $\chi^2(2) = 408.11$, $p < .001$ (See Figure 23). Respondents with perceived firsthand experience of the impacts of climate change were overrepresented in the medium and high distress groups, and underrepresented in the low distress group. As will be discussed later, direct experience with perceived evidence of climate change can be both confronting and transforming in terms of a powerful and more personal realisation of this global threat and its implications.

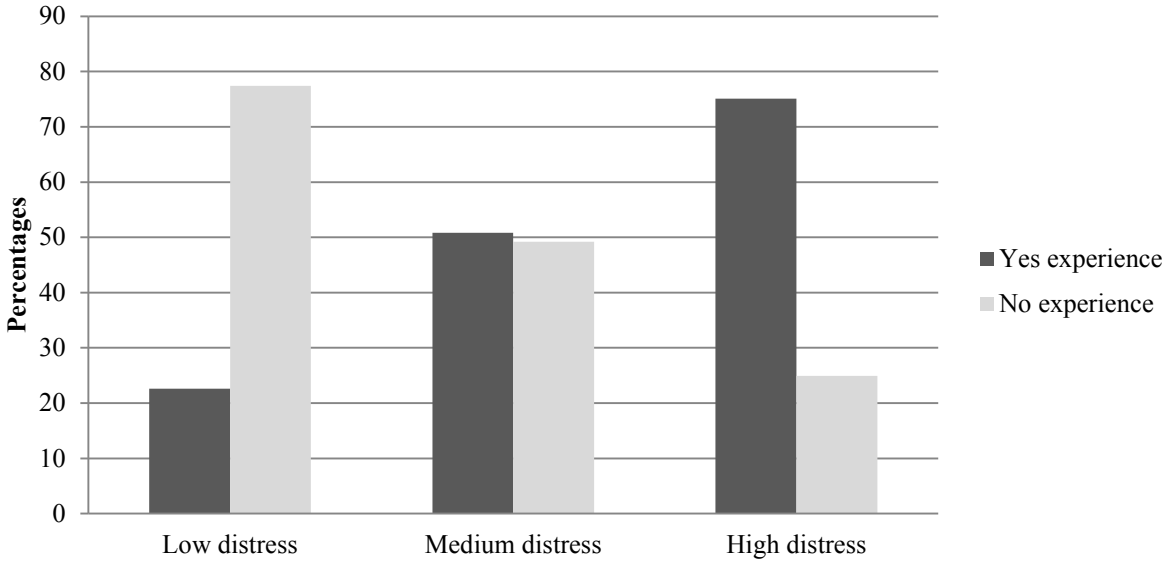


*Figure 23*. Direct experience with perceived climate change impacts by psychological distress

An obvious set of questions in the context of the potential psychological impacts of climate change relates to how one might best describe or characterise this higher distress group. Table 5 compares the three groupings of respondents on the basis of self-reported distress in the context of climate change. It is clear that those in the higher distress group are significantly more likely to reside in areas notionally more exposed to the threat of climate change, they are more likely to accept the reality of climate change, more likely to be concerned about climate change and to see it as a real risk, more likely to have a strong connection with their natural environment, and more likely to see themselves as having a 'green' self-identity. Importantly, this higher distress group was also significantly more likely to be adapting to climate change (e.g., changing their thinking, appraisal of, and/or emotional and motivational response to this looming threat and issue), and engaging in environmentally significant behaviours than was the case for the low and medium distress groups.

***"A large number of respondents (38%), for example, were worried about what the world will really be like for future generations because of climate change."***

*Table 5*. Comparison of the three distress groups on the major climate change variables

| | | | | | Group means | | |
|---|---|---|---|---|---|---|---|
| | Range of responses N = 3096 | Mean N = 3096 | *F* | $\eta^2$ | Low distress n =1047 | Medium distress n = 1568 | High distress n = 481 |
| **Exposure/vulnerability** | 5-30 | 19.17 | 106.85*** | .07 | 17.61 | 19.34 | 21.98 |
| **Connection to the environment** | 6-36 | 25.44 | 428.88*** | .22 | 21.54 | 26.34 | 31.03 |
| **Trust** | 4-23 | 12.03 | 347.74*** | .18 | 10.02 | 12.81 | 13.83 |
| **Objective knowledge** | -7-10 | 2.68 | 338.07*** | .18 | 1.06 | 3.24 | 4.41 |
| **Media exposure** | 1-13 | 1.47 | 83.83*** | .05 | 1.14 | 1.48 | 2.18 |
| **Green self-identity** | 3-15 | 10.16 | 596.52*** | .28 | 8.34 | 10.66 | 12.50 |
| **Belief in climate change** | 4-20 | 15.90 | 775.11*** | .33 | 12.63 | 17.18 | 18.82 |
| **Climate change concern** | 7-32 | 23.34 | 1607.53*** | .51 | 17.01 | 25.65 | 29.58 |
| **Risk perception** | 5-30 | 18.94 | 1088.08*** | .41 | 13.97 | 20.57 | 24.42 |
| **Self-efficacy** | 5-28 | 18.38 | 896.78*** | .37 | 14.25 | 19.83 | 22.64 |
| **Responsibility/willingness to act** | 4-20 | 12.68 | 957.67*** | .38 | 9.84 | 13.60 | 15.91 |
| **Psychological adaptation** | 8-48 | 28.64 | 1592.90*** | .51 | 20.73 | 30.99 | 38.25 |
| **Behaviour** | 0-15 | 6.43 | 242.07*** | .14 | 5.13 | 6.74 | 8.24 |

***All of the groups were significantly different from each other across all shown variables, $p < .001$.
Alpha reduced to .017 for all post hoc comparisons
Note: For details of the items used to construct each of the climate change variables, see Appendix J

Spatial and temporal distancing of climate change was assessed across the three distress groups with a number of items (#15a-d). The mean ratings reported here are based on a 5-point Likert scale (1 = *strongly disagree* to 5 = *strongly agree*). A significant difference was found for item (#15a), which asked respondents if they viewed climate change as happening far away from their own region, $F(2, 2901) = 62.73$, $p < .001$, $\eta^2 = .04$. Respondents in the high distress group ($M = 1.75$, $SD = 0.97$) were significantly different from the medium ($M = 2.04$, $SD = 0.92$), and low ($M = 2.33$, $SD = 0.95$) distress groups. The medium group was also significantly different from the low group. These results indicate respondents in the high and medium distress groups more strongly disagreed with this statement than the low distress group, suggesting the former groups see their local region and Australia as a whole as equally if not more vulnerable to the impacts of climate change, and that this threat, for them, as not just a distant threat.

Not surprisingly, a significant difference was found between distress groups with respect to climate change affecting the local area (#15b), $F(2, 2903) = 311.17$, $p < .001$, $\eta^2 = .18$. Respondents in the high distress group ($M = 4.24$, $SD = 0.82$) were significantly different from the medium ($M = 3.78$, $SD = 0.84$), and low distress groups ($M = 3.02$, $SD = 1.14$.). A significant difference was also found between the medium and low distress groups. Respondents in the high distress group perceived the impacts of climate change to be much more likely to affect their *local* area than was the case for the medium and low distress groups. No significant differences were found between the three distress groups on item #15c, which explored the extent of respondents' agreement with the statement that 'climate change would mostly affect developing countries'.

The final question in this series of items assessing spatial and temporal distancing, item (#15d), explored anticipated personal impact of climate change. A significant difference was found between the groups, $F(2, 2926) = 618.30$, $p < .001$, $\eta^2 = .30$. Respondents in the high distress group ($M = 4.24$, $SD = 0.79$) were significantly different from the medium ($M = 3.55$, $SD = 0.85$), and low distress groups ($M = 2.58$, $SD = 1.03$). A significant difference was also found between the medium and low distress groups. Respondents in the high distress believed more strongly that climate change was likely to have a big impact on people like themselves. Hence all of these results confirm that the often reported psychological distancing effect with respect to the threat of climate change is happening (e.g., Spence et al., 2011b; Uzzell, 2000), but that this effect, and the anxiety protection afforded, is substantially reduced for those who are experiencing climate change distress.

Respondents were asked to rate the condition of the natural environment in their *local* region of Australia (#31), as well as the *world* (#33), on a 6-point Likert scale (1 = *very poor* to 6 = *excellent*). A significant difference was found between the three distress groups with respect to how they viewed the condition of the world, $F(2, 3093) = 58.67$, $p < .001$, $\eta^2 = .04$, and their own local area, $F(2, 3093) = 31.73$, $p < .001$, $\eta^2 = .02$. Respondents from the high distress group rated the natural environment (world condition) as significantly different ($M = 3.12$, $SD = 1.06$), from the medium ($M = 3.37$, $SD = 0.98$), and low ($M = 3.68$, $SD = 1.01$, $M = 4.30$) distress groups. Respondents from the high distress group also rated their *local* area as significantly different ($M = 3.87$, $SD = 1.10$), from the medium ($M = 4.07$, $SD = 0.96$), and low ($M = 4.30$, $SD = 1.09$) distress groups. Overall, the results suggest respondents in the

high distress group assessed the environment more poorly at local and global levels than did the medium and low distress groups. Importantly, all three groups assessed the condition of their local environment as more favourable than the world environment.

A significant difference was found between the three distress groups in response to item (#25) which assessed the perceived importance of the climate change issue, $F(2, 3093) = 1410.57$, $p < .001$, $\eta^2 = .48$. Responses from the high distress group ($M = 5.47$, $SD = 0.65$), were significantly different from the medium ($M = 4.64$, $SD = 0.93$), and low groups ($M = 2.78$, $SD = 1.35$) (range; 1 = *not at all important* to 6 = *extremely important*). A significant difference was also found between the medium and low distress groups. Large numbers of respondents from the medium and high distress groups believed climate change was an extremely important issue.

A significant difference was found between the distress groups in terms of how closely they were following the news about the environment (#39), $F(2, 3093) = 329.69$, $p < .001$, $\eta^2 = .18$. The range of possible responses for questions #39 and #40 was between 1 = *not at all* to 6 = *a great deal*. Respondents in the high distress groups; ($M = 4.80$, $SD = 1.02$) were significantly different from the medium ($M = 3.92$, $SD = 1.34$) and low distress groups ($M = 3.14$, $SD = 1.38$). The medium distress group was also significantly different from the low group. The groups also differed significantly in relation to how often they were thinking about the issue of climate change (#40), $F(2, 3093) = 962.25$, $p < .001$, $\eta^2 = .38$. Respondents in the high distress group ($M = 4.92$, $SD = 0.86$) were significantly different from the medium ($M = 3.82$, $SD = 1.05$) and low distress group ($M = 2.48$, $SD = 1.12$). The medium group was significantly different from the low distress group. Overall, the results indicate that respondents in the higher distress group are more likely to be thinking about and adapting to the issue of climate change than are those in the low and medium groups. This general finding, however, requires immediate qualification as it would appear that while psychological adaptation positively mediates the impacts of psychological distress for many respondents, for others this experienced distress appears to constitute an ongoing and adverse psychological impact colouring experienced quality of life and environment.

To determine respondents' respective prior experience with natural disasters, a series of questions was asked. Firstly, respondents were asked to indicate, "yes" or "no", as to whether they had experienced a natural disaster warning or impact situation (#52). Response to this question was compared across the three distress groups, with the results approaching significance, $\chi^2(2) = 5.74$, $p = .05$. Fewer respondents in the low and medium distress groups indicated that they had experienced a natural disaster, whilst there was an overrepresentation of respondents with such experience in the high distress group. Further analyses included a composite measure of prior experience with natural disasters. This measure was created to explore respondents' exposure to and experience with disasters, where higher scores reflected greater exposure and experience. A significant difference was found between the groups with respect to respondents' prior disaster experience, $F(2, 1154) = 11.71$, $p < .001$, $\eta^2 = .02$. Respondents in the high distress group ($M = 9.82$, $SD = 2.65$) were significantly different from those in the medium ($M = 8.99$, $SD = 2.93$) and low ($M = 8.58$, $SD = 3.10$) groups. These results suggest that it is not only previous experience with disasters that is important, but the nature of that prior experience and personal impacts which in turn influence

respondents' experienced distress in the context of the threat and consequences of global climate change.

A significant difference was also found between the distress groups with respect to judgments concerning the extent to which climate change is influencing the frequency and intensity of extreme weather events (#51), $F(2, 3093) = 878.28$, $p < .001$, $\eta^2 = .36$. Respondents were asked to rate their response on a 6-point Likert scale (1 = *Not at all* to 6 = *A good deal*). Respondents in the high distress group ($M = 5.31$, $SD = 0.80$) were significantly different from the medium ($M = 4.58$, $SD = 1.08$), and low ($M = 2.94$, $SD = 1.44$) groups. The medium group was also significantly different from the low distress group. The results suggest respondents in the high and medium distress groups hold clear and relatively strong beliefs that climate change is influencing a spectrum of extreme weather events.

At the end of the survey respondents were asked whether their level of concern about climate change had changed over the past several years (#60) on a 6-point Likert scale (1 = *decreased substantially* to 6 = *increased substantially*). A significant difference was found across the three groups with respect to changes in concern levels, $F(2, 3093) = 770.53$, $p < .001$, $\eta^2 = .33$. Respondents in the higher distress group ($M = 4.89$, $SD = 0.85$) were significantly different from those in the medium group ($M = 4.19$, $SD = 0.81$), both of which reported a greater increase in concern than did the low distress group ($M = 3.16$, $SD = 0.96$). A significant difference was also found between the medium and low distress groups. The results demonstrate that concern levels for the higher and medium distress groups have increased over the past few years, whilst concern levels have either remained relatively stable, or moderately declined for the low distress group. It is possible that we are beginning to see a plateauing of concern levels for the higher distress group, as the level of concern for this group is already quite high, and there is understandably a finite ceiling on specific worries and concerns in today's stressful and ever-changing world (e.g., Marx et al., 2007; Weber, 2006).

## SUMMARY

A principal objective in the preceding group comparisons was to examine how those respondents scoring relatively highly on psychological distress in the face of climate change might differ from other survey respondents across key variables. Again, 481 respondents, or 16% of the survey sample achieved distress scores which resulted in their being placed in the high distress group. The findings suggest that this shared and relatively greater level of experienced distress was associated with other, convergent, demographic differences and psychological responses, through differences between the high and moderate distress groups (51% of respondents)were often modest, in contrast with the low distress group (34% of respondents).

The high distress group was younger, and better educated, with an overrepresentation of women and those intending to vote Labor or Green. Those scoring in this higher distress range were also more likely to accept that climate change was due in large part to human

activities, more likely to think that Australia was already feeling effects of climate change and/or would experience these effects in the next 10 years, and more likely to judge the condition of the Australian and global environment as less favorable. Respondents in the higher distress group were also more likely to have had direct experience of perceived climate change impacts, were less likely to be expressing views reflecting geographic or temporal distancing, were more likely to see their locality as exposed and vulnerable to the effects of climate change, were more likely to be psychologically adapting to the threat of climate change, and were more likely to be engaged in pro-environmental behaviours associated with climate change mitigation. Finally respondents in the higher distress group were more likely to report that the issue of climate change was personally important and that their concern level had increased over the preceding few years.

It would appear that periodic experiences of genuine distress in the face of the climate change threat are, in their own way, salutary rather than debilitating for most of the survey respondents, and seemingly a source of positive motivation and personal resolve to squarely acknowledge and address the threat and problem, however serious and grave. This is, of course, premised on this current, more moderate, and less clinical understanding of 'distress'. It is likely that engaging in pro-environmental behaviours generally, and consciously altering one's lifestyle and habits to reduce one's own and one's household's climate change impact, make the specific threat and implications of climate change more 'real' and salient. Yet at the same time engaging in such actions can by very psychologically adaptive and self-efficacious with respect to making a difference and being part of a collective effort to address the problem of climate change (e.g., Weber, 2012).

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 (approximately two thirds). 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 still 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, behavioural engagement and adjustment, 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 forces here by way of protection motivation processes and optimism bias 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.

It is important to reflect on the self-reported increases in levels of concern over the past several years for 71% of survey respondents. 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. But 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 the qualitative nature of such psychological responses and impacts. It is noteworthy that self-reported concern levels increased over the past several years for 71% of respondents. This occurred at a point in time when many journalists and Australian surveys were reporting decreased levels of acceptance and concern on the part of Australians. As well, it is arguable that concern levels for many were already high, making such increases all the more noteworthy and meaningful, and perhaps elevating climate change concern into climate change distress for some respondents. These matters of psychological changes relevant to the threat of climate change are again raised and discussed in the next section of the report addressing psychological adaptation.

***"It is arguable that concern levels for many were already 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 TO CLIMATE CHANGE

A principal focus in this research, and the funding which supported the research, relates to adaptation to climate change. Climate change science and IPCC 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 & Swim, 2011; Reser et al., 2012a). 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 (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 et al., 2012). Importantly, psychological adaptation also invokes and involves psychological *impacts*, and both the benefits and costs of environmental changes and human adaptations.

*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. While the multiple psychological processes and factors involved in adaptively responding to perceived environmental threats and consequent states of psychological adaptation are not easy to represent, Figure 24 attempts to capture salient considerations and processes in the context of climate change.

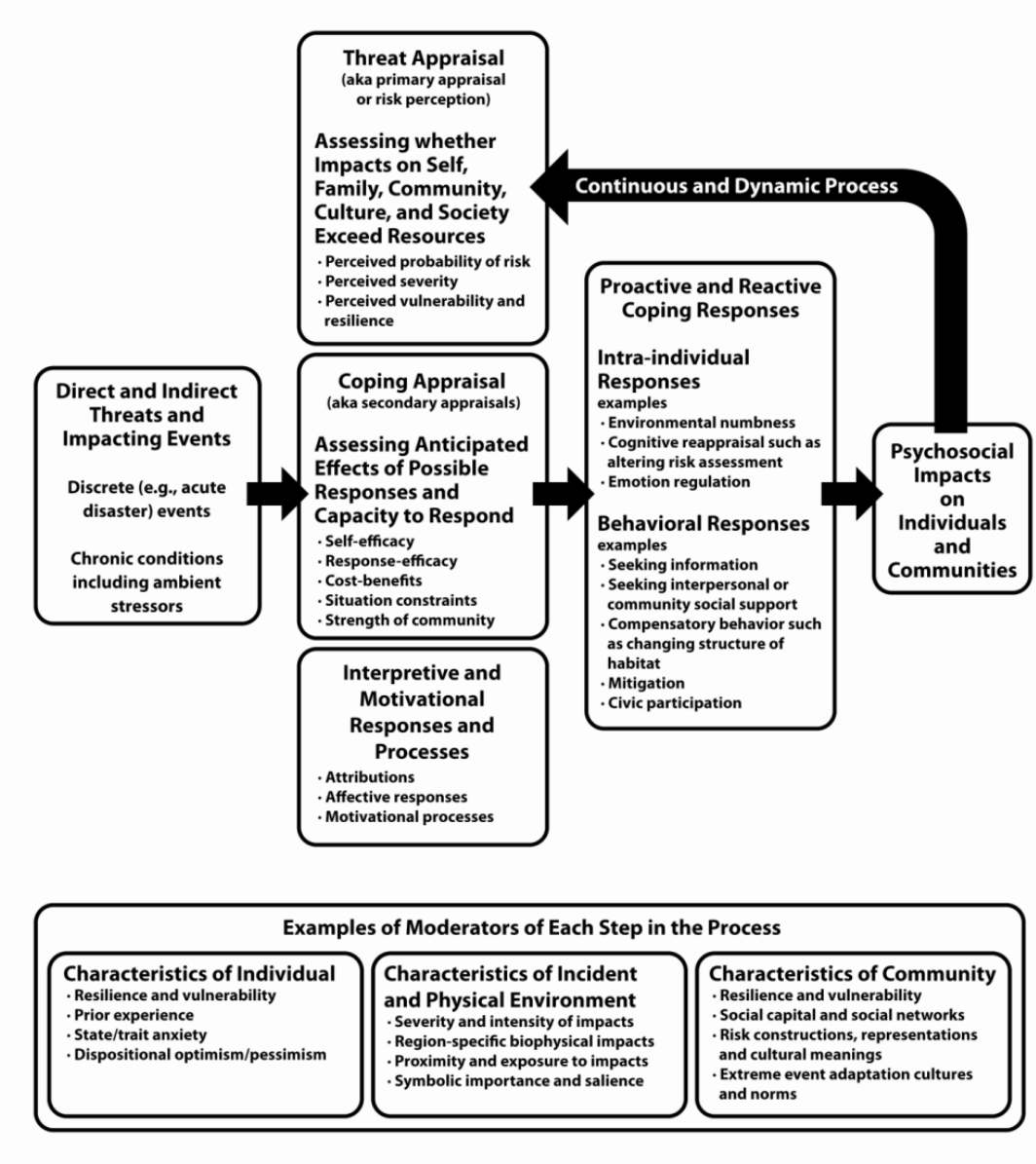


*Figure 24*. Psychological adaptation to climate change

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Figure 24, in addition to bringing together those convergent processes and considerations relating to psychological adaptation and psychosocial impacts, attempts to highlight and integrate both ongoing environmental stress and stress and coping frameworks, the mediating and moderating roles of particular variables and processes, the dynamic and transactional character of people-environment interactions, and the nature and importance of direct and indirect individual and collective experience and risk appraisal and sense making in complex and interacting biophysical, social, and information environments (Reser & Swim, 2011).

Again, an important objective of the survey focus on public risk perceptions, understandings, and responses to climate change and natural disasters has been not only to document the present state of such public views and responses, but also to establish a database and research platform from which changes in these views can be monitored and documented, along with the psychological and social impacts of those risk communications and perceived environmental changes on individuals and communities. Survey results for 2010 reflect an initial snapshot in time of public perceptions and responses, but it was nonetheless possible to assess some important changes through self report from this initial 2010 data collection – for example, by asking respondents about changes that they may be aware of in their own thinking, feelings, and appraisals of the threat of climate change. Again, such changes in individuals' risk appraisals, personal views, understandings, motivations, and other psychological responses, made in the context of climate change discussions, media exposure, or direct encounters, or which are associated with thinking about or emotionally responding to the implications of climate change, constitute important psychological adaptations to climate change.

As with psychological distress in the context of climate change, there were no available climate-change specific or psychological scales which measure psychological adjustments, adaptations or impacts to the threat of climate change. 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 et al., 2011). But coping itself 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 longer 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 development and way forward.

At a number of points in the survey respondents were asked about such changes, with this information allowing for some conclusions to be drawn about psychological adaptations to climate change. At the same time, all measures of individual views, judgments, understandings, and concerns provided for the possibility of taking subsequent measures and readings, thereby allowing for more objective measurement of changes and adaptation to climate change over time. It is also reasonable and useful to consider such responses and adaptations to an environmental threat or sequence of environmental changes as psychological or social *impacts*. Many social and behavioural scientists would describe the measuring and monitoring of such changing responses to an environmental threat or stressor as an environmental impact assessment exercise, in this case a psychosocial environmental

impact assessment and/or monitoring exercise (e.g., Esteves, Franks, & Vanclay, 2012; Reser & Bentrupperbäumer, 2001; 2005). In reality, the threat of global climate change has undoubtedly been having psychological and social impacts on individuals, communities, and societies for the past few decades, but these have rarely been acknowledged, addressed, or systematically measured and monitored (e.g., Doherty & Clayton, 2011; Reser & Swim, 2011).

## COMPOSITE MEASURE OF PSYCHOLOGICAL ADAPTATION

While many, if not most, of the responses to this survey could be seen to reflect psychological impacts of the threat of climate change, and particularly in the case of parameters such as climate change risk appraisals, concern levels, beliefs, values, and future hopes and fears, those questions most specific to *changes* in respondent psychological and behavioural responses to the threat of climate change and therefore to psychological adaptation, are questions #35, #39, #40, #45, #60, and #61. An objective in including a composite scale addressing psychological adaptation was to examine how intra-individual adaptation or adjustment to the threat or experienced impacts of climate change might relate to other parameters investigated by the survey, such as objective knowledge, direct versus indirect experience and exposure, self-efficacy, climate change concern, and psychological distress. Such inclusion also allowed for a latent variable which most closely approximates psychological adaptation in the context of climate change for structural equation modeling, and for analyses of the putative mediating role which psychological adaptation plays in motivation processes generally relating to climate change adaptation and mitigation behaviours, and to these behaviours themselves.

Question #45 constitutes a provisional 7-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 included two additional items (#39, #40) and one deletion (#45b) from the original 7 items. This final psychological adaptation measure in the context of climate change was the 8-item scale described above. 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*). The scale contained items such as, "**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**". Scores were summed (possible range = 8-48), with higher scores indicating greater psychological adaptation ($M = 28.65$, $SD = 8.69$). This scale had a Cronbach's alpha of .89, indicating a highly reliable measure.

Averaged results across all participants indicated substantial self-reported changes in thinking about, feeling about, and generally responding to the threat of climate change. Inspection of specific items indicated that 57.3% of respondents agreed that they had, "changed the way they think about the seriousness of environmental problems because of

climate change", and 55.7% of respondents 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).

## PSYCHOLOGICAL ADAPTATION DEMOGRAPHIC ANALYSES

Female respondents reported significantly greater levels of psychological adaptation ($M = 29.6$, $p < .001$) than did male respondents ($M = 27.6$). Respondents aged between 35 and 54 years evidenced significantly greater adaptation scores ($M = 29.2$, $p < .05$) than did older participants aged over 55 years ($M = 28.1$). These findings are interesting, given that younger respondents were more likely to report being distressed about climate change, but older respondents were more likely to report some level of personal adaptation to the threat and implications of climate change. This might reflect the fact that their prior and current life circumstances, as well as their available financial resources, made such changes easier and less personally impactful. Respondents with a university degree reported significantly greater levels of adaptation ($M = 29.9$, $p < .001$), than did respondents with a trade/certificate ($M = 28.9$), or high school education ($M = 27.3$). Respondents intending to vote Green or Labor at the next Federal election evidenced significantly higher levels of adaptation ($M = 30.9$, $p < .001$), than those respondents intending to vote for another party ($M = 26.9$). There were no significant differences found in psychological adaptation between groups based on differing parental, employment or residential status (i.e., urban/rural), home ownership, or income. Overall, the results from this study suggest that those respondents most likely to be adapting to the threat and impacts of climate change are female, aged between 35 and 54 years, hold post-school qualifications, and likely to vote Green or Labor at the next Federal election.

## PSYCHOLOGICAL ADAPTATION CORRELATIONAL ANALYSES

The correlation findings across other key survey variables further delineate the emerging picture of how differing geographic, life circumstance, and psychological variables are associated with psychological adaptation to climate change. It is noteworthy that correlations for geographic parameters relating to exposure, proximity, and direct experience in the context of psychological adaptation are strong and robust. Correlations between psychological adaptation and residential exposure ( $r = .46$), lifestyle exposure ( $r = .36$), and prior disaster experience ($r = .20$), all suggest that, for at least some respondents, psychological adaptation is strongly associated with direct experience with a challenging and at times taxing physical environment. The appreciable positive correlation between psychological adaptation and media exposure ($r = .32$) also suggests that indirect and virtual exposure and experience can influence people's psychological responses and adaptations to these social representations and media coverage of this phenomenon and risk domain (See Appendix K).

Measures of association between psychological adaptation and individual self perceptions and value stances towards the natural environment indicate further and even stronger relationships between psychological adaptation and variables such as green self

identity ($r$ = .70); biospheric, altruistic, and egoistic values ($r$ = .61, .62, .54); self-efficacy, ($r$ = .69); and felt responsibility, ($r$ = .69). Similarly, with respect to those measures addressing risk perceptions and psychological responses, correlations were strong and convergent. Associations between psychological adaptation and belief in climate change ($r$ = .59), climate change concern ($r$ = .73), risk appraisal ($r$ = .64), and distress ($r$ = .78) all suggest that multiple and interacting psychological changes in thinking, risk appraisal, acceptance, and emotional and motivational responses were occurring for a majority of respondents, and that the direction of these changes was, on the whole, with respect to a more active and concerted engagement with the issue/problem and adaptive response options. All of these correlations are $p < .001$.

The strength and direction of these correlations suggest that psychological adaptation may play core mediating roles in relation to most other key variables. The highest correlations are particularly interesting in that psychological adaptation appears to be strongly associated not only with concern and distress, but also with motivational factors relating to self perception in terms of identity, efficacy, responsibility, connectedness to the natural world, beliefs and values, and risk appraisal and acknowledgement of the problem.

## COMPARISONS ACROSS LOW, MEDIUM AND HIGH ADAPTATION GROUPS

Correlational analyses were followed by group comparisons based on respondents' self-reported adaptations (changes in perceptions and responses) to the threat and impacts of climate change. Respondents were divided into low, medium, and high adaptation response to climate change groups. Those scoring between 8 and 21 were regarded as 'low adapters' (n = 685), those scoring between 22 and 34 were considered to be 'medium adapters' (n = 1559), and those scoring between 35 and 48 were deemed to be 'high adapters' (n = 852) (total range, 8–48). These post hoc group comparisons invite both parametric and non parametric statistical analysis as some variables and corresponding measures are nominal, whereas other variables are continuous, interval level, measures. Chi-square analyses and analysis of variance (ANOVA) were undertaken to compare and contrast the three groups on a number of composite variables as well as on some single item measures.

A significant association was found between psychological adaptation and acceptance of some level of human causality for climate change, as operationalised by participant responses to (#9), "**Thinking about the causes of climate change, which of the following best describes your opinion**", $\chi^2(8) = 502.65$, $p < .001$. The low adaptation group was overrepresented in their selection of the response, "Climate change is entirely/mainly caused by natural processes", whereas the medium, and high adaptation groups were underrepresented. Conversely, the low and medium adaptation groups were underrepresented in selection of, "Climate change is mainly/entirely caused by human activity", and overrepresented in the high adaptation group. An underrepresentation was found in the low and high adaptation groups with respect to the item, "Climate change is partly caused by natural processes and partly caused by human activity", with an overrepresentation in the medium group. Results indicate that those respondents who accept the anthropocentric forcing of climate change were more likely to be in the high adaptation groups, and with

these individuals changing their appraisal and views toward this changing environmental condition and quite possibly changing their behaviours to reduce their environmental footprint. (see Figure 25).

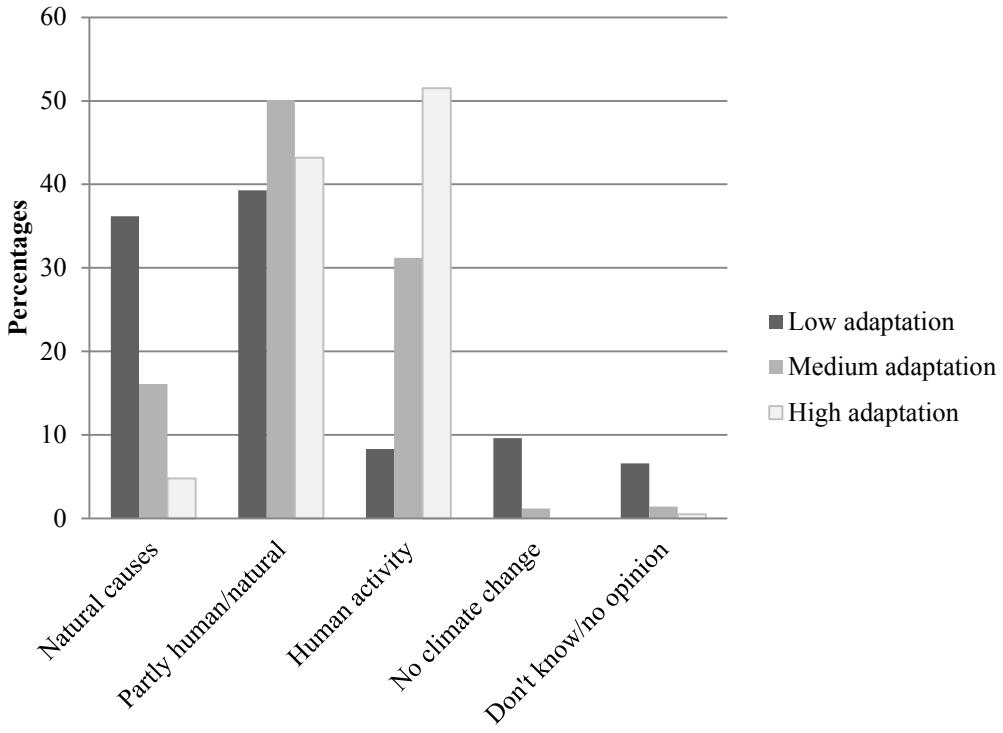


*Figure 25*. Attributed caused of climate change and psychological adaptation

A further association was found between perceived temporal immediacy of climate change and psychological adaption in the context of (#14), "**When if at all, do you think Australia will start feeling the effects of climate change**", $\chi^2(12) = 790.12$, $p < .001$ (See Figure 26). Low and medium adaptation groups were underrepresented in the endorsement of the response option, "We are already feeling the effects", as compared with an overrepresentation for the high adaptation group. In the selection of the response category, "In the next 10 years", an underrepresentation was found for the low and high adaptation groups, while respondents in the medium adaptation group were overrepresented. The low and medium adaptation groups were overrepresented in their response to, "In the next 25, 50, 100 years", with the low adaptation group overrepresented in the selection of response category, "Never".

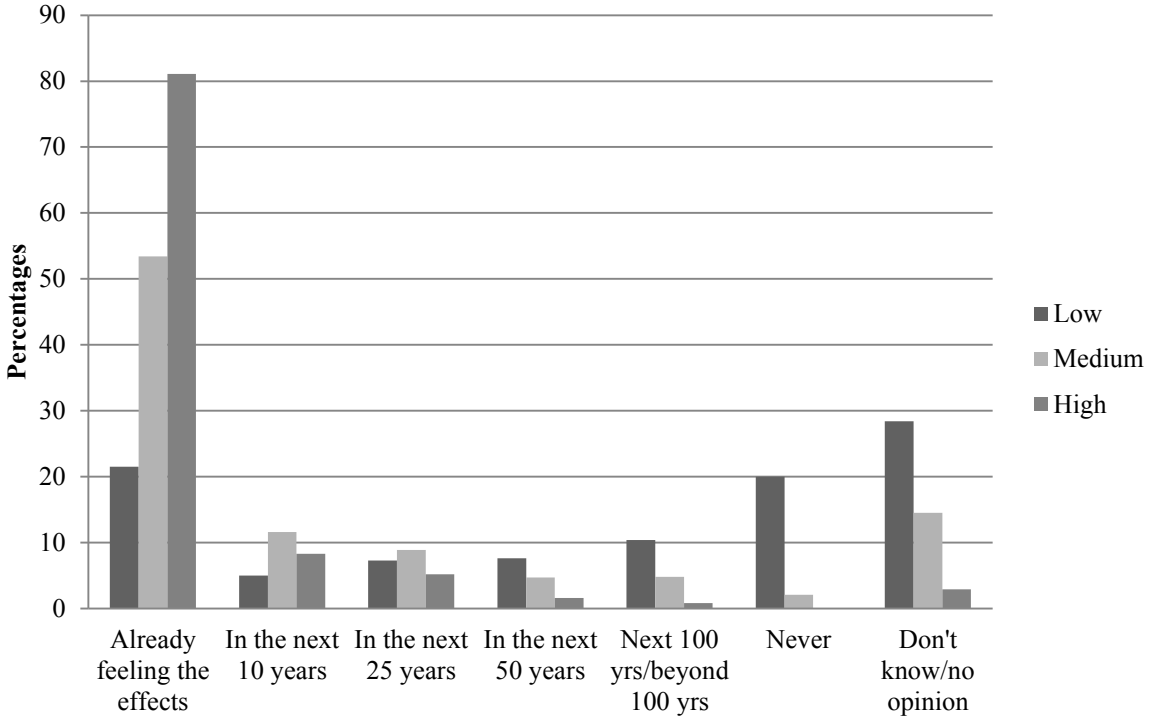


*Figure 26*. Perceived temporal distance and the climate change threat

A significant association was found between direct experience and exposure to the perceived impacts of climate change across the adaptation groups, $\chi^2(2) = 499.88$, $p < .001$ (See Figure 27). Respondents reporting "no" to perceived changes in their environment due to the impacts of climate change were overrepresented by both the low and medium adaptation groups, in contrast to an underrepresentation for the high adaptation group. This pattern was reversed for participants who responded "yes", that they had directly experienced the probable impacts of climate change. These findings provide further support for the proposition that direct experience and exposure to climate change impacts appear to be influencing psychological adaptation responses.

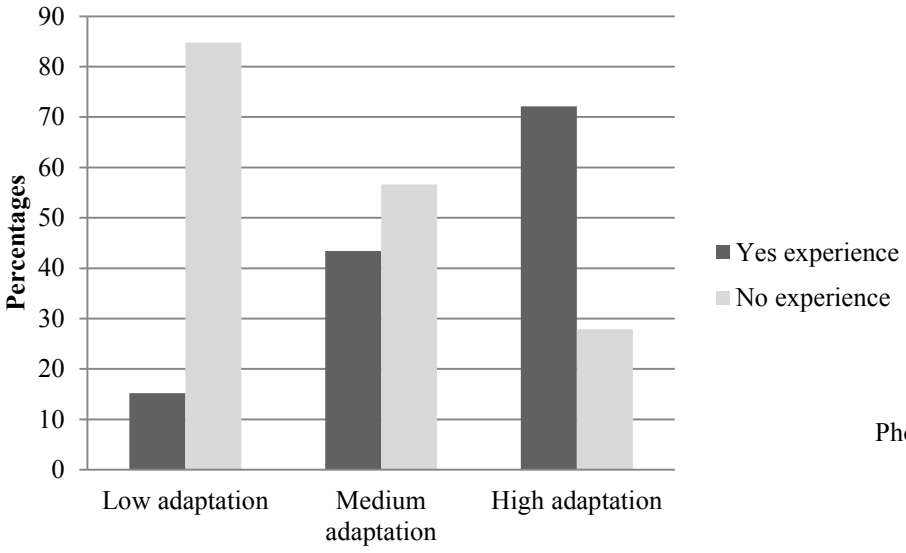


Photo: Watchsmart

*Figure 27*. Direct exposure with climate change impacts by psychological adaptation group

Table 6 provides further information characterising those respondents engaged in more adaptive responses and behaviours in the context of climate change. Respondents indicating higher levels of psychological adaptation reported a stronger connection to the natural environment, higher levels of perceived vulnerability to both the impacts of climate change as well as to natural disasters, and scored higher on 'green self-identity'. The high adaptation group was also more likely to be engaged with the topic of climate change. For example, these individuals reported viewing twice as many climate change-related documentaries and films than did the low adaptation group. This interest and media consumption may be reflected to some extent in the respective objective knowledge scores for these two groups, with more correct scores recorded for the high adaptation group. While it is understandable that greater levels of concern and distress were evidenced by the high adaptation group on both personal (egocentric) and societal (altruistic) grounds, it is arguably counter-intuitive that self-efficacy and behavioural engagement (i.e., actions to reduce carbon footprint) would also be strongest for the more distressed members of this group. Yet, on reflection, one would expect that individuals who are more knowledgeable (through formal and self education as well as from direct experience), more concerned, and who see themselves as particularly exposed and vulnerable to the anticipated consequences of climate change, might well be galvanised to reassess and re-evaluate this profound risk, and respond accordingly, both psychologically and behaviourally.


***"Those who see themselves as particularly exposed and vulnerable to the anticipated consequences of climate change, might well be galvanised to reassess and re-evaluate this profound risk, and respond accordingly, both psychologically and behaviourally."*** **Photo: Watchsmart**

*Table 6*. Comparison of the three psychological adaptation groups on the major climate change variables

| | Range | Overall Mean | | | Low adaptation | Medium adaptation | High adaptation |
|---|---|---|---|---|---|---|---|
| | N = 3096 | N = 3096 | *F* | η² | n = 685 | n = 1559 | n = 852 |
| Exposure/vulnerability | 5-30 | 19.17 | 256.34*** | .14 | 16.13 | 18.87 | 22.15 |
| Connection to the environment | 6-36 | 25.44 | 721.70*** | .31 | 19.44 | 25.28 | 30.57 |
| Trust | 4-23 | 12.03 | 218.02*** | .12 | 9.96 | 12.19 | 13.39 |
| Objective knowledge | -7-10 | 2.68 | 322.28*** | .17 | .78 | 2.68 | 4.22 |
| Media exposure | 1-13 | 1.47 | 132.08*** | .08 | .93 | 1.35 | 2.14 |
| Green self-identity | 3-15 | 10.16 | 1029.39*** | .40 | 7.51 | 10.07 | 12.45 |
| Belief in climate change | 4-20 | 15.90 | 670.90*** | .30 | 11.99 | 16.20 | 18.47 |
| Climate change concern | 7-32 | 23.34 | 1267.32*** | .45 | 16.19 | 23.48 | 28.85 |
| Risk perception | 5-30 | 18.94 | 820.11*** | .34 | 13.30 | 19.09 | 23.20 |
| Self-efficacy | 5-28 | 18.38 | 1018.24*** | .39 | 13.27 | 18.37 | 22.50 |
| Responsibility/willingness to act | 4-20 | 12.68 | 1011.40*** | .39 | 9.31 | 12.55 | 15.65 |
| Distress | 7-42 | 21.90 | 1596.93*** | .51 | 12.48 | 21.95 | 29.40 |
| Behaviour | 0-15 | 6.43 | 3021.94*** | .23 | 4.34 | 6.31 | 8.31 |

***All of the adaptation level groups were significantly different from each other across all shown variables, $p < .001$.
Alpha amended to ($p = .017$) for post hoc comparisons.
*Note*: For details of the items used to construct each of the climate change variables, see Appendix J

Additional analyses were undertaken to explore differences across the three adaptation groups in relation to the spatial and temporal distancing of climate change impacts (#15a, b, c, d) (Range: 1 = *strongly disagree* to 6 = *strongly agree*). A significant difference was found between mean group responses to item #15a, which asked respondents to indicate their level of agreement with the statement, "**Climate change will mostly affect areas that are far away from here**", $F(2, 2901) = 103.40$, $p < .001$, $\eta^2 = .07$. Respondents in the high adaptation group ($M = 1.73$, $SD = 0.93$) were significantly different from the medium ($M = 2.15$, $SD = 0.91$) and low level adaptation groups ($M = 2.42$, $SD = 0.96$) in their disagreement of this statement. The medium level group mean was also significantly lower than the low adaptation group mean. All respondents, regardless of group membership, disagreed with this statement to some degree. However, respondents from the high adaptation group were more prone to see their local environments as both exposed and vulnerable to the impacts of climate change.

A significant difference was found between the groups with respect to the extent to which climate change was seen to be affecting their local area (#15b), $F(2, 2903) = 336.49$, $p < .001$, $\eta^2 = .19$. Respondents in the high adaptation group ($M = 4.19$, $SD = 0.82$) were significantly different from those in the medium ($M = 3.57$, $SD = 0.91$), and low adaptation groups ($M = 2.89$, $SD = 1.14$) in this respect. A significant difference was also found between the medium and low adaptation group means. These results again suggest that respondents in the high adaptation group viewed climate change as more likely to affect their local area than was the case for the medium and low adaptation group respondents. No appreciable differences were found between the three adaptation groups with respect to item #15c, which concerned the extent to which climate change was seen to be affecting developing countries.

Item #15d asked respondents to indicate if climate change was likely to have a big impact on people like them. A significant difference was found between the three groups, $F(2, 2926) = 516.60$, $p < .001$, $\eta^2 = .26$. Respondents in the high adaptation group ($M = 4.07$, $SD = 0.86$) were significantly different from the medium ($M = 3.29$, $SD = 0.92$), and low adaptation groups ($M = 2.49$, $SD = 1.02$). A significant difference was also found between the medium and low adaptation group means. These results suggest that respondents in the high adaptation group were more likely to view climate change as likely to have a big impact on them personally than was the case for respondents in the medium and low adaptation groups.

A significant difference was also found with respect to the importance of climate change for the three adaptation groups, based on item #25, "**How important is the issue of climate change to you personally?**" from 1 (*not at all important*) to 6 (*extremely important*), $F(2, 3093) = 1299.26$, $p < .001$, $\eta^2 = .46$. The high adaptation group respondents' scores ($M = 5.37$, $SD = 0.75$) were significantly higher than those of the medium ($M = 4.17$, $SD = 1.14$) and low adaptation groups ($M = 2.54$, $SD = 1.28$). A significant difference was also found between the medium and low adaptation group scores. These results suggest that high adaptation group respondents viewed climate change as a substantially more important and personally relevant issue, as did those in the medium adaptation group. It is crucial to note

that the rated personal importance of this issue has been one of the strongest and most consistent predictors of associated attitudes and behaviours in the context of climate change, and is an important tracker item in many national surveys (e.g., Krosnick et al., 2000; Villar, Krosnick & Koczela, 2011).

A significant difference was found between the three adaptation groups and respondents' assessment of the condition of the natural environment across the world, $F(2, 3093) = 48.53$, $p < .001$, $\eta^2 = .03$, as well as with respect to their own local region in Australia (#31, 33), $F(2, 3093) = 9.44$, $p < .001$, $\eta^2 = .006$. (Range between 1 = *very poor* to 6 = *excellent*). Respondents in the high adaptation group viewed the condition of the natural environment as significantly poorer, both in the world and their own local region ($M = 3.20$, $SD = 1.08$; $M = 4.01$, $SD = 1.08$), as compared with respondents in the medium ($M = 3.45$, $SD = 0.97$; $M = 4.13$, $SD = 0.99$) and low adaptation groups ($M = 3.71$, $SD = 0.98$; $M = 4.24$, $SD = 1.07$). A significant difference was also found between the medium and low adaptation groups in their ratings of the condition of the natural environment for the world, however, this was not found for ratings of respondents' local region in Australia. Whilst a significant difference was found, caution is required when interpreting the results given the small effect size.

A significant difference was found between the low, medium, and high adaptation level groups in respect of the composite measure of prior experience with natural disasters, $F(2, 1154) = 24.27$, $p < .001$, $\eta^2 = 04$. Respondents in the high adaptation group were significantly different ($M = 9.75$, $SD = 2.90$) from the medium ($M = 8.86$, $SD = 2.81$) and low adaptation groups ($M = 8.07$, $SD = 3.17$) in their cumulative disaster experience scores. The medium adaptation group mean was also significantly higher than the low adaption group mean. These results suggest that respondents with greater experience and exposure to natural disasters are psychologically adapting (i.e., change their thinking, views and responses to, the threat and impacts of global climate change) to a greater extent than are low and medium disaster experience and exposure respondents.

A significant difference was found between the three groups with respect to self-reported changes in climate change concern levels over the past several years (#60), $F(2, 3093) = 681.62$, $p < .001$, $\eta^2 = .31$. Respondents in the high adaptation group reported greater increases in concern ($M = 4.72$, $SD = 0.88$) than did those in the medium, ($M = 3.93$, $SD = 0.87$), and low adaptation groups ($M = 3.04$, $SD = 0.94$). A significant difference was also found between the medium and low adaptation group means. These results indicate a significant increase in concern levels over the past few years for the high adaptation group, with reported concern levels remaining relatively constant for the medium and low adaptation groups.

## SELF-REPORTED CHANGES IN CLIMATE CHANGE CONCERN

Item #60 asked respondents whether their level of concern about climate change had increased, decreased or remained the same over the past several years on a six-point rating scale (1 = *Decreased substantially* to 6 = *Increased substantially*) ($M = 3.95$, $SD = 1.07$).

Item #61, an open-ended question asked respondents, "**If your views have changed at all, could you briefly explain why and how they have changed?**" Responses to this open-ended question fell into the categories provided in Table 7 and 8. The data coding was based on a sub-sample of 2000 respondents, note that all respondents did not answer this question. It is noteworthy that the great majority of these responses related to *increases* in levels of concern about climate change. The most populated category (106 responses) related to *increased awareness and knowledge* about the nature, magnitude, and concrete consequences of climate change. The next highest categories were *media coverage* and *perceived lack of action by government* (92 responses each), *perceived increases in the frequency and severity of natural disasters and extreme weather events* (85), *changes to seasonal patterns in one's local and known environment* (75), and a *perceived increase in scientific evidence and scientific concern* (71 responses). The relative frequencies across categories are in many instances counter-intuitive, and provide a corrective to a seeming widespread acceptance that, for example, the *anticipated increased costs of living associated with climate change* (26), or *concern for future generations* (22) are particularly salient. These findings again validate this substantial increase in self-reported concern levels in recent years for a majority of respondents, and begin to illuminate the reasons for such increases, notwithstanding already high levels of concern.

***These finding validate this substantial increase in self-reporting concern level.***

**Photo: Angus Veitch**

*Table 7*. Reasons given for increased levels of concern about climate change

| Category (illustrative response) | Frequency | % |
|---|---|---|
| More awareness/knowledge **("I guess I have just become more aware of how fragile our ecosystems are and if we continue to abuse these, our planet – like anything – will just dry up and crumble")** | 106 | 12.3 |
| More media attention **("I've learnt more about it through reports in the media and on TV. I realise it's much more serious than I thought, and have learnt more about how much our government needs to act on its promises regarding climate change")** | 92 | 10.7 |
| Lack of action by the Government **("There has been more instances of events that could be related to climate change and the government does not seem to be acting – am now more concerned that climate change will not be addressed")** | 92 | 10.7 |
| Increase in frequency/severity of natural disasters **("Far more natural disasters since then – cyclones, bush fires. They seem to be way more frequent nowadays")** | 85 | 9.9 |
| Noticing changes in the immediate environment **("Even the fruit trees in my yard are fruiting less – winters are no longer cold")** | 75 | 8.7 |
| Increased scientific evidence/information **("Constant concern expressed by scientists and others indicates that it is imperative to consider the issue. I consciously do my tiny little bit but often consider how ineffective it is")** | 71 | 8.2 |
| Changes in weather patterns **("Because of the weather changes they have started to scare me with how bad they are")** | 48 | 5.6 |
| Increased information seeking ("**Read more scientific data about the effects of climate change. More aware of the changes in wild weather and drought that have affected my local area. Saw a map of my local area projecting areas affected by rising sea levels – opened my eyes to the possible enormity of the problem more than just hearing levels quoted etc")** | 28 | 3.2 |
| Increases in cost of living **("I think all the natural disasters that have occurred around the world in the past year have made a lot of people think about climate change. Also the rising costs of electricity and petrol have made everyone think about alternatives that are both cost effective and environmentally sustainable")** | 26 | 3.1 |
| Experiencing drought **("returned to the rural area, where the lower lakes are dying before our eyes")** | 24 | 2.8 |
| Concern for future generations **("Having experienced 2 earthquakes in different countries – one almost resulting in floods, it has certainly made me think about the impacts that are to come in my child's future. I am frightened for her")** | 22 | 2.5 |
| Impacts of climate change are increasing **("I am more concerned than ever that not enough is being done and that there are more and more examples of phenomena that can be linked to climate change")** | 20 | 2.3 |
| Water restrictions/availability **("I feel more concerned about it. Given the extremes of weather, the bushfires and the lack of water as my children grow older I worry more about the world we are leaving to them")** | 19 | 2.2 |
| Linking climate change and natural disasters **("I have become more aware of our surroundings, due to the increased number of and increased severity and regularity of natural disasters being shown in the media")** | 18 | 2.1 |
| Increased availability of energy efficient choices and alternative power (**They've changed a bit because I've just finished a major project on redesigning an object to use an alternative power source and designed the product to be eco-friendly and sustainable. I'm more aware now of what I can do, what we should be doing")** | 15 | 1.7 |
| Normative influences (**"I believe my levels of concern have increased due to natural events on a worldwide scale - more adverse conditions, more power cuts, more storms and more land lost to the sea levels that have made me question the situation. I think there have been more informative high profile documentaries that have also helped influence my thought process over climate change")** | 10 | 1.2 |
| Total | 751 | 87.2 |

*Table 8*. Reasons given for decreased levels of concern about climate change

| Category (illustrative response) | Frequency | % |
|---|---|---|
| Natural cyclical phenomena (**"Become more skeptical that it is all human – I think it could be due to natural causes as well. But, at the same time, I am far more conscious about how environmentally friendly I am, and how I teach it to my daughter")** | 31 | 3.6 |
| Political deception **("I think that more research needs to be undertaken regarding climate change, at the moment it seems as though politicians etc are using it to win elections and profit from the introduction of taxes that will not necessarily be useful without further research being conducted")** | 24 | 2.8 |
| Conflicting evidence **("After reading evidence from scientists both for and against climate change, I now believe that it is a myth and we are just going through a cycle which is part of nature")** | 22 | 2.5 |
| Climate change does not exist **("I am no longer certain that we are experiencing 'climate change'. This is not to say I am not concerned by environmental issues or sustainability because I am! I am just not sure convinced of global warming")** | 15 | 1.7 |
| Media sensationalism **("Lack of definitive / subjective information worldwide without vested interests and media hype giving a biased viewpoint. There are a few books around but are expensive and not necessarily available for research")** | 13 | 1.7 |
| Desensitised (**"didn't really think much about it, I guess reading and hearing more has changed my views and thinking ...")** | 5 | 0.6 |
| Total | 110 | 12.8 |

A number of researchers have reported and addressed the matter of fluctuating levels of concern about climate change, and in particular modestly decreased levels of concern over the past few years according to a number of national survey findings in North America, Britain, and Australia (Brechin, 2010; Brulle et al., 2012; Krosnick, 2008; Krosnick & MacInnis, 2011; Krosnick & Villar, 2010). There are a number of points worth making. There have been many national and global events over the past few years that could readily explain such variability, with these including the vagaries of the global financial crisis, the particular concentration and intensity of extreme weather events that occurred over the past few years across these three countries, the sensationalism of much media reporting, as well as the dramatic drop in media coverage of climate change for several years, the 'climategate' aftermath and concerted efforts of sceptic and vested interest lobby groups, the political discord and discourse surrounding the Copenhagen Summit, and strident national political debates and polarisation of views (e.g., Boykoff, 2011; Shwartz, 2010; Villar, Krosnick & Koczela, 2011, Washington & Cook, 2011). As well, of course, these modest reported drops in concern levels are hardly surprising, coming off a very high base level, the likely contributions of" issue fatigue" and "finite worry", and amidst multiple other appreciable concerns, such as the escalating political instability in the Middle East, andNorth Africa and the continuing global financial crisis.

The open-ended responses from those reporting a decrease in their concern levels in response to # 61 provide some local context for Australian survey respondents. Interestingly the most frequent category of response would appear to relate to increased self-efficacy and optimism, and some measure of psychological adaptation, whereas the second most frequent category relates to increasing disenchantment with the nature of the political debate and exploitation of this issue by politicians and vested interests. For some respondents, there would appear to have been a polarisation of responses to the issue over time, with this

resulting in both increased concern as well as increased scepticism. Also noteworthy is a palpable media fatigue and disillusionment with what is perceived to be considerable and transparent media sensationalism, hype, and inflation of the scepticism debate in Australia. The representative respondent statements in Table 9 provide a rich and informative picture of reflective public sentiment. It is important to appreciate that in the case of these open-ended items, the data base includes responses from substantial proportions of the 3096 sample, often providing paragraph length and very strongly felt responses Finally, it is important to note that this focus on reported concern in the context of climate change adaptation and psychological impacts makes considerable sense, in that such a self-reported state and changing response to an environmental threat or issue is one of the most valid, meaningful, and sensitive indicators available with respect to respondent views, appraisals, and the psychological impacts of a threat such as climate change.

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***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.***

*Table 9*. Illustrative selection of reasons for changed levels of concern about climate change

| |
|---|
| The problem with climate change is that it happens so slowly. With the climate changing so slowly and technology increasing so fast, I believe it won't be long before we are able to reverse the effects of climate change, so there is no need for immediate concern (Melbourne metro, male, 26 years). |
| Every day one reads more and more about the effects and impacts on climate change. It's frightening (Melbourne metro, female, 44 years). |
| I am a lot more aware of climate change as it has been in the media and we have had a lot of natural disasters all over the world that is reported by media to be associated with climate change (Perth metro, female, 43 years). |
| I think all the natural disasters that have occurred around the world in the past year have made a lot of people think about climate change. Also the rising costs of electricity and petrol have made everyone think about alternatives that are both cost effective and environmentally sustainable (Brisbane, female, 33 years). |
| I feel more frustrated because I feel I can't do anything to change anything, but I'm also calmer because I've come to accept this (Sydney metro, female, 40 years). |
| I believe my levels of concern have increased due to natural events on a worldwide scale - more adverse conditions, more power cuts, more storms and more land lost to the sea levels that have made me question the situation. I think there have been more informative high profile documentaries that has also helped influence my thought process over climate change (Sydney metro, female, 29 years). |
| I would suggest that they have decreased marginally simply because I don't have enough energy to consistently worry about it, thus I need to learn to do what I can but not make myself increase in anxiety to try and fix things (Melbourne metro, female, 29 years). |
| At that point it was a big media issue and it wasn't brought to my attention, but now that you see the side effects of climate control (i.e., Black Saturday), I have taken wider look at it and they way it is affecting us all (Melbourne metro, female, 30 years). |
| Just the awareness of what's going on, such as ozone depletion. The Greenland ice sheet and Antarctica melting away, sea levels rising, extinction of species upsetting eco systems all over and the increase in natural disasters (Melbourne metro, male, 52 years). |
| I think because I am becoming more aware of the environment now, and I have grandchildren and I worry about their future lives (Melbourne metro, female, 54 years). |
| There has been more instances of events that could be related to climate change and the government does not seem to be acting - am now more concerned that climate change will not be addressed (Melbourne metro, female, 36 years). |
| Beginning to be a little skeptical. No-on can agree about it not scientists or environmentalists. Once we had an ice age - but we also had climate change. Climate change is being used as a weapon to increase costs. Everyone blames climate change for putting up their prices. It's become an economic bandwagon (Sunshine coast, female, 56 years). |
| I believe the reports of climate change are politically exaggerated (Perth, female, 53 years). |

We know that threat appraisal plays a central role in stress and coping responses to acute threats and personal stressors (e.g., Lazarus & Folkman, 1984) and that psychological adaptation to and coping with perceived threats and accompanying stress is a crucial mediator of longer term psychological impacts and behavioural engagement (Lazarus, 1991). The threat of climate change, unlike more acute personal stressors and extreme weather events, constitutes an ongoing and background environmental stressor of profound global consequence. Hence it could be expected that psychological adaptation and coping responses to continuous risk communications regarding the threat of climate change are likely to differ, reflecting diverse strategies and the role of important individual dispositional and life-history differences influencing differences in coping with a consequential but, for many, psychologically distant and amorphous threat (Reser et al. 2012a; Reser & Swim, 2011). The status of climate change as an ongoing and global environmental stressor to which people are continuously exposed through media coverage would seem to clearly matter. The nature of these psychological processes and responses to the threat of climate change such as reappraisal, avoidant coping, and behavioural engagement are crucially important to understanding and addressing psychological impacts and psychological and behavioural adaptation and adjustment to climate change. Climate change concern is perhaps best viewed as both a conceptual umbrella and a specific type of more general environmental concern(s) which serves as a measurable and informative indicator and barometer of changing public risk perceptions, responses and impacts in the context of monitoring important climate change-related changes and impacts in the human landscape.

These qualitative responses relating to why respondents' concern levels have changed are particularly informative with respect to respondents' thoughts and observations about changes in their own psychological responses and views (and likely perceived changes in others' responses and views). Such qualitative data brings us much closer to the actual content, processes, and mindful reality of psychological adaptation and adjustment. Notwithstanding necessary qualifications when dealing with such self report data (e.g., Schwarz, 1999; Strack & Schwarz, 2007), an important reality is that people are often the most knowledgeable and available observers of their own internal responses and changing views as well as changing motivations and behaviours. The explanations provided by respondents to this and other questions were often quite detailed and articulate, and not typically self-serving or reflective of social desirability. Respondents appeared to be very honestly and genuinely engaging with this question about why, in their judgment, their concern level about climate change had altered over the past several years. Equally impressive is the fact that concern levels of 71% of respondents had increased over this relatively short time period, and in the context of the associated and very contested social, political, and environmental issue status of this global threat, for many from an initial already high level. These qualitative findings both complement and inform the convergent quantitative findings picture of high levels of acceptance, concern, and appreciable psychological adaptation in this national sample of Australia respondents.

## 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 Jon Krosnick, at Stanford University and the Woods Institute for the Environment, and the ABC News polls (Krosnick, 2008). This listing is similar to many being used in such national surveys (e.g., Leiserowitz et al., 2010a, 2010b; Roser-Renouf & Nisbett, 2008; Steg & Vlek, 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 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 (Reser et al., 2012a). Additionally, of course, behavioural engagement can be an excellent indicator of motivations, barriers, and the relative success of policy initiatives. Such behavioural checklists do tend to have a strong pro-environmental and climate change mitigation focus, however the present collaborative research undertaking and the comparison benefits of standardised survey items determined this selection and listing. The listing of action possibilities was also 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).

To measure behaviour, respondents were asked to indicate what actions they were currently taking to reduce their carbon footprint (#34). Participants were presented with a list of 15 pro-environmental behaviours and were asked to tick those activities which reflected their current behaviours and actions. Respondents were also able to indicate additional behaviours which reduced their carbon footprint by ticking the response option “other”.

Results indicated that a large proportion of respondents engaged in recycling behaviours 88.2%, and used compact florescent light bulbs 82.8%. Close to 50% of respondents reported using less fuel, driving less, and taking alternative modes of transport (i.e., walking, riding, scootering). Interestingly, 39.9% of respondents indicated that they were buying local food (e.g., organic), and/or growing food as an action to reduce their carbon footprint. Not surprisingly, respondents reported buying or using more fuel-efficient

cars, 34%, and a further 25.9% indicated they were using public transport. Just less than one quarter of all respondents indicated that they were reducing air travel, and 17.9% were buying energy from renewable sources. Smaller numbers of respondents indicated that they were carpooling (9.8%) and buying carbon offsets (5.8%). Only 2.8% of respondents reported doing nothing. (Refer to Figure 28).

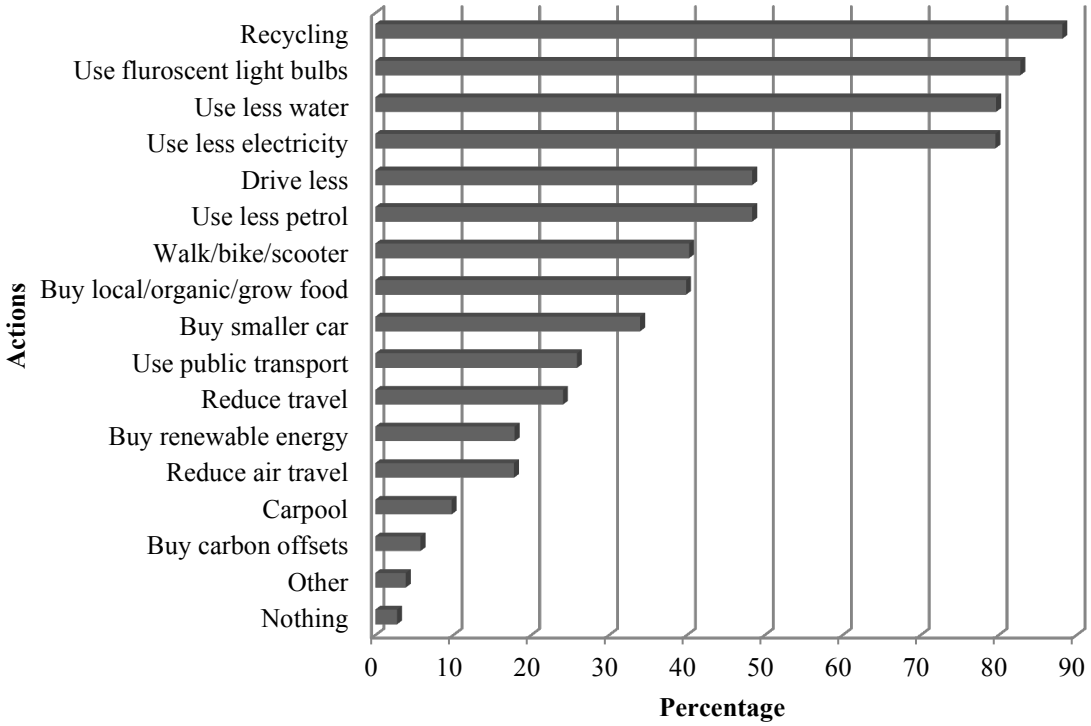


*Figure 28*. Actions taken to reduce carbon footprint

## COMPOSITE MEASURE OF BEHAVIOUR

Question #34 was used to create a composite measure of self-reported behaviour comprising 15 out of the 17 response categories ('other' and 'nothing' were excluded). Scores were summed (possible range 0-15), with higher scores indicating a greater number of carbon-reducing behaviours ($M$ = 6.43, $SD$ = 2.89).

## BEHAVIOUR CORRELATIONAL ANALYSES

The correlations between behavioural engagement and key survey variables indicate strong positive relationships, for example, between behaviour engagement and green self-identity ($r$ = .70), adaptation ($r$ = .53), responsibility ($r$ = .48), self-efficacy ($r$ = .50), objective knowledge ($r$ = .46), distress ($r$ = .42), residential exposure ($r$ = .46), and climate change concern ($r$ = .44). (Refer to Appendix K). All correlations are significant at $p < .001$. These correlations are logical and relate to reasonably self-evident explanations for why respondents would be motivated to engage in pro-environmental and own footprint-reducing behaviours. These motivating factors are no doubt acting independently in some instances

and interactively in other circumstances, and for different individuals. It is noteworthy that such actions are strongly correlated with green self-identity.

## BEHAVIOUR DEMOGRAPHIC ANALYSES

An exploration of behavioural engagement across demographic cohorts provides further insights into these findings (see Appendix L). Female respondents were engaged in significantly greater carbon footprint reduction behaviours ($M = 6.6$, $p < .001$) than were male respondents ($M = 6.2$). Environmental behaviours increased with age, with respondents aged over 55 ($M = 6.6$, $p < .001$) evidencing significantly higher mean scores than those aged under 35 ($M = 6.1$). Respondents with a university education reported significantly greater behavioural scores ($M = 6.7$, $p < .001$) than those with a high school education ($M = 6.2$). Respondents who reported that they were not working evidenced significantly greater mean scores ($M = 6.7$, $p < .001$) than respondents who were currently employed ($M = 6.2$). Voting intention exhibited clear and significant differences in behavioural engagement, with those respondents intending to vote Green or Labor indicating significantly greater mean scores ($M = 6.9$, $p < .001$) than those who intended to vote for another party ($M = 6.1$). Interestingly, those respondents reporting a lower income (less than $60,000) reported significantly greater mean scores ($M = 6.7$, $p < .001$) than those earning between $60,000 and $100,000 ($M = 6.2$), or those earning over $100,000 ($M = 6.1$). Additional demographic variables, such as parent/grandparent status, residential location, and home ownership accounted for no significant or noteworthy behaviour differences across respective groups.

## QUALITATIVE DATA ANALYSES

Psychological processes underlying behavioural engagement were indirectly addressed through a number of open-ended items. Following the behaviour item #34, respondents were asked to think about the main reasons for taking action to reduce their carbon footprint. This was the first open-ended question in the survey and prompted a large response from the majority of participants. Table 10 presents frequencies and percentages by coding categories for the first 500 respondents to #35, "**What do you think are the main reasons for taking these actions**?" The rationale for this question included an examination of respondents' own views of their motivations, and the relative salience and importance of these motivations. As well, these responses tell us something about respondents' explanations and accounts of their own behavioural responses to the anthropogenic carbon emissions issue. An individual's response could indicate several different reasons or motivations, and in such instances all distinct reasons were coded and entered as multiple category entries.

The ordering of response categories by relative frequency in Table 10 immediately shows that associated cost-saving benefits were very salient, though most frequently mentioned as an accompanying comment such as, "Because I can do these things easily without a huge change to my lifestyle, then I can save some money for myself and I feel like I am doing my bit to help the environment". 'Making a difference' and or 'a contribution', and 'doing one's bit', the second most frequent motivation/explanation offered, overlapped in

some ways with the third most reported motivation, that of protecting, assisting, and preserving the natural environment. Illustrative examples included, "I want to feel I'm taking a small part in shaping the future", and "The welfare of my community and to help maintain a planet that will be able to sustain itself for millions of years to come". Together these, and related ecocentric reasons, put financial considerations into a more balanced perspective. Emergent coding categories of 'felt responsibility', 'to do something', 'because of who I am', 'to do the right thing', 'I want to do these things', underscore the importance of how respondents see themselves, and how their environmental responses and actions are an important part of this self-perception, self-presentation, and identity. These responses also emphasise the personal importance of these issues and convergent environmental threat, as well as the symbolic importance and significance of one's actions. 'Normative expectations of others', 'perceived moral responsibility', and 'need to be a good citizen' were also salient considerations for respondents, and reflect the very real power and influence of such considerations (e.g., Cialdini, 2003).

While it is noteworthy that few respondents in this sub-sample of 500 respondents mentioned climate change specifically, it must be remembered that this was a larger contextual theme in the survey. One's carbon footprint was specifically mentioned in #34, and over 5% of respondents mentioned reducing one's carbon footprint while not specifically mentioning climate change. Hence it is reasonably clear that climate change provided the broader context for many respondents. While such responses in some ways suggest expected or stereotypic reasons, responses overall indicated very diverse and often seemingly deeply felt personal values and views. It must also be considered that in the context of such a question, immediately following the reporting of one's own behaviour, and given limited access to one's own motivations, responses need not accurately reflect actual or objective motivations and needs (e.g., Nisbett, & Wilson, 1977; Schwarz, 1999). Nonetheless the richness of responses, the evident desire to communicate why on the part of most respondents, the ubiquitous disregard of what might be considered socially desirable responses, and the passion and reflective awareness of many respondents, was truly impressive.

*Table 10*. Reasons for reducing carbon footprint

| Response category (n = 500 respondents) | Frequency | Percentage |
|---|---|---|
| **Associated financial benefit, necessity, save money, reduce costs** | 127 | 17.3 |
| **Making a difference, doing my bit, making a contribution** | 100 | 13.6 |
| **To protect, help, save, preserve the environment, sustainable future** | 77 | 10.5 |
| **Normative expectations, everyone does it, everyone expects me to do the above, collective moral responsibility, to be a good citizen** | 46 | 6.3 |
| **Concerns for the environment, caring for the environment** | 40 | 5.4 |
| **Reducing one's own carbon footprint, impact** | 38 | 5.2 |
| **For future generations, for my children** | 35 | 4.8 |
| **Counters the wasting of conserves, finite resources** | 33 | 4.5 |
| **Felt personal responsibility** | 30 | 4.1 |
| **Because it's easy to do, actions don't impact my life and don't cost me more** | 27 | 3.7 |
| **Other responses that don't quite fit the question asked** | 26 | 3.5 |
| **To do something, to feel like you are doing something** | 21 | 2.9 |
| **Because of who I am, It is what I do, have always done these things, it is part of my everyday life** | 17 | 2.3 |
| **To do the right thing** | 14 | 1.9 |
| **To address climate change** | 13 | 1.8 |
| **It makes sense to conserve, sensible** | 11 | 1.5 |
| **Media and community encouragement, advertising and education** | 9 | 1.2 |
| **Because of external controls and restricted options** | 9 | 1.2 |
| **Because of my education, upbringing** | 8 | 1.1 |
| **Felt guilt** | 8 | 1.1 |
| **Other reasons/explanations (e.g., be a good role model, children nag me, reduce distress, to be self reliant, to feel better)** | 44 | 6.0 |
| **Total** | 733 | |

Overall this qualitative data substantially informs motivational, explanatory, and other psychological considerations underlying reported behavioural engagement, albeit from the respondent's own perspective. The richness of this qualitative data, in this item and in the case of our other open-ended survey items, also confirms the very genuine engagement of respondents in this exercise and issue, and the clear reflective consideration they have given to their behavioural responses to the threat of climate change. This qualitative data also confirms and complements the appreciable levels of concern, distress, and psychological adaptation evident in more quantitative and psychometric survey items. While no separate coding category was established relating to the personal importance or psychological significance of one's behavioural actions or involvements, as this is a rather different coding exercise, the content of these responses clearly indicated that, for many respondents, the actions they were taking were very personally significant and meaningful. Very few

responses directly referred to net *environmental significance* or greenhouse gas emission reduction, raising an interesting question about the relative salience and importance of objective environmental significance (i.e., greenhouse gas emission reduction) (e.g., Gardner & Stern, 2008; Stern, 2000).

An alternative way of framing and interpreting these motivational and explanatory responses is to ask whether many of these seem to serve or reflect psychological needs as contrasted with financial or situation-specific circumstances and constraints. It is clear that many of these responses fall into categories which relate more to psychological significance and personal meaning than to objective environmental significance or financial benefit. It is difficult to not see and interpret many of these diverse motivations and explanations as reflecting various ways of coping with a disturbing and for some profoundly distressing threat and likely prognosis for the environmental future (e.g., Reser et al., 2012a). Such coping strategies are difficult to distinguish from adaptation. From conventional stress and coping models in psychology the distinction between psychological adaptation and mitigation is basically the distinction between primary and secondary coping, with this secondary coping being largely focused on changing one's appraisal of the threat and reassessing or reframing one's own exposure and ability to deal with the situation. This self-focused adaptation and internal emotional and motivational state regulation is well captured in many of the respondents' answers to #35:

## IDENTIFYING BARRIERS TO PRO-ENVIRONMENTAL BEHAVIOUR

The next question in the survey (#36), asked respondents to indicate why it is that they were *not* taking more actions to address climate change. Similar to the behaviour checklist, respondents were asked to tick as many of the ten *provided* response categories that applied. Respondents also had the opportunity to indicate the response category "other" and specify additional reasons why they were not taking more actions. The principal finding was that just over half of all respondents reported that such behavioural engagement was "too expensive". Smaller numbers of respondents indicated that it was "too big a problem for me to have any impact" (16.6%), or that it was "too inconvenient or too much effort" (15.9%). Interestingly, 14.8% of respondents selected the response option 'don't know what else to do', whilst 13% of participants didn't think it was necessary. Ten percent of respondents did not think it will do any good to take further actions, with a further 10% indicating a lack of interest and motivation. A number of respondents indicated that they didn't believe climate change was happening and therefore were not prepared to take further action to address the problem (10.3%). The asserted non-belief in climate change for 10.3% of respondents is surprising, but in the context of explaining why one is *not* engaging in such behaviours and associated self-presentation considerations this is understandable (Refer to Figure 29).

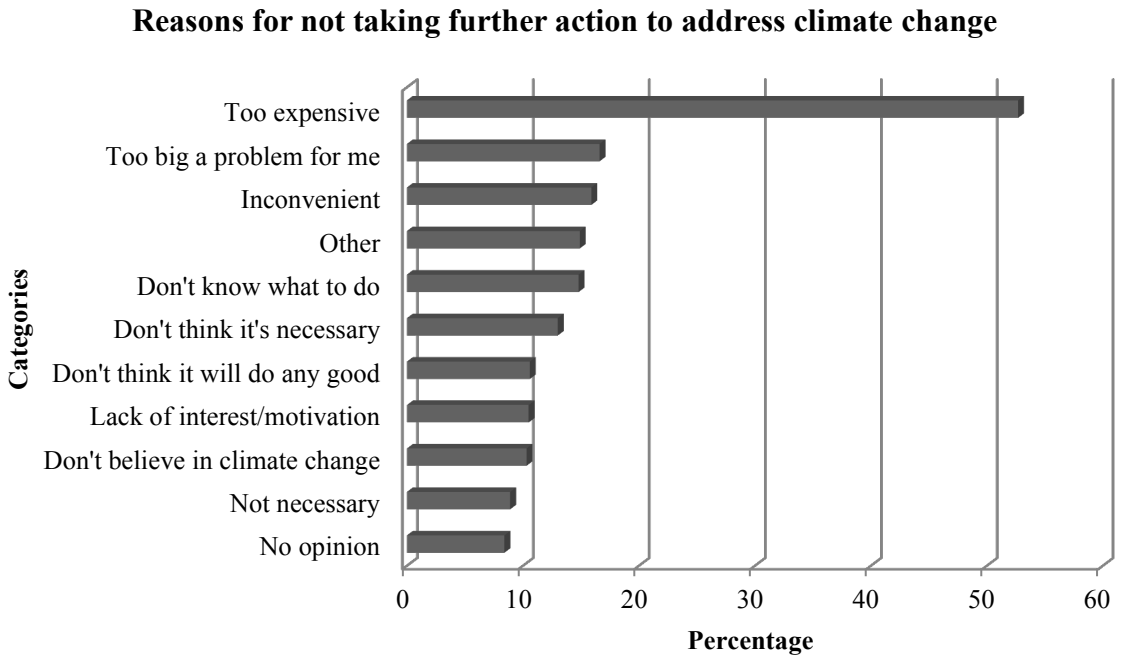


*Figure 29*. Reasons for inaction

As shown in Figure 29, a large number of respondents (14.9%) ticked the "other" response category. A subsample comprising the first 1000 respondents was used to investigate the specific reasons included in the "other" category. A number of categories emerged from the data, such as, some respondents indicated they 'were already doing enough'; whereas other respondents cited 'a lack of resources' (e.g., renting versus owning, lack of public transport). As one respondent noted, "Due to the location where we live it would be too difficult to car pool or use vehicles less; we live in a rural location". Many respondents suggested 'others were to blame' (e.g., big business, government, other countries), whilst some respondents perceived 'a lack of outcome efficacy and personal control over the problem', and "I don't believe I can reduce my carbon footprint to a degree that it would make a difference". A number of respondents reported a 'lack of knowledge and/or evidence' as the reason behind not taking further action, whilst for other respondents a much stronger non-belief in climate change was evident. 'Laziness', 'lack of time/interest' and 'health issues' were other emergent categories from this sub sample of $n = 1000$.

The behaviour engagement findings overall might be viewed as more relevant to climate change mitigation than adaptation. We have hopefully made it clear that, from a psychological and individual level perspective, adaptation and mitigation are closely intertwined. These survey results suggest that respondents are, on the whole, not only very actively engaged in some pro-environmental and carbon footprint-reducing behaviours, but that this engagement appears to be both mindful and quite 'psychologically significant' or personally meaningful for many. This in turn would suggest that climate change is an important and salient concern and issue for most survey respondents. To the extent that this behavioural involvement, and underpinning perceptions and motivations, have been changing over time, these findings would suggest that individual level psychological adaptation to the

threat of climate change is certainly taking place. Unfortunately this 2010 database by itself cannot provide this change data in terms of changed behaviours themselves. An additional and important purpose of behavioural engagement data has been to provide a behavioural outcome measure, albeit self-reported, which would allow for model-based analyses of theoretically important and *psychological adaptation* relevant mediating and moderating variables and processes. These structural equation modelling results are presented and discussed following a consideration of our extreme weather and natural disaster findings, and an analysis of demographic differences for key climate change variables.


***Noteworthy environmental changes compel us to ask why, with perceived human casual contribution and felt responsibility being a potent motivational driver of behaviour change.*** **Photo: Peripitus**

## THE NEXUS BETWEEN CLIMATE CHANGE AND NATURAL DISASTER RISK PERCEPTIONS, EXPERIENCES, UNDERSTANDINGS, AND RESPONSES

The Australian survey addressed public risk perceptions, understandings, and responses to extreme weather events and natural disasters as well as to climate change. There were a number of reasons for this. The funding for the Australian component of this cross national project was principally provided by the Department of Climate Change and Energy Efficiency (DCCEE) and the National Climate Research Facility (NCCARF) through their Disaster Management Research Plan. An important rationale for the research was to be able to compare and contrast the threat and risk domain of climate change with that of natural disasters and extreme weather events in terms of public risk perceptions and responses. In addition, there was good reason to think that there might well be a strong interrelationship between public perceptions and understandings of climate change and extreme weather events, given that the more concrete and visible manifestations of climate change are noteworthy changes in weather patterns and associated changes in the nature, intensity, frequency, magnitude and seasonality of extreme weather events. As well, media coverage and representations of climate change are typically in the context of extreme or dramatic weather fronts, specific events, or natural disasters (e.g., Boykoff, 2008; Boykoff & Smith, 2010; Yumul, Cruz, Servando, & Dimalanta, 2011).

Known weather-related phenomenon are understandably much easier to imagine and think about than the abstract, complex, and geographically and temporally distant phenomenon of 'global climate change' and associated planetary climatic systems and atmospheric concentrations of greenhouse gases (e.g., D'Agnese, 2000). Weather has also always been a powerfully salient aspect of the natural environment that individuals, communities, and cultures are attuned to, engaged with, and routinely use, analogically and metaphorically, in their ongoing monitoring of their environment and its contingencies (e.g., Lockhart, 1988; Morrow, 1996). Hence, public perceptions of and understandings about extreme weather events should provide some insights concerning how public understandings of climate change might differ from climate change science accounts of climate change. Finally, there exist extensive research and practice literatures on disaster risk perception, communication, appraisal, preparedness, and response which might well inform climate change adaptation, mitigation, public communication, and engagement initiatives (e.g., APA, 2006; Goldstein, 2005; Gow & Paton, 2008; Laughery, Wogalter, & Young, 1994; Reyes & Jacobs, 2006). Documentation of an important nexus between climate change and natural disasters in public risk perceptions, understandings, and responses would warrant a more serious exploration of how this rich and existing body of disaster research and best practice might be better utilised in the context of climate change and vice-versa (e.g., IPCC, 2011: Marx et al., 2007; Whitmarsh et al., 2011).

Specific research objectives were:

- to examine the relative salience and strength of climate change as a risk and threat within these two quite distinct contexts of other threats and concerns;

- to examine these in a way which would allow for consideration in the context of other published findings on the relative ranking of climate change as a public issue and concern;
- to examine the possible nexus between climate change and natural disaster risk perceptions and understandings, and especially the extent to which experiences of the latter inform understandings of the former;
- to examine the nature and extent of respondents' direct experience with natural disaster events and with the perceived impacts of climate change.

It is important to appreciate that this national survey of pubic risk perceptions and responses to climate change and natural disasters followed several years of extreme weather events and natural disasters both in Australia and globally (Refer to Appendix F & G). Globally these included, in the initial seven months of 2010, the Haiti earthquake (Jan), a massive earthquake in Chile (Feb), severe floods in China (May) and Pakistan (July), an extensive heatwave across the Eastern United States and Canada (July), and extensive bushfires in Southern California (July).

In Australia vast sections of the continent were still in the grip of the Millennium drought. In 2009 Australia experienced a significant heatwave in late January and early February, affecting four states, Victoria, South Australia, Tasmania, and Southern NSW. During this period a large number of temperature records were broken. Victoria experienced extreme fire weather conditions, with these conditions resulting on Saturday, 7 February, in two days of devastating bushfires and apocalyptic scenes, with many centres having their hottest day on record accompanied by winds exceeding 100 km/h, creating the conditions for one of Australia worst bushfire disasters, Black Saturday (Bureau of Meteorology (BOM), 2010, 2011).

2010 was ushered in with three cyclones crossing the North Australian coast (Lawrence 14-23 December 2009; Olga 23-30 January; Paul 27 March to 3 April, and a fourth cyclone, Hamish, paralleling the Queensland coast between March 4-10. These events were accompanied by a severe thunderstorm in Perth on the 22$^{nd}$ of March, with 5-6 cm hailstones, resulting in hundreds of millions of dollars of damage, and a similar severe storm in Melbourne on the 6$^{th}$ of March. What is perhaps most salient, other than the Black Saturday inferno, were the widespread floods in Queensland from the end of February 2009 through the first week of March, 2010.

Globally, 2010 was the world's equal warmest year on record, along with 2005 and 1998, and ended the warmest ten year period (2001-2010) on record (BOM, 2011). 2010 was also Australia's second wettest year on record, commencing with end of an El Niño system through the first five months and transitioning to a strong La Niña system which was well-established by July, effectively ending the Millennium drought of the preceding decade. July 2010 was Australia's wettest July since 1998, and rainfall from August through December was the highest on record across Queensland and parts of the Northern Territory.

While such extreme weather systems and Southern Oscillation shifts characterise the Southern Pacific Ocean latitudes of Australia, the extreme weather events bridging 2009 and 2010 were clearly exceptional, though no longer present at the time of the survey, as substantial seasonal changes were then in place across the 'winter' period encompassing June and July.

It is arguable that these dramatic and extreme weather events and natural disasters might well have made the nature and threat of natural disasters more salient in the context of a survey running from mid-June to mid-July, 2010. Given the widespread media coverage of global climate change during this same period, there are reasonable grounds for arguing that the Australian public was exposed to extensive virtual coverage of both climate change and natural disasters over the 12 months preceding the survey, with this coverage of actual global and national events providing at the same time a very relevant and real-world context for the survey questions which participants were asked to respond to. A cogent argument can also be made that the relatively normal weather conditions prevailing over the period of the survey minimized the probability of any proximal national weather conditions or 'primes' influencing survey results (e.g., Joireman, Truelove, & Duell, 2010).

## PERCEIVED INTERCONNECTIONS BETWEEN CLIMATE CHANGE AND NATURAL DISASTERS

An important objective of the research was to examine possible commonalities, differences, and interrelationships between public risk perceptions, understandings, and responses to the threat of climate change and natural disasters. Items #23 and #24 were the first survey sections to directly address these potential interrelationships and relative risk salience. Item #23 had respondents rate and effectively rank order a spectrum of natural disaster and ecosystem threats and phenomena with respect to their own level of concern. 'Climate change' was provided as the last item in this 13 item sequence. In item #24 respondents were then asked to again indicate relative level of concern for a set of ten non-environmental threats and phenomena, with 'climate change' once more being provided as the final item and 'natural disasters' and an additional collective environmental threat item also included in this list (See Appendix I). The questions asked were in the form of: "**How concerned are you that each of the following environmental threats [issues and threats] might directly [adversely] affect you, your family, or your local environment in the foreseeable future?**" The questions were posed in this way to encompass not only the individual respondent, but their significant others, their local region, and a more natural and meaningful time frame.

The findings are themselves interesting, but benefit from related survey response results to fully interpret. The post-survey administration rank ordering of natural disaster and ecosystem threats, including climate change, are provided below (see Figure 30).

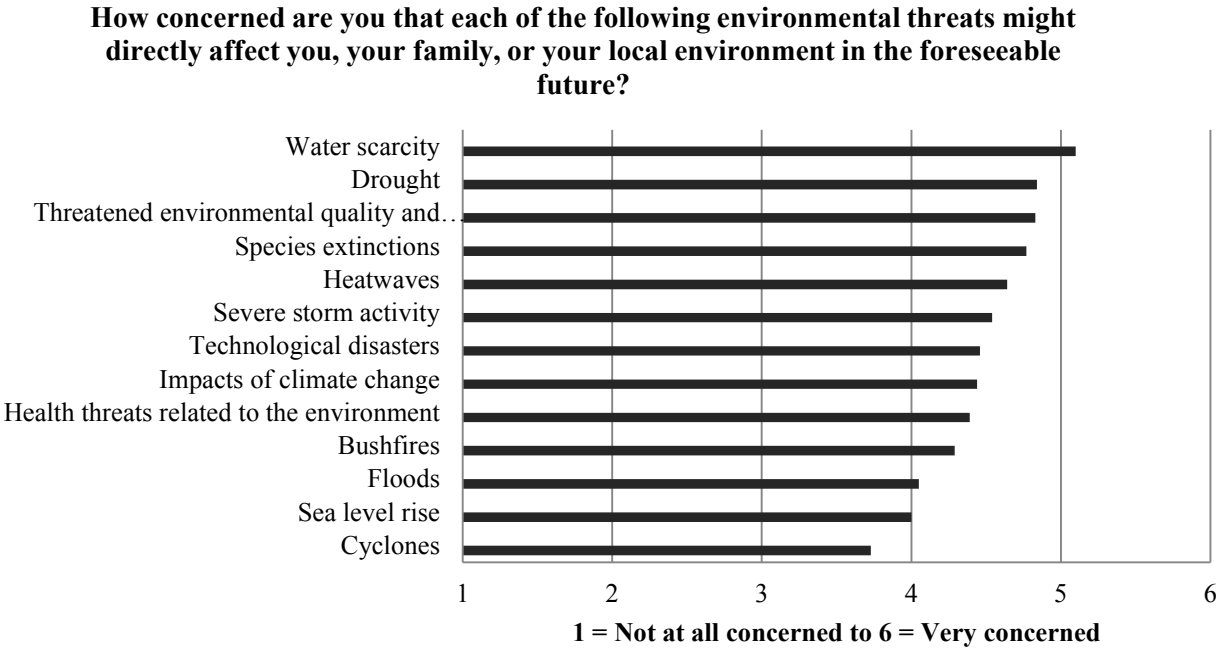


*Figure 30*. Relative concerns about specific environmental threats

It is noteworthy that the lowest mean rating for these threats approached 4 on a 6-point scale, going from (1 = *not at all concerned* to 6 = *very concerned*), suggesting that all of these risks were viewed as matters of real concern by most respondents. The highest concern rating was for water scarcity and the lowest was for cyclone threat. While 'impacts of climate change' is ranked overall as 8$^{th}$ in this listing of 13 risks, it is worth noting that 56% of respondents gave climate change a rating of either 5 or 6, with this rating not appreciably different from ratings given for health threats relating to the environment, technological disasters, and severe storm activity. These results suggest that *all* of these disaster and environmental threats are salient and important matters of concern. It must be kept in mind that this is an aggregate national 'picture' reflecting ratings from all 3096 respondents, and therefore reflects a strong representation not only of rural and remote residents, but also of urban and suburban residents living in higher density regions of Australia.

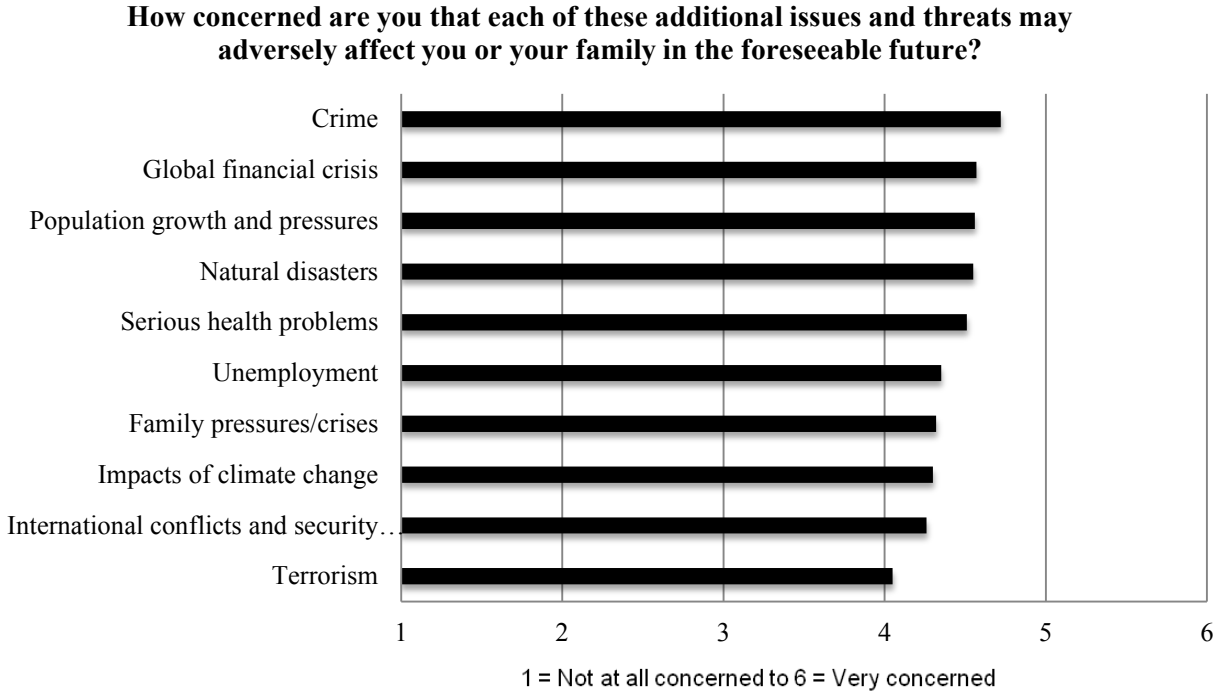


*Figure 31*. Relative concerns about specific non-environmental threats

The rank ordering of the "additional issues and threats" on the basis of concern mean ratings in Figure 31 are again interesting. Again, this rating task for mostly 'non-environmental' threats and risk domains, allowed for an examination of relative concern levels with respect to the threats of climate change and natural disasters. Climate change still comes 8th in such a ranking on the basis of rated concern level, as contrasted with natural disasters, which as a single issue and threat domain, now comes 4th. Again it is possible that the framing of the items and overall task, as well as the context of the preceding natural disaster and extreme weather event exercise, may have influenced individual item concern ratings and consequent overall rank orderings of individual item mean ratings. In many ways the wording of instructions and the response format in effect set up a continually changing judgment task in which the comparison anchors and contexts are simultaneously changing as respondents progress through the items. But in practical terms and considering the survey results as a whole, it seems clear that *environmental* risks and threats invoke different perceptual anchors and frames of reference for risk judgments and 'concern' appraisals. Reported personal concern about 'the impacts of climate change' would appear to become a less immediate and distinct threat and concern when directly compared with the more 'available' concerns of everyday life and contemporary and more accessible and easily understood threats (e.g., global financial crisis, health problems, unemployment) (Tversky & Kahneman, 1974). It is also worth noting that the concern rating for climate change was similar in item #23 (environmental threats) as well as item #24 (additional issues and threats) ($M = 4.44$, $M = 4.30$).

It must be kept in mind that the level of concern ratings with respect to the above risk domains came one third of the way through a survey exercise in which respondents would have moved into a particular associative space and attentional focus. One might argue that this could have either heightened or attenuated emotional and associative responses related to concern ratings. But in either case the ratings were not done in the context of a more neutral and less-engaged reflective space, but in a context of seriously thinking about and responding to a survey addressing energy concerns, societal issues, environmental matters generally, and the implications of global climate change. In this broader context, it is clear that concerns about the impacts and implications of climate change are roughly equal in intensity to other environmental threats, on average, and indeed encompass a number of these other threats.

These findings pertaining to climate change vis-à-vis natural disaster and other issues and concerns must be considered with respect to a number of possible context and framing effects, and in the larger context of the present survey findings as a whole. The stated focus of the survey was "Public understandings, risk perceptions, and responses to climate change and natural disasters", and respondents would have completed a number of preceding items relating to energy futures and security, climate change beliefs and concerns, policy choices and preferences, etc. Hence they would have been particularly mindful of a specific set of considerations relating to climate change and other salient environmental and social issues. It is also the case that individual responses were likely influenced by particular beliefs relating to the nature and credibility of the climate change threat and climate change science, and by their own direct exposure to and experience of both the climate change threat and natural disaster and severe weather events, with these latter considerations influenced by residential location and circumstances and occupation and lifestyles. The survey sampling design and sample numbers allow for a meaningful breakdown of respondents by residential and occupational exposure, as well as by specific natural disaster and extreme weather event prior experience.

When those individuals residing in cyclone prone regions are examined, the risk of cyclones is seen to be a far more salient concern. Compare, for example, Figure 30 (n = 3096) with Figure 32 (n = 206, respondents living in cyclone prone areas) where cyclones are the source of least, and most, concern respectively. When one considers the geographic exposure and historical distribution of disaster and climate change threat across Australia, it is evident that disaster risk perceptions, exposure, and experience must differ regionally. To the extent that these risk factors are perceived and understood as being co-extensive with anticipated impacts of global climate change, it is, again, understandable that everyday discussions and understandings of climate change are strongly interlinked with understandings, concerns, and experiences with natural disasters and extreme weather events.

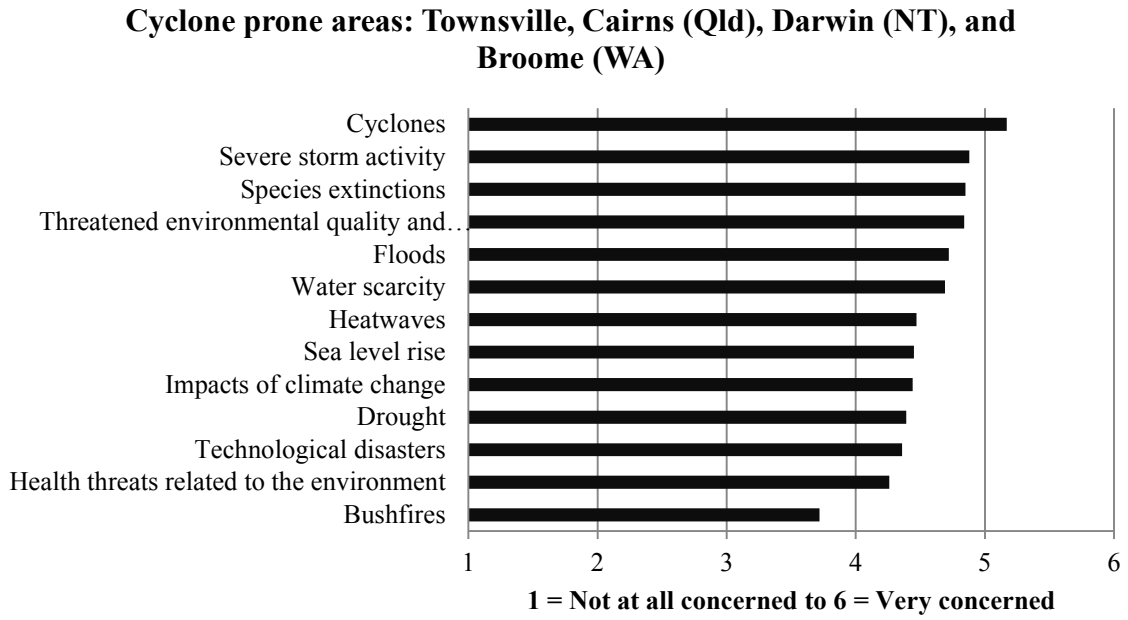


*Figure 32*. Relative concerns over environmental threats for respondents residing in cyclone prone regions

Referring back to our convergent methods for examining possible interlinkages between climate change and natural disasters in public risk perceptions and understandings, an important strategy with high face and construct validity was to simply ask respondents whether, in their view, climate change is influencing the frequency and intensity of extreme weather events. Responses to such a question provide further insight and evidence regarding public acceptance of the reality of climate change, as well as causal attribution processes and knowledge of consequences. The formal question asked was #51, "**Overall, how much do you think climate change is influencing the frequency and intensity of weather events like storms and droughts?"** (See Figure 33).

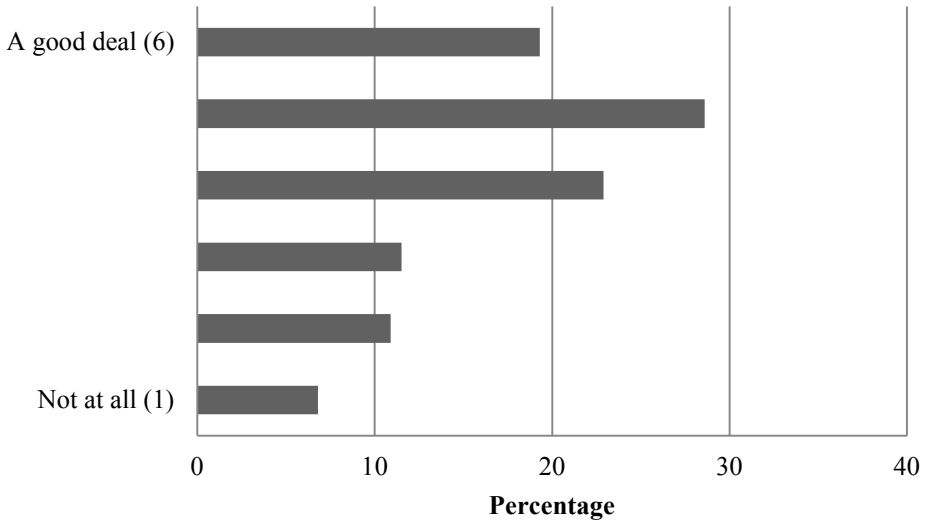


*Figure 33*. Perceived nexus between climate change and extreme weather events

Seventy-one percent of respondents endorsed one of the initial three rating options of this six point scale relating to greater causal contribution of climate change to extreme weather events, and 47.9% within the first two scale points, indicating that this perceived influence of climate change on current weather events is a very widespread perception and belief in Australia. This finding also supports other evidence from the survey that respondents do by and large understand the projected consequences and unfolding impacts of climate change, and how these will likely be associated with extreme weather events and natural disasters, as well as the nature and magnitude of the climate change threat. It is noteworthy that North American respondents in a recent Yale Survey (Leiserowitz et al., 2011a) reported thinking that worldwide, 'global warming' will cause more intense cyclones (57%), many more droughts and water shortages (62%), severe heatwaves (64%), many more forest fires (59%), and many more floods (57%) if nothing is done to address it. The majority of respondents also reported that climate change made each of the following events worse, and was in part responsible for record high temperatures in the U.S. in 2011 (67%), the drought in Texas and Oklahoma in 2011 (65%), the Mississippi spring floods in 2011 (60%), record snowfalls in the U.S. in 2010 and 2011 (60%), and Hurricane Irene (57%). These results are very consonant with our Australian findings of an important association in public understandings between climate change and extreme weather and natural disasters.

The survey research required a careful consideration of how to best examine possible interlinkages between the threat of climate change and the threat of natural disasters and extreme weather events both objectively and phenomenologically. This task was framed and addressed as a comparison and contrasting of two arguably distinct risk domains whilst acknowledging that media representation of climate change, and the unfolding impacts of climate change, typically find expression in terms of extreme weather events and natural disasters. Data sources included the following:

- Participant perspectives in response to direct questions
- Rating of concern about environmental threats, non-environmental issues and threats, along with natural disasters and impacts of climate change
- Reported direct experience with climate change (local/global)
- Perceived interlinkages between climate change and intensity of weather events (e.g., storms, droughts)
- Reported direct experience with natural disasters and quantification and categorisation of the nature of these events and associated experience
- Reported impact of these events: property damage, anxiety and stress, subjective vulnerability, with respect to the disaster event
- Open-ended items regarding the details of these perceived climate change encounters

Findings relating to these considerations are found not only in this section, but throughout the report, and more specifically in Appendix I.

## EXPOSURE AND VULNERABILITY

The geographic stratification of the survey sample was based on sampling 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. 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 or exposure (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 et al., 2011b; 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).

The more straightforward matters of objective exposure and subjective perceptions and experience with respect to climate change and natural disasters are compounded by the fact that individuals and communities are also 'exposed' to extensive media coverage and representations of climate change and natural disaster threats and events, with these virtual threats and events also being local, national, and global. Hence most individuals in Australia have differing levels of both direct and indirect exposure to and experience with 'climate change' and natural disasters, with this virtual exposure being as likely to be global as national. Importantly this indirect exposure and experience of these environmental changes and impacts can have powerful *psychological impacts* on individuals, and upon risk perceptions, understandings, experienced vulnerability, and on psychological and behavioural responses (Nabi & Wirth, 2008; Reser et al., 2011; Wagner, Kronberger, & Seifert, 2002). A related matter and question is 'to what extent does direct experience with climate change or

natural disasters influence perception of and response to media coverage of such threats and impacts?' There are related considerations with respect to social problem construction, the social representation of risk, and the social amplification and attenuation of risk, etc (e.g., Bauer & Gaskell, 2002; Pidgeon et al., 2003; Renn, 2011).

Both the residential circumstances of respondents and the framing of survey questions in terms of local, regional, national, and global considerations allowed for more specific consideration of these matters. The previous consideration of relative concern with respect to a spectrum of natural disaster and risk domains reflected the importance of objective and perceived proximity and relative exposure, with extent of concern about particular extreme weather risks largely paralleling event probabilities and more recent occurrences. The situation of climate change is arguably distinct in that this phenomenon and threat itself encompasses a spectrum of extreme events and impacts, and 'climate change' is also of a more global and chronic nature as a changing and much longer-term environmental condition and stressor (e.g., Evans & Cohen, 1987; Evans & Stecker, 2004; Reser & Swim, 2011). Nonetheless climate change appears to have particular salience, immediacy, and meaning for respondents in terms of their local environment and their exposure to and experience with extreme weather events (e.g., Leduc, 2010; Scannell & Gifford, 2011). It is noteworthy that when asked "**When, if at all, do you think Australia will start feeling the effects of climate change?**", 54% of respondents reported that they were already feeling the climate change effects as compared with 41% of British respondents. A further 16.7% of Australian respondents expected that they would be feeling the effects of climate change within the next 25 years.

## COMPOSITE MEASURE OF RESIDENTIAL EXPOSURE

For the purpose of further statistical analyses, a three-item composite measure of residential exposure and vulnerability was created. Participants were asked to rate on a 6-point Likert scale how vulnerable (1 = *not vulnerable* to 6 = *very vulnerable*) their own residential region is to natural disasters and how vulnerable it is to the impacts of climate change (#56, #57). Respondents were also asked to indicate how close they live to areas frequently affected by extreme weather events or natural disasters (#73). Scores were summed (possible range 3-17), with higher scores reflecting a greater perceived vulnerability and exposure to natural disasters and the impacts of climate change. This scale achieved a Cronbach's alpha of .66, an acceptable level of reliability for a 3-item scale.

## RESIDENTIAL EXPOSURE CORRELATIONAL ANALYSES

Correlational analyses indicated that perceived residential exposure was strongly and positively correlated with climate change concern ($r = .46$), adaptation ($r = .46$), risk perception ($r = .45$), distress ($r = .42$), belief in climate change ($r = .38$), self-efficacy ($r = .38$), responsibility ($r = .36$), direct experience with climate change ($r = .35$), connection to the environment ($r = .34$), and green self-identity ($r = .33$), and was moderately correlated with objective knowledge ($r = .31$), behaviour ($r = .26$), prior disaster experience ($r = .25$), trust ($r = .23$), and media exposure ($r = .15$). Correlations are all significant at $p < .001$.

These correlational findings are very consistent with the published literature on perceived environmental risk exposure and vulnerability (e.g., Brody et al., 2008). The modest strength of some of these associations perhaps reflects the less than ideal reliability of the composite scale and the more difficult nature of #Q57, relating to the judged vulnerability of one's own region to the impacts of climate change. Taken together, these findings suggest that variables such as acceptance of climate change, prior disaster and climate change experience, self-efficacy, and objective knowledge all contribute to judgments as to the salience, local relevance, and perceived importance of known and anticipated environmental threats.

## RESIDENTIAL EXPOSURE DEMOGRAPHIC ANALYSES

Analyses of the demographic data found that female respondents had significantly higher levels of perceived vulnerability and exposure to both climate change and natural disasters ($M = 11.1$, $p < .001$) than did male respondents ($M = 10.2$). Respondents aged 35 – 54 evidenced significantly higher scores of vulnerability ($M = 10.9$, $p < .001$) than those aged <35 ($M = 10.5$), and respondents aged over 55 years ($M = 10.4$). Participants with a certificate/trade qualification had significantly higher scores ($M = 10.9$, $p < .001$) than those with a high school certificate ($M = 10.4$). Rural residents evidenced significantly higher vulnerability scores ($M = 11.7$, $p < .001$) than urban residents ($M = 10.2$), and those respondents intending to vote Green or Labor at the next Federal election had significantly higher scores ($M = 11.1$, $p < .001$) than those intending to vote for another party ($M = 10.3$).

The more noteworthy differences here related to gender, urban versus rural context, and voting intention. These findings are not surprising but are important in terms of the emerging picture regarding public risk perceptions and understandings. The relatively strong finding here respecting urban/rural differences is interesting in that this finding does correspond with real differences in objective exposure, and the reality than nonacceptance of climate change does not preclude a realistic appraisal of local environmental risks. Equally, political affiliation and associated subscription to a particular world view can clearly influence risk perceptions and appraisals associated with a phenomenon like climate change, which is a highly politicised social and political issue, as well as environmental issue (e.g., Dunlap, & McCright, 2008; McCright, & Dunlap, 2011b).

## DIRECT EXPERIENCE WITH NATURAL DISASTERS

An important area of common interest and overlap in these two national surveys (AUS and UK) was that relating to whether prior experience with natural disasters or extreme weather events might influence climate change acceptance, risk perception, concern, and/or carbon emission reducing behavioural engagement. In the British context, periods of intense rainfall and consequent widespread flooding across different regions of the country over the past decade, and in the year preceding the survey, was arguably the most salient natural 'disaster' for the British public (e.g., Pidgeon & Butler, 2009). In Australia a broad spectrum of extreme weather events and natural disasters characterised the decade preceding the national survey, including a drought affecting much of the country, until broken in the Australian summer period prior to the 2010 survey, coinciding with a very strong La Niña regime and wet season, inundating extensive regions of Australia. *Direct* experience with natural disasters of course equates with *prior* experience of disasters, a topic for which a substantial literature exists.

### BRITAIN

Nineteen percent of Cardiff survey respondents reported having experienced flooding in their local area recently. Multiple-mediation analyses were conducted to explore the differences in climate change perceptions (i.e., perceived instrumentality, concern, uncertainty, perceived vulnerability) and preparedness to reduce energy consumption to combat climate change for those who had experienced flooding and those who had no such experience. Results showed that respondents with flooding experience expressed greater levels of concern over climate change, were less uncertain that climate change was really happening, and felt more confident that their actions would have an effect on climate change. Respondents with recent flood experience were also more willing to reduce their energy use to tackle climate change (Spence et al., 2011a).

### AUSTRALIA

In the Australian survey respondents were asked whether they had ever experienced a natural disaster warning or impact situation (#52). No time frame was 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 (#53). The objective was to document both extent of such experience over time, as well to record the self-reported situational and psychological impact of the event(s). In comparison with the Cardiff research this assessment of direct experience was notionally over one's lifetime and not confined to one's local region, rather than 'recently' and in one's local area.

Thirty-seven percent of Australian respondents (i.e., 1158 individuals) indicated that they had had one or more such experiences. Table 11 presents the relative proportions of respondents (i.e., out of 1158 individuals) reporting prior first-hand experience across differing types of natural disaster events.

*Table 11*. Experience of type of disaster event(s) and frequency

| | 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 | | 593 | | 535 | | 621 | | 186 | |

Note: Percentage figures relate to the 3096 total survey respondents.

Clearly cyclones, bushfires, drought, and floods occurred with similar frequency for this group. The relative frequencies of events categorised as 'other' in Table 11 indicate that a substantial number of respondents had also directly experienced earthquakes (52), tsunami warnings or impacts (47), major storms and hailstorms (66), tornados, typhoons or hurricanes (22), and dust storms (5), as well as volcanoes, tidal waves, and damaging winds (13). Typhoons and hurricanes are alternative names for cyclones, and hence the number of respondents with direct experience of this disaster type is actually 681, or 22% of survey respondents overall.

It is important to keep in mind that many respondents had experienced these extreme weather and climatic events multiple times, with the number of people experiencing such events on over four occasions being quite high. These frequencies, and respondents' overall direct experience, are noteworthy considering that 70.2% of survey respondents were from urban and suburban regions of Australia. For many individuals disasters are a recurring and familiar aspect of life in their residential region. Urban dwellers are not immune to natural disaster threats, with bushfires, cyclones, and floods having put many Australian cities on red alert, and in a number of cases directly in harm's way (e.g., Cyclone Tracy, the bushfires of Black Saturday, the Brisbane floods of 1974 and 2011).

Of the 1146 respondents who reported experiencing natural disaster warning or impact situations, 624 or 54% had experienced four or more such events. The survey sample included 188 individuals, or 16% of those with direct disaster experience, who reported having experienced more than ten such events, with 9 of these respondents having experienced 20 or more disaster situations. An examination was made of all of those respondents who had experienced four or more disaster situations across a number of core survey variables, that is, 624 individuals. The comparison figures for this subgroup of respondents with high levels of prior disaster experience are given in Table 12.

*Table 12.* Selected comparison findings for those with prior experience of 4 or more disaster events

| Item number if applicable | Construct | Respondents experiencing four or more disasters events (*n* = 624) | Full national survey (*n* = 3096) |
|---|---|---|---|
| | Belief acceptance | 73% | 74% |
| | Certainty of climate change (strongly, tend to agree) | 72% | 71% |
| | Acceptance of human causal contribution | 92% | 90% |
| #7 | Concern (Very, fairly concerned) | 69% | 66% |
| #10 | How serious a problem is climate change for Australia (Very serious somewhat serious) | 76% | 78% |
| #56 | Vulnerability of own region to natural disasters (Very, vulnerable) | 55% | 38% |
| #57 | Vulnerability of own region to climate change (Very, vulnerable) | 41% | 33% |
| | Direct climate change experience/encounter | 44% | 45% |
| #55 | Experienced anxiety and stress (Considerable, appreciable) | 49% | 18% |
| #51 | Climate change influence on extreme weather events (A good deal, substantially) | 50% | 48% |
| | Climate change distress score | 22% | 22% |
| | Psychological adaptation score | 30% | 29% |
| | Urban to rural ratio | 56%/44% | 70%/30% |

What is immediately apparent is that this substantial disaster experience group is not markedly different from other respondents with no or much more limited natural disaster exposure and experience across the variables examined. The 69% of those individuals reporting being 'very' or 'fairly' concerned about climate change is not very different from the 66% figure for the national sample as a whole. Seventy-three percent of this sample thought that the world's climate was changing (#8), a figure almost identical to the 74% figure for the full Australian survey sample. A marked difference does appear with respect to perceived vulnerability of own region in the case of both natural disasters and climate change, with those who have had appreciable disaster experience, reporting that their own region was more vulnerable to natural disasters and to the impacts of climate change. Similarly those individuals with repeated experiences of natural disasters reported experiencing considerably greater stress and anxiety than those with fewer disaster experiences. It is noteworthy that the ratio of urban to rural respondents was 56% to 44%, reflecting the fact that respondents living in rural regions of Australia are more likely to be exposed to and to directly experience natural disaster events. These finding are very consistent with the correlation data which examined relationships between our composite

measure of disaster exposure and experience and the above variables. See Appendix K. While all such correlations were significant, they were modest.

What these and other survey findings suggest is that prior natural disaster experience, no matter how extensive, does not appear to appreciably influence parameters such as belief or acceptance of climate change, concern about climate change, or climate change distress or psychological adaptation. Indeed it would appear that periodic exposure and repeated experience with extreme weather and natural disaster events likely normalise these occurrences for some, but such prior experience also appears to be associated with a raised collective consciousness, wariness, and felt exposure and vulnerability to such events. Interestingly, this group of disaster-experienced respondents were not dismissing the threat of climate change, and indeed 44% of this group reported experiencing noteworthy changes and events which they thought might be due to climate change (as compared with 45% for the full national sample). What is very clear in the research findings, though, is that direct experience and encounters with what is seen as a probable manifestation of climate change (and for many this was reported as an extreme weather event) seems to dramatically influence the salience and importance of other core variables in the survey, as indicated in Table 14. This further suggests the importance of the way extreme weather events and natural disasters are being framed and understood by individuals and communities. If such events are viewed through a climate change-imbued understanding of global climatic changes, then the significance and importance of these same events appears to be far more consequential in terms of psychological responses and impacts.

While the event category achieving the highest reported frequency was that of cyclones (57%) of the 1158 respondents, followed closely by floods (54%), it was clear from other qualitative data in the survey that drought (46%) was possibly the most salient and symbolically powerful natural disaster in respondents' experience. This is not surprising given the 'slow disaster' nature of drought, its reach and landscape impact, and its ongoing, background stressor status, not unlike the nature and status of global climate change as a chronic environmental stressor (e.g., Anderson, 2010; Reser & Swim, 2011). It is also the case that many regions of Australia had been experiencing considerably more than the 'decade of drought' that preceded the 2010 survey and water scarcity was a very serious concern throughout much of Australia including many urban areas. But the spectre and desolation of drought can be forgotten in the context of sudden and acute disaster events, hence retrospective accounts of specific events and disasters can underemphasise the powerful psychological, social, and regional impacts of an 'event' that can span a decade and dramatically change the appearance and status of landscapes and human communities (e.g., Anderson, 2010; Gleick & Heberger, 2012; Healey, 2005).

It is difficult to compare these prior direct experience figures with findings from other research samples or national populations as such figures are seldom published or encountered. It is noteworthy that the prior experience figure of 37% compares with a figure of 20% for our comparison national sample from Britain, though this British survey question related specifically to the only noteworthy natural disaster phenomenon directly affecting British residents 'recently', namely flooding. Ironically, at the time of completing this report,

in March of 2012, an ongoing disaster stalking Britain was that of drought which had been a very unusual but recurrent condition in 2010 and 2011. Preliminary analysis of 2011 July-August Australian survey data ($n$ = 4347) indicates that 28% of respondents reported experiencing a natural disaster threat or impact situation *in the past 12 months* with many individuals experiencing cyclone, flood, bushfire, or drought situations two or three times over this very eventful one year period (Reser et al., 2012c).

The relative instances of disaster events are no doubt somewhat more complex than Table 11 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 convergent disaster events were simply counted once by respondents, with the accompanying floods of a cyclone in Northern Australia, for example, being entered as a single cyclone event. As well, over one's lifetime, it is likely that a number of specific events, however dramatic, might not be recalled in the context of an online survey such as the present one. This would suggest that the actual incidence of such events and associated direct experience is in fact greater than what these figures would suggest. As well, the research team 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 longer term psychological and social impacts (e.g., Reser, 1996; Reser & Morrissey, 2008).

## PRIOR EXPERIENCE AND IMPACT OF EVENTS

There is considerable convergent evidence that prior disaster experience can make a substantial difference with respect to resilience, adaptive capacity, future preparedness, and short and longer term psychological distress (e.g., Adeola, 2008; Faust, Black, Abrahams, Warner, & Bellando, 2008; Reyes & Jacobs, 2006; Russell, Goltz, & Bourque, 2011). However this literature is mixed with respect to whether such prior experience confers unalloyed benefits in terms of future preparedness or psychological resilience and learned resourcefulness (e.g., Norris, Smith, & Kaniasty, 1999; Siegrist & Guscher, 2008; Tierney, Lindell, & Perry, 2001). Much depends upon the nature of this prior experience, which also relates to the nature of the disaster event. If an individual has coped reasonably well and was able to exercise a modicum of control in extraordinary circumstances, this can be a positive albeit challenging and stressful experience, conferring enhanced self-efficacy and confidence. If an individual or group has had an experience of being overwhelmed, not able to cope effectively, and possibly traumatised, the experience can substantially undermine self-efficacy, self confidence, and adaptive capacity in future disaster or emergency contexts (Reser & Morrissey, 2008).

In the context of this 2010 survey a brief assessment was attempted of the general psychological and situational impacts of respondents' reported experiences with these natural disaster events. Responses to questions #54 and #55 provide some indication of the infrastructure and psychological impacts resulting from direct experiences with extreme weather events (see Figure 34 and 35). These results suggest that 7.3% of respondents with such experience suffered substantial property damage in the context of the event, and 17.8% of respondents experienced appreciable stress during these circumstances. Certainly the

disaster mental health literature would argue strongly that such events and experiences are profoundly impactful for many people, and often traumatic (e.g., APS, 2009; Norris et al, 2002a, 2002b; Ursano, Fullerton & Norwood, 2003).

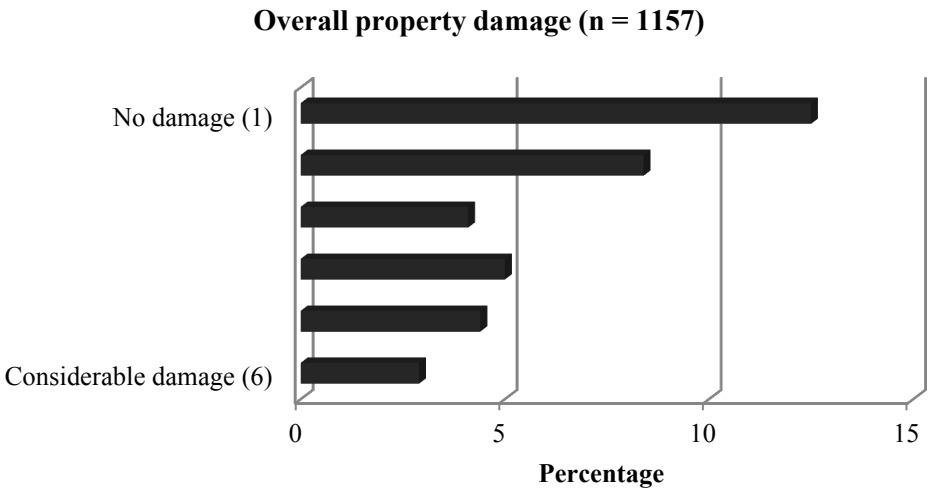


*Figure 34*. Natural disasters and property damage

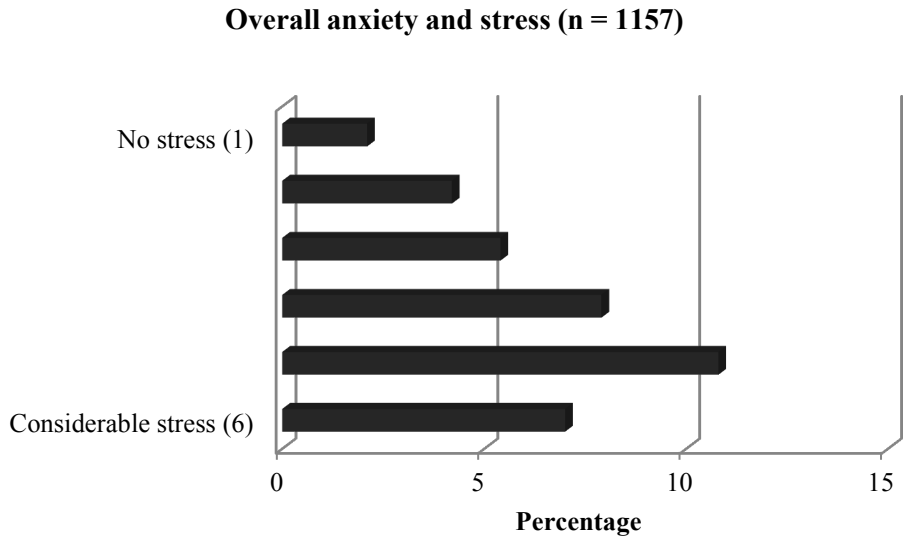


*Figure 35*. Natural disasters and psychological response

## IMPLICATIONS FOR ADAPTATION TO CLIMATE CHANGE

The matter of prior experience with natural disasters and how this might relate to acceptance of, adaptation to, and behavioural engagement with, climate change was a matter of explicit focus for our Cardiff research collaborators as well as ourselves, and of particular interest to our funding body, NCCARF. Our cross-national comparisons with Britain are of particular interest as Britain's most salient, recurrent, and damaging natural disaster phenomenon over the past decade has been flooding, though, again, drought has become a

salient issue and condition over the past several years. As well, there appears to have been a noteworthy change in public understandings with respect to the nature and probable causal influence of climate change on extreme weather events, notably prolonged rain and flooding. Whereas such events would rarely be attributed to climate change a decade ago in Britain, such causal attributions would appear to be becoming increasingly common, in media coverage as well as with respect to public understandings (e.g., Spence et al., 2011a). Data collected in 2003 showed that respondents who had or who had not experienced flooding differed very little with respect to climate change perceptions and self-reported actions relating to the threat of climate change (Spence et al., 2011a; Whitmarsh, 2008). Of particular relevance were strategic analyses of those 2010 British survey respondents who had direct personal experience of flooding, a total of 363 individuals, or 19.2% of their national sample of 1822 respondents. Reported flooding experiences were significantly associated with perceptions relating to climate change and, indirectly, with behavioural intentions relating to energy reduction. In the case of our parallel Australian survey, a distinct difference was global climatic location and geography, and quite serious exposure to both the full spectrum of natural disasters and to the projected impacts of climate change. As with the Cardiff data, our findings clearly evidence that prior experience with natural disasters is associated with psychological adaptation to climate change and behavioural engagement, though the strength of these relationships are modest. What appears to be a far stronger predisposing and mediating factor is direct experience with environmental changes and events which are thought to be associated with climate change. Such significant experiences appear to be strongly associated with multiple key psychological variables and processes relating to psychological adaptation to and the psychological impacts of climate change.

## DIRECT EXPERIENCE WITH CLIMATE CHANGE

While the Cardiff survey did not explore the question of perceived climate change experience or encounters, the Australian survey specifically asked whether respondents had experienced any noteworthy changes or events in their local natural environment, or elsewhere in Australia or the world, which they thought might be due to climate change. This allowed for a closer examination of the role of 'direct' exposure and experience in public risk perceptions and understandings of climate change, psychological impacts as measured by climate change concern and distress, as well as self-reported behavioural engagement in own carbon emission reduction behaviours, as contrasted with the importance and impacts of direct experience across a spectrum of natural disaster encounters. Question #47 asked "**Have you experienced any noteworthy changes or events in your local natural environment which you think might be due to climate change?"** Thirty-six percent of respondents answered yes, with many of these individuals providing very detailed information in response to an open-ended follow-up question asking about what these changes or events were or are. Appendix M presents these reported changes and events by category. In response to a subsequent and similar question with respect to such experiences or encounters "**elsewhere in Australia or the world**", 25% of respondents indicated that they had experienced noteworthy changes which they thought "might be due to climate change". Adjusting for the fact that a number of survey participants responded affirmatively to both questions, it becomes clear that 45% of respondents reported direct experience with environmental changes or events which they deemed to be the likely consequence and/or manifestation of climate change. This is arguably a very high proportion of respondents and attests to the acceptance and importance of climate change. It is interesting by way of international comparison that 35% of North American respondents in the most recent Yale Climate Change Communication Survey also reported having personally experienced the effects of global warming (Leiserowitz et al., 2012b).

Participant responses to open-ended question 48, "**Can you briefly indicate what these changes or events were or are**?" are interesting on a number of counts. The engagement on the part of respondents with this initial open-ended item was impressive, with many participants writing multiple sentences in this on-line survey, with this question completed by many more than the 45% who indicated that they had personally seen changes or events which might be due to climate change. Indeed many respondents emphasized that they had seen *no* such changes or events. But the majority of the examples and explanations from participants who had experienced changes or events which they thought might be due to climate change were detailed, heart-felt, and clearly very salient to these respondents. Appendix M provides examples of these statements, and a taxonomy of changes and events into which comments fell. It is interesting and informative that many of the comments referred to particularly sensitive and meaningful everyday indicators, such as dropping water levels in dams, cracked and parched earth, dying trees and lawns, local beach erosion, changing growing seasons for plants, the decreasing presence of frogs and birds, the seeming increasing frequency and severity of extreme weather events, the increasingly impacted and fragile touchstones of the Murray River, the Great Barrier Reef, the state of local parks or

nature strips, etc. Clearly, a very substantial proportion of this largely urban and peri-urban national population are seeing what they interpret to be the unfolding impacts of global climate change in their own local regions and backyards.

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

Appendix K includes those more relevant correlational findings with respect to previous experience with natural disasters, core psychological and other demographic variables, including direct experience with climate change. These results indicate that personal encounters with the perceived impacts of climate change are strongly associated with psychological adaptation ($r$ = .44), climate change concern ($r$ = .43), belief ($r$ = .41), risk perception ($r$ = .39), distress ($r$ = .39), self-efficacy ($r$ = .35), responsibility($r$ = .35), residential exposure ($r$ = .35), objective knowledge ($r$ = .31) and behaviour ($r$ = .26). Correlations were all significant at $p < .001$.

More modest but significant associations were found between prior disaster experience and residential exposure ($r$ = .25), adaptation ($r$ = .20), risk perception ($r$ = .20), distress ($r$ = .16), behaviour ($r$ = .15), media exposure ($r$ = .14), responsibility ($r$ = .13), climate change concern ($r$ = .12), and belief ($r$ = .07). These overall correlational findings immediately suggest that direct, personal encounters with what are perceived to be events or impacts associated with climate change are particularly salient and meaningful, and that these associations appear to be much more psychologically and symbolically significant than is the case for direct prior and cumulative experience with extreme weather or natural disaster events.

These findings invited a further comparison of differences between those respondents with and without direct disaster experience and key climate change focused-psychological variables, as contrasted with group comparisons for those with and without direct climate change encounters and experience on key psychological variables. Table 13 presents the mean scores on selected variables for respondents who have had previous experience with disasters, as contrasted with corresponding mean scores for those who have had no such experience. The scores are based on item #52, "**Have you ever experienced a natural disaster warning or natural disaster impact situation**". Only two statistically significant differences across these groups were found, and these were very modest. This is a very surprising finding as we know that direct experience with disaster events is actually very psychologically salient and impactful for most people. What these findings suggest is that the nature and impact of indirect, virtual, and vicarious experience with disasters is itself very powerful and consequential, with such impacts appearing to be as salient and impactful as in the case of direct experience. A related argument here is that all respondents are likely to have been exposed to ubiquitous media coverage of natural disasters over the past several decades, with this being a very general and nondiscriminating experience.

*Table 13*. Direct experience of a natural disaster warning or disaster impact situation

| | 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 | |
| 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: $^{**}p < .01$. $^{***}p < .001$.

Table 14 presents the mean scores on selected variables for respondents who indicated that they had had direct experience with climate change related- instances, events, or impacts. These latter results are strikingly different from consideration of the effects of direct experience with natural disaster or extreme weather events. In every instance mean differences are appreciable, as well as being statistically significant. Climate change encounters are associated with greater knowledge, stronger belief, greater concern, greater distress, stronger felt responsibility, and greater psychological adaptation and behavioural involvement in addressing climate change. What might account for this? It may be that 'seeing/experiencing' is more than 'believing', that such direct encounters with perceived climate change impacts and events change understandings, adjustments, and motivations, and elevate not only concern and distress, but feelings of responsibility and self-efficacy.

*Table 14*. Direct experience of perceived climate change impacts in both Australia and overseas

| | 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 |
| 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 highest group mean. Differences between means are expressed as: $^{**}p < .01$. $^{***}p < .001$.

The survey findings overall would suggest that natural disasters and extreme weather events are indeed understood as phenomena directly associated with global climate change, and hence the ultimate rank ordering of mean concern ratings in items #23 and #24 is more notional *than actual or psychological* in terms of how these threats and risk domains are understood and responded to. That is, climate change is effectively being rated and hence ranked against extreme weather phenomena which are themselves perceived to be manifestations of climate change. This understanding of the climate change threat in terms of natural disaster and extreme weather events is particularly evident in open-ended responses to items 48 and 61. This is also consistent with research findings from North America and Europe with respect to elicited associations to climate change and global warming, with the most frequently mentioned first associations by British respondents, for example, relating to weather (e.g., Leiserowitz, 2005; Lorenzoni, Leiserowitz, Doria, Poortinga, & Pidgeon, 2006).

## DEMOGRAPHIC ANALYSES

### RESULTS FOR URBAN AND RURAL

For the purpose of group comparisons by community/region type, a national comparison was operationalised by combining urban and suburban respondents (70.7%) and rural, rural residential, and country town respondents (29.3%). Across all of the substantive 23 variables reported in Appendix L, only eight evidenced very modest differences, though these were statistically significant ($p < .001$). The more salient of these modest differences were, as might be expected, with rural and country town respondents reporting being more connected to nature, more exposed to the natural environment and its elements through residential location and lifestyle, and having somewhat greater disaster experience. This in itself might account for much of the above reported differences. Acceptance of climate change was also marginally less, with rural respondents having a mean belief score of 15.5 as compared with 16.1 ($p <. 001$), and a climate change concern score of 22.0 as compared with 23.5 ($p <. 05$). Rural respondents also scored modestly lower on overall trust in scientists, government and media sources, with a mean trust score of 11.7, as compared with 12.2 ($p <. 001$). These findings appear to be very similar to those reported by the authors of CSIRO's sequenced 2010 and 2011 national climate change surveys (Leviston & Walker, 2010, 2011). Notably, no real differences were found with respect to environmental values, the perceived importance of climate change, objective knowledge, risk perception, climate change distress, climate change self-efficacy, personal responsibility, perceived direct experience with climate change, psychological adaptation, or pro-environmental behavioural engagement.

It is unfortunately difficult to compare these findings with other research being undertaken in Australia examining the risk perceptions, understandings, and responses of nonurban communities as there have been very few studies where the focus, methodologies, and measures have been comparable. The sequenced 2010 and 2011 CSIRO national surveys report gross findings very similar to ours, that is they found in both years that respondents in rural areas were slightly less likely to think that climate change was happening than those in capital cities or regional towns (Leviston & Walker, 2011). However these reports, too, provide insufficient information on how geographic area and residence location items were framed and answered, or how matters relating to the urban rural continuum were operationalised. In the case of our own research, our selected radiating postcodes from designated population centres combined did not allow for the sensitivity we had hoped for with respect to sensitively sampling this continuum.

### URBAN TO RURAL/REMOTE

At the time of the writing of this report, many reported Australian studies and conference papers were addressing the matter of whether the rural community in Australia was, on the whole, less accepting of the reality of climate change, and less concerned about it. The impression generated was that the rural community was both more sceptical and less concerned than were urban and suburban Australians. Many of these reported 'survey' and

focus group discussion findings, however, appear to reflect the input of key primary producer organisation members, and other selected groups and communities, rather than being more representative and unbiased samples of particular regions. Nonetheless there do appear to be a number of published studies regional studies which are reporting similar findings relating to differences between rural and urban communities, though data is typically collected in rural communities and compared, notionally, with perceived or elsewhere reported urban views. (e.g., Buys, Miller, & van Megen, 2011; Commonwealth of Australia, 2008, 2010; Donnelly, Mercer, Dickson & Wu, 2009; Evans, Storer, & Wardell-Johnson, 2011; Thwaites, Curtis, Mazur, & Race, 2008). Our own survey findings have not found the marked urban-rural differences reported by others to any significant extent. There are reasons, as stated previously in this report, why this might be the case, with these relating, for example, to the problematic categorisation and establishment of the urban, peri-urban, and country town residential status of many respondents, who may well be rural residents for all practical purposes. The urban/rural membership of our service provider survey panel might also be raised. However, our demographic data and survey responses overall, and the panel membership of our service provider, would suggest these possible explanations accounting for little difference between urban and rural respondents across most measures are not compelling.

Discussions with other colleagues and researchers working in rural regions would indicate that there are other cogent reasons why some differences may be found. One is that there are political correctness and party identification issues tied to one's more public views on climate change, which in rural regions of the country might well reflect the conservative side of politics and a prevailing anti-carbon tax legislation view. As well rural residents are well aware of and inured to the extreme weather events projected for climate change, which have become part and parcel of the stereotype and national narrative of 'the man [family] on the land'. It is likely that the resilient, she'll be right stereotype of rural Australians, cumulative individual and community experience, local public discourse, and the political conservatism of many rural communities would lead to somewhat lower survey readings of public acceptance and concern with respect to climate change, and regional exposure and vulnerability in some rural communities. Another possibility is that the climate change narrative and explanation for more recent extreme weather events has had somewhat less traction in some rural communities as the competing narrative of dramatic nonanthropogenic and shorter term climate change provides a very powerful and pervasive alternative account of what seems to be happening locally and nationally in terms of weather and landscape change, based on direct experience and media coverage of extreme weather events and global climate change. In essence it would appear that extreme weather events in recent years that could well be tied to climate change are instead being normalised as outlier events not inconsistent with the historically extreme and less predictable weather patterns of rural Australia, i.e., that these are manifestations of unusual 'climate variability' not anthropogenic 'climate change'.

These same colleagues, though, and many rural mental health workers across Australia, also affirm that there is a less public but high level of climate change acceptance

and concern in the rural community, which find ready expression in those contexts where it is ok to speak of such matters. It is arguable that most individuals with a close connection to their local natural environment through residence and occupation, and typically strong attachment and sentiment, are very aware of increasingly visible signs of environmental and weather pattern changes that are out of their experience and of concern. Our own survey findings, and our quantitative as well as qualitative survey items, are suggesting that levels of acceptance and concern about climate change between urban and rural regions in Australia are actually surprisingly similar, and do reflect very real psychological well being and perceived quality of life and environment impacts for many (e.g., APS, 2011, Morrissey & Reser, 2007; Reser, Morrissey & Ellul, 2011).

While considerable research effort is currently underway in Australia examining the views and adaptive capacity and resilience of the rural sector, and in particular Australian farmers and graziers, there clearly exist multiple challenges in carefully documenting and monitoring changing risk perceptions, public understandings, and responses to the complex risk domain and phenomenon of climate change, and the concurrent environmental, social, political, economic, and policy and governance issues associated with climate change. Certainly a first step is to more clearly demarcate this nonurban 'rural' sector in a standardised way, that accurately captures and characterises very different demographic and socioeconomic groups, communities, and regions of Australians. Equally important is a standardisation of best practice in methodologies and measures which can foster meaningful and coherent national and regional databases. The matter of sensitive and valid objective measures is fundamental. Unfortunately it has simply not been possible to extract a clear and coherent picture of urban rural differences emanating from other studies with which to compare our own findings.

## REGIONAL AND SETTLEMENT COMPARISONS

Not only are geographically and climatically distinct regions of Australia differentially exposed to the threats of climate change and extreme weather events, regional cultures have differing risk perceptions and understandings of particular threats and phenomenon, associated with histories and local cultures based on long experience and established patterns of adaptation and adjustment (e.g., Cohen, 2007). Our sampling stratification, within the limitations of region-specific respondent numbers, allows for comparisons across states, regions, settlement types, and hazard exposure and history. In that section of the report examining the relative salience of and respondent concern about climate change, particular extreme weather events, and other risk domains, it becomes clear that, for example, in cyclone-prone northern coastal communities, respondents were more concerned about cyclones, severe storm activity, and floods, than other natural disaster or extreme weather events.

## COMPARISONS BY STATE

The results for state comparisons across core variables (see Table 15) are not easy to interpret. There were relatively few instances where statistically significant differences in

mean scores occurred. This undoubtedly reflects the somewhat arbitrary status of state boundaries, and the very heterogeneous nature of Australian states, geophysically, geographically, and demographically. Nonetheless these instances of significant differences are worthy of brief comment. It is interesting that objective knowledge scores of respondents from the Northern Territory were significantly different from other states, yet very close to scores for ACT respondents. It should be noted that both 'states' (i.e., Territories) had the highest per capita educational achievement levels as indicated by #65 "**Please indicate the highest level of education you have completed**". As well, state coverage of the issue of climate change may well have been greater than in other states, though for differing reasons, relating to political salience in the case of the ACT and relative climate change exposure in the case of the Northern Territory. The significantly greater acceptance of climate change in the Northern Territory might well reflect the objective exposure of this state to climate change impacts as well as the lifestyle exposure of its residents to changing natural environments. That climate change concern was significantly greater for Western Australian respondents is more difficult to explain, though in virtually all of these instances of a significant difference, the actual mean differences are not very marked. The higher mean distress scores for Northern Territory participants might well be associated with the previously noted differences relating to objective knowledge and acceptance of climate change. That Victorian respondents scored highest on risk perceptions might well reflect the fact that the convergence of drought, a historic heat wave, and the bushfires and fatalities of Black Saturday in 2009, arguably constituted one of the worst and most 'apocalyptic' natural disasters in Australia's recent history.

Finally, the fact that Northern Territory respondents achieved significantly higher mean scores on residential exposure, and perceived direct experiences of climate change, is no doubt related to the relative exposure of this state to climate change impacts and associated extreme weather events, and its location, in combination with those factors previously noted. But it would be fair to say that these state comparisons are more noteworthy for the absence of appreciable or patterned differences.

To further explore the contribution played by region of Australian in explaining variance in the key climate change variables, a series of two-level (individuals within regions) multilevel analyses were performed. Region was operationalised by grouping similar postcodes to form 32 geographically-homogenous regions ranging in size from 18 to 282 participants. Not surprisingly, significant proportions of the variance in lifestyle exposure (16.5%), residential exposure (13%), and past adverse experience (11.6%) were explained at the between-region level (with the remainder explained at the between-individual level). However, region explained little of the variance in most other variables, including Belief (1.4%), Concern (1.6%), Distress (1.3%) and Behaviour (0.07%).

*Table 15*. State comparisons on key climate change variables

| | ACT (1) N = 80 | NSW (2) N = 612 | NT (3) N = 47 | Vic (4) N= 477 | Qld (5) N = 934 | SA (6) N = 428 | WA (7) N = 383 | Tas (8) N = 135 |
|---|---|---|---|---|---|---|---|---|
| Objective Knowledge | 3.09 | 2.35 | 3.17** | 2.97 | 2.5 | 2.85 | 2.97 | 2.76 |
| Belief in Climate Change | 16.46 | 15.35 | 16.77*** | 16.36 | 15.48 | 16.26 | 16.58 | 15.90 |
| Climate Change Concern | 23.69 | 22.67 | 23.86 | 24.15 | 22.65 | 23.91 | 24.42*** | 23.14 |
| Risk Perceptions | 19.03 | 18.57 | 18.62 | 19.73** | 18.71 | 19.27 | 19.26 | 17.56 |
| Distress | 22.39 | 21.46 | 23.47*** | 23.05 | 21.07 | 22.06 | 22.99 | 21.27 |
| Self-efficacy | 18.11 | 18.18 | 18.64 | 18.57 | 18.15 | 18.39 | 19.02 | 18.46 |
| Personal Responsibility | 12.95 | 12.47 | 13.15 | 12.89 | 12.42 | 12.63 | 13.27** | 12.92 |
| Adaptation | 29.79* | 28.21 | 31.23 | 29.45 | 28.07 | 29.03 | 29.00 | 27.99 |
| Behaviour | 6.51 | 6.25 | 5.87 | 6.62 | 6.34 | 6.76 | 6.36 | 6.35 |
| Residential Exposure | 10.91 | 10.53 | 13.51*** (1,2, 4-8) | 10.80 | 11.14 | 10.15 (1-5) | 10.08 (1-5) | 9.15 (1-5) |
| Trust | 12.00 | 12.06 | 12.06 | 12.35*** | 11.58 | 12.09 | 12.61 | 11.91 |
| Direct Experience of CC | .56 | .41 | .57*** | .55 | .40 | .50 | .44 | .36 (1,3) |
| Importance of CC | 4.11 | 4.06 | 4.17 | 4.31 | 4.00 | 4.23 | 4.36*** | 4.09 |
| Prior disaster experience | 8.53 | 9.02 | 9.64 | 8.59 | 9.18 | 8.96 | 9.04 | 8.20 |

*$p < .05$, ** $p < .01$,*** $p < .001$. Alpha reduced to $p < .0083$ when comparing group means.
Note: Each state is numbered in the column headings. The numbers in brackets located in the body of the table indicate differences between the states (i.e., results from the post-hoc tests after ANOVA revealed a significant difference by state). For example, South Australia is significantly different from States 1-5 in relation to residential exposure.

## GENDER

Consistent gender differences in climate change risk perceptions and responses is one of the clearest findings in the climate change survey literature (McCright, 2010; Zelezny, Chua, & Aldrich, 2000). In Australia, for example, research undertaken by the Australian Bureau of Statistics (2008) found that male respondents were less concerned about climate change and water shortages than were female respondents. More recently, a national study undertaken by the CSIRO National Research Flagship Energy Transformed measuring Australian attitudes to climate change found that female respondents were more likely to believe that climate change is happening than were male respondents (Ashworth et al., 2011). These results are very consistent with other Australian survey research which further documents that females are not only more likely to believe in human-induced climate change, but also to believe that they will be impacted during their lifetime (e.g., Ipsos-Eureka, 2010, Leviston & Walker, 2010, 2011; Sweeney Research, 2010). The 2010 Australian findings reported here are no different. The remarkable consistency and strength of these findings are nonetheless noteworthy and of particular value, given the broader suite of psychological measures in this Griffith research (e.g., climate change concern, distress), and the Australian context, providing for a more in-depth consideration of these gender differences.

Consistent and often substantial gender differences were found across all key survey variables with the exception of lifestyle exposure. These differences were almost exclusively in the direction of female respondents being more concerned, reporting greater acceptance of climate change, greater perceived importance, greater distress, a stronger sense of personal responsibility, greater vulnerability and exposure to climate change impacts and natural disasters, higher levels of self efficacy, and greater risk appraisal, adaptation and behavioural engagement. Female respondents also reported higher levels of exposure to and experience with natural disasters and perceived impacts of climate change, although modest differences are noted. Interestingly, females achieved significantly higher scores on *objective* knowledge than did male respondents. This result however is reversed for *subjective* knowledge levels, with males reporting greater knowledge than females. These findings are consistent with recent results obtained in the US relating to gender and knowledge. Females evidenced greater levels of climate change knowledge than did males, whilst at the same time males reported greater perceived understanding of climate change than did females (e.g., McCright, 2010). While it seems that women have a greater understanding of climate change science than men, they appear to underestimate this level of knowledge relative to males.

Male respondents were more sceptical about the issue of climate change than were female respondents, with 2.1% of males and 1% of female respondents classified as a disbeliever or strong sceptic (on the basis of an operational specification of genuine scepticism, i.e., this was based on responses to items #8, #9, #12, #14). When using a less conservative calculation (#8 plus two out of the remaining three items), 4.3% of males and 2.3% of females would be regarded as genuine climate change sceptics.

Other Australian researchers have explored the role of gender, personality, and vulnerability factors in predicting climate change distress. Searle and Gow's (2010) research was one of the few studies to empirically measure and document how people are psychologically responding to climate change. The three most common responses provided by their survey respondents, when thinking about climate change, were concern (61%), worry (39%), and anger (32%). This study found that female respondents evidenced greater levels of distress than did male respondents. Similarly, Agho, Stevens, Taylor, Barr and Raphael (2010) found that females were much more likely to change their way of living due to the risk of climate change than were males. Overall, it seems females are more likely to be concerned and distressed about the threat and impacts of climate change, but they are also more likely to be adapting to the challenges of climate change than are males.

## EDUCATION

It is important to note that educational achievement was spread across the respondent sample, with 17.9% of respondents having achieved less than year 12 studies, a further 17.1% having completed Year 12, whilst 33.4% had obtained a diploma or trade certificate. Thirty percent of respondents had an undergraduate or postgraduate degree (See Appendix I). The Australian Bureau of Statistics Education and Work Report released in May 2011, found 29% of people aged 15-64 had completed Year 11, with a further 21% finishing Year 12. Seventeen percent completed a Certificate III or IV, and 24% obtained a Bachelor Degree or above. These figures suggest that educational achievement among the current sample is somewhat higher than the national sample.

Positive associations were found between education and a number of key variables, belief/acceptance ($r$ = .08), risk perception ($r$ = .05), concern ($r$ = .08), distress ($r$ = .07), felt responsibility ($r$ = .09), psychological adaptation ($r$ = .12), self efficacy ($r$ = .08), objective knowledge ($r$ = .11), subjective knowledge ($r$ = .11), green self-identity($r$ =. 08), media exposure ($r$ = .11), and behaviour ($r$ = .08). Trust was not associated with education. All correlations were significant ($p < .001$) but very modest.

For the purpose of group comparisons, respondent educational attainment was categorised as having completed high school or less, post high school subjects or training (e.g., trade, apprenticeship), and university degree (e.g. undergraduate, postgraduate). Overall, educational differences were found across the key variables. Respondents with university education demonstrated significantly greater levels of objective and subjective knowledge, belief, concern, felt responsibility, heightened risk perception, adaptation, and behavioural engagement, as well as greater climate change distress and felt efficacy. Actual mean differences in scores across educational groups were not large, though there is a clear pattern and association between education and climate change belief and concern evident in these results. These findings do strongly suggest, though, that public risk perceptions and responses to climate change are not all about education. There are clearly multiple other considerations and determinants involved. Refer to Appendix L.

## AGE

The age distribution of respondents differed somewhat from the national profile, with the 2010 sample containing proportionally fewer younger respondents in the 15 to 24 category (7.8% vs 17.5%), proportionally more respondents in the 25-54 age bracket (60% vs 54.2%), and proportionally more respondents in the 55 plus age group (31.6% vs 28.3%) than in the broader Australian population (ABS, 2006). It is noteworthy that 12% of the survey sample was over the age of 65.

Negative associations were found between age and a number of key variables, with age being inversely related to climate change belief/acceptance ($r$ = -.14), risk perception ($r$ = -.13), concern ($r$ = -.13), distress ($r$ = -.14), felt responsibility ($r$ = -.09), self efficacy ($r$ = -.09), objective knowledge ($r$ = -.09), and trust ($r$ = -.14). A small, but positive association was found between age and behavioural engagement ($r$ = .07), connection to nature ($r$ = .07), and subjective knowledge ($r$ = .06). All correlations were significant $p < .001$, but again modest. Psychological adaptation was not significantly correlated with age.

Significant age differences were found across key survey measures. Respondents aged over 55 were much more likely to have a connection to the natural environment, spend time outdoors, score high on subjective knowledge, and engage in more pro-environmental behaviours than did younger respondents. Interestingly, this same age cohort scored lowest on belief, importance, concern, risk perception, distress, personal responsibility, residential exposure, trust, objective knowledge, self-efficacy and psychological adaptation. Respondents aged less than 35 scored highest on the key variables, with the exception of residential exposure and adaptation, in which respondents age 35-54 scored the highest.

It would appear that respondents over the age of 55, while on the whole accepting the reality of climate change and concerned about it, are *relatively less* accepting and concerned than younger respondents. This age cohort has seen considerable weather variability in their lifetimes, feel less trusting of information sources and government action, and generally feel less responsible, or able to undertake many substantive or meaningful adaptation or mitigation measures. Nonetheless it is interesting that this group was significantly more likely than younger age groups to be engaged in pro-sustainability behaviours.

## MULTIVARIATE MODELS PREDICTING CLIMATE CHANGE BELIEFS AND BEHAVIOURS

The final stage of the data analyses involved estimating and testing two 'families' of climate change structural models. The criterion in the first set of models was strength of belief in the existence of climate change (hereafter labelled *Belief*), while the criterion in the second set was the number of carbon footprint- reducing behaviours currently engaged in (hereafter, *Behaviour*). Our aims were: (a) to determine the overall goodness of fit of the hypothesised models, (b) to compare the fit of these models with that of competing models, (c) to assess the direct, indirect and total contributions of each predictor to the explanation of the criteria, and (d) to determine the extent to which the criteria - Belief and Behaviour - are explained by these sets of predictors.

All modelling was performed using LISREL 8.72 (Jöreskog & Sörbom, 1996) and maximum likelihood estimation procedures. The following parameter constraints were common to all models:

- questionnaire items were specified as loading on a single designated factor, with all item cross-loadings and error covariances constrained to zero;
- unless otherwise specified, loadings and factor variances were estimated freely;
- covariances between all exogenous variables, and between disturbances in the endogenous factors at the same level of the models, were also freely estimated.

The fit of the models was assessed by several indices. These were the Root Mean Square Error of Approximation (RMSEA, where a satisfactory fit is indicated by values less than .08), the Non-Normed Fit Index (NNFI, where a satisfactory fit requires values greater than .95), the Comparative Fit Index (CFI, interpreted as for the NNFI), and the Standardised Root Mean-Square Residual (SMR, with the cut-off for a satisfactory model fit similar to those for the RMSEA) (Byrne, 1998; Kline, 1998; Tabachnick & Fidell, 2007). The chi-square statistic was not relied upon because of its tendency to be inflated when sample sizes are large. However, the relative fit of nested models was assessed using the chi-square difference test ($\Delta\chi 2$ test). Due to departures from normality in the distribution of most measurement items, the Satorra-Bentler robust chi-square statistic was interpreted (e.g., Du Toit, Du Toit, Jöreskog, & Sörbom, 1999). Model parsimony was assessed using the Parsimony Normed Fit Index (PNFI, where smaller values indicate a better fit). After re-coding of "no opinion" and "don't know" responses to a value equal to the scale midpoint, all 3,096 cases were available in all analyses. Figure 36 provides an overview of the data modelling stages.

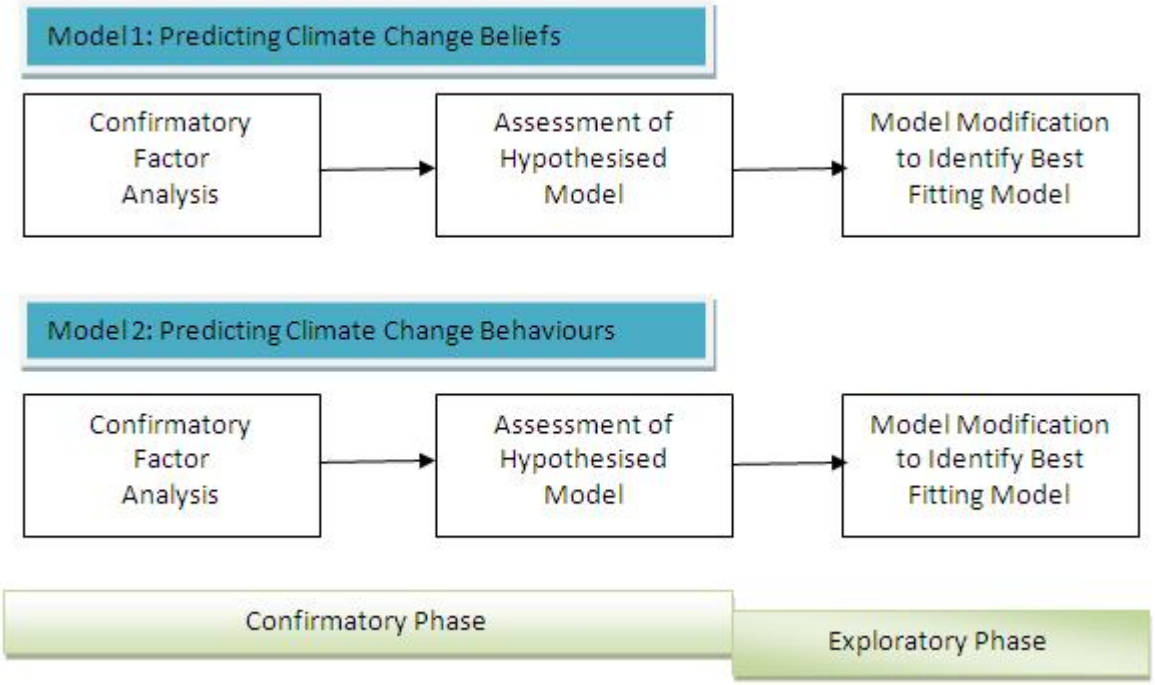


*Figure 36*. Overview of SEM Analyses

## MODEL 1: PREDICTING CLIMATE CHANGE BELIEFS

Model 1 sought to predict strength of belief in the existence of climate change by way of seven exogenous and nine mediating variables. The level 1 (exogenous) variables were: gender (0 = female, 1 = male), age (in years), highest educational attainment (7-point ascending ordinal scale), parent or grandparent status (0 = no, 1 = yes), voting intention (6-point ordinal scale, in ascending order of political parties' sympathies for environmental issues), a latent variable tapping perceived proximity of one's place of residence to climate threats (hereafter labelled *Residential Exposure*), and a latent variable tapping extent of engagement with, and activity in, the natural environment (*Lifestyle Exposure*).

These level 1 variables were hypothesised to predict strength of belief in climate change via the following level 2 (mediating) variables: connection to nature (herein labelled *Connection*), Schultz's (2001) three environmental values scales (*Biospheric*, *Altruistic*, and *Egoistic* values), self-identification with "green" issues and causes (*Green Self-Identity*), consumption of televised and film media regarding climate change (*Media Consumption*), trust in what authorities say about the environment (*Trust*), objective knowledge about climate change (*Knowledge*), and prior adverse experience of extreme weather events (*Experience*). There was a single variable at the third level of the model, belief in (acceptance of) climate change (*Belief*), with all of the preceding variables expected to predict, either indirectly (in the case of the level 1 variables) or directly (level 2 variables), this criterion. Details of the items used as indicators of the latent variables are available in Appendix J. Capitalised and italicised variable names are used for those composite scale measures which have been used to operationalise particular constructs.

Following Anderson and Gerbing (1988), prior to testing the structural models the measurement model was assessed by way of confirmatory factor analysis (CFA). Results indicated that all parameters were highly significant (*p*s < .001), and the model provided a good fit to the data, $\chi^2$ (860) = 5,801.67, RMSEA = .043 (90% CIs = .042 - .044), NNFI = .99, CFI = .99, SRMR = .062, AIC = 14,078.18, and PNFI = .82.

The hypothesised version of the structural model was highly-saturated and nearly-fully mediated. Only three of the level 1- to- level 2 structural paths were not expected to be significant, namely, those to *Experience* from each of gender, education, and voting intention. This model was found to fit the data well, $\chi^2$ (896) = 4,730.18, RMSEA = .037 (90% CI = .036 - .038), NNFI = .99, CFI = .99, SRMR = .074, AIC = 15,543.8, and PNFI = .86. Of note is the finding that each of *Media Consumption* and *Prior Adverse Experience* explained virtually no variance in *Belief*, and that the effects of *Connection* and *Egoistic* values were negative, indicating that – in the context of this multivariate model - belief in climate change became stronger as levels of these two predictors declined. (These negative effects, in the presence of positive bivariate correlations, were presumably a consequence of the high correlations between *Connection* and *Egoistic* values and the other predictors in the model). The model explained 54% of the variance in *Connection,* 42% of that in *Biospheric values,* 50% in *Altruistic values,* 36% in *Egoistic values*, 42% in *Green Self-Identity*, 12% in *Media,* 29% in *Trust,* 27% in *Knowledge,* 18% in *Prior Experience, and* 57% in *Belief* in climate change. All of the level 1 variables had significant indirect effects on *Belief*, with the strongest indirect effects associated with (in order) *Residential Exposure*, voting intention, and gender (all $p < .001$).

In the next stage of analysis, model modification was undertaken in a step-wise fashion using the modification indices, and the significance of the parameter estimates, as guides. This process aimed to add predictive paths and trim the model of redundant paths - thereby achieving greater parsimony - without significant losses to the closeness of model fit. This iterative process resulted in the following changes to the hypothesised model:

1. Nine paths from a level 1 to a level 2 variable were eliminated: these were the paths from age to *Media Consumption*, from education to each of *Biospheric values*, *Altruistic values* and *Trust*, from parental status to *Knowledge*, from voting intention to *Egoistic values*, and from *Lifestyle Exposure* to each of *Altruistic values, Egoistic values* and *Knowledge*.

2. Direct paths from the level 1 variables, age, (grand)parental status, and *Residential Exposure,* to the level 3 criterion, *Belief,* were added.

3. Paths from the level 2 variables, *Media Consumption* and *Biospheric values,* to *Belief* were removed.

When revised in these ways, the model provided a very good fit to the data, $\chi^2$ (904) = 4,535.88, RMSEA = .036 (90% CI = .035 - .037), NNFI = .99, CFI = .99, SRMR = .076, AIC = 15,097.38, and PNFI = .86. Indeed, the chi-square difference test indicated that this model fitted the data better than did the hypothesized model, $\Delta\chi^2$ (8) = -194.3, $p < .001$, and was

more parsimonious (with eight fewer structural parameters). As was the case with the hypothesised version of model 1, *Residential Exposure* had the strongest and most consistent direct effects on the level 2 variables, but, in contrast to the hypothesised model, *Residential Exposure* was also a strong predictor of *Belief* in climate change. As in the hypothesised model, the level 2 variables, *Altruistic Values*, *Knowledge,* and *Trust* were strong predictors of *Belief*, and *Egoistic values* was a strong negative predictor of *Belief*. However, in contrast to the hypothesised model, with *Media Consumption* and *Biospheric values* replaced as predictors of *Belief* by three level 1 variables, *Experience* was significantly, but negatively, related to *Belief*.

The model explained the same or slightly less (between 0% and 5%) of the variance in each of the level 2 variables (specifically, proportions of the variances accounted for were: *Connection* (53%), *Biospheric values* (40%), *Altruistic values* (47%), *Egoistic values* (35%), *Green Self-Identity* (40%), *Media Consumption* (11%), *Trust* (24%), *Knowledge* (25%), and *Prior Experience* (16%)). However, the revised model explained more of the variance in *Belief* (64%) than did the hypothesised model (57%). All of the level 1 variables, except (grand)parental status, had significant indirect effects on *Belief*, with the strongest indirect effects associated with *Residential Exposure* and voting intention.

## MODEL 2: PREDICTING CLIMATE CHANGE BEHAVIOURS

The second set of models aimed to predict the number of carbon footprint-reducing behaviours currently enacted (*Behaviour*). Model testing and evaluation were conducted as per model 1. CFA results indicated that all parameters were highly significant (*p*s < .001), and the measurement model provided a good fit to the data, $\chi^2$ (752) = 10,379, RMSEA = .064, NNFI = .98, CFI = .98, SRMR = .050, AIC = 20,197 and PNFI = .91.

The hypothesised model is shown in Figure 37. It comprised four levels. The single exogenous variable, at level 1, was belief in the existence of climate change. *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 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 was tested and shown to fit the data quite well, $\chi^2$ (757) = 10,412, RMSEA = .064 (90% CI = .063 - .065), NNFI = .99, CFI = .99, SRMR = .051, AIC = 20,267, and PNFI = .91. Figure 37 presents the standardised parameter estimates and variances explained in the endogenous variables. As expected, *Belief* significantly predicted all Level 2 variables; *Distress, Risk,* and *Responsibility* each significantly predicted *Adaptation*; and *Self-Efficacy* and *Adaptation* each significantly predicted *Behaviour*. In addition, *Belief* had a

significant ($p < .001$) indirect effect on each of *Adaptation* and *Behaviour,* while *Distress* ($p < .001$) and *Self-Efficacy* ($p < .01$) had indirect effects on *Behaviour*. Contrary to expectations, however, neither *Concern* nor *Self-Efficacy* predicted *Adaptation,* and *Responsibility* did not predict *Behaviour*. These unexpected findings are likely due to the high correlations between these and other predictors.

Modifications to model 2 proceeded in two phases: first, stepwise additions (in order of descending modification indices) of all previously-constrained paths; second, stepwise omission of all non-significant paths. In the first phase, five models were tested - one involving the addition of each of the paths that had been constrained to zero in the hypothesised model. Results indicated that the addition of both the path from *Belief* to *Adaptation* and that from *Distress* to *Behaviour* resulted in a significant improvement in fit over models that included only one of these paths.

A drawback of this expanded model is that it includes five non-significant paths. Application of the chi-square difference test indicated that removal of only one of these paths, that from *Responsibility* to *Behaviour*, improved model fit, $\Delta\chi^2$ (1) = -4.79. With these changes made, the model fitted the data well, $\chi^2$ (756) = 10,352, RMSEA = .064 (90% CI = .063 - .065), NNFI = .99, CFI = .99, SRMR = .050, AIC = 20,219 and PNFI = .91. Several features of this model are noteworthy. First, the path directly from *Distress* to *Behaviour* is negative ($\beta = -.23$, $p < .001$), whilst the indirect path from *Distress,* via *Adaptation*, to *Behaviour,* is positive ($\beta = .33$, $p < .001$). Overall, the effect of *Distress* on *Behaviour* is positive, but modest. These findings suggest the possibility that *Distress* has two effects on climate change behaviours: it leads to psychological adaptation, which in turn promotes carbon-reducing behaviours, but it also inhibits such behaviours, through other unmeasured processes (possibly, by inducing a sense of helplessness, a process of denial, or even a state of panic). Second, while the *Responsibility* to *Behaviour* direct path was non-significant and was omitted, the total effect of *Responsibility* on *Behaviour* was stronger (.17, $p < .01$) than was that of *Concern* (.01, *ns*), *Risk* (.04, $p < .01$), or *Distress* (.09, $p < .01$). The variables with the largest total effect on *Behaviour* were *Adaptation* (.63, $p < .001$), *Belief* (.40, $p < .001$) and *Self-Efficacy* (.24, $p < .001$). The strong influence of our measure of *Adaptation* on behaviour is consistent with theory and worthy of particular note.

## SUMMARY OF STRUCTURAL EQUATION MODELLING

We used structural equation modelling to fit and estimate a series of multivariate predictive models of the correlates (and likely antecedents) of beliefs in climate change and of mitigating behaviours enacted in response to climate change. In summary, we found that:

- the best-fitting models explained approximately 64% of the variance in *Belief* and 34% of that in *Behaviour*
- in general, the hypothesised (fully or partially) mediated models were supported in that most predictors had their effects on the criteria via variables that had been specified to act as mediators at later stages of the model. Major exceptions were the

direct effect of *Residential Exposure* on *Belief* in model 1, and the direct effect of *Distress* on *Behaviour* in the revised version of model 2.

- in model 1, *Belief* was best predicted by the level 1 variable of *Residential Exposure,* and by the level 2 variables of *Altruistic values*, *Knowledge, Trust, Green Self-Identity* and (negatively) by *Egoistic values*. Thus, respondents who had the strongest beliefs in climate change tended (a) to live in areas that are most exposed to climate change threats, (b) to hold altruistic environmental values, (c) to have superior knowledge of climate change phenomena, (d) to place trust in what authorities say about climate change, (e) to self-identify with environmental groups, issues and causes, and (f), with these other predictors in the model, to not hold egoistic environmental values.

- in model 2, *Behaviour* was best predicted by the level 3 variable of *Adaptation,* and by the level 2 variables, *Distress* and *Self-Efficacy,* with the latter two variables predicted by level 1 variable*, Belief*. Thus, respondents who enacted the most behaviours aimed at reducing their carbon footprint tended (a) to have adapted psychologically to the threat and reality of climate change, (b) to display high levels of distress due to climate change, and (c) to possess high levels of self-efficacy regarding what they can do to mitigate the effects of climate change.

While these conclusions follow 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 panel 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 effects, and they cannot be taken to imply causality.

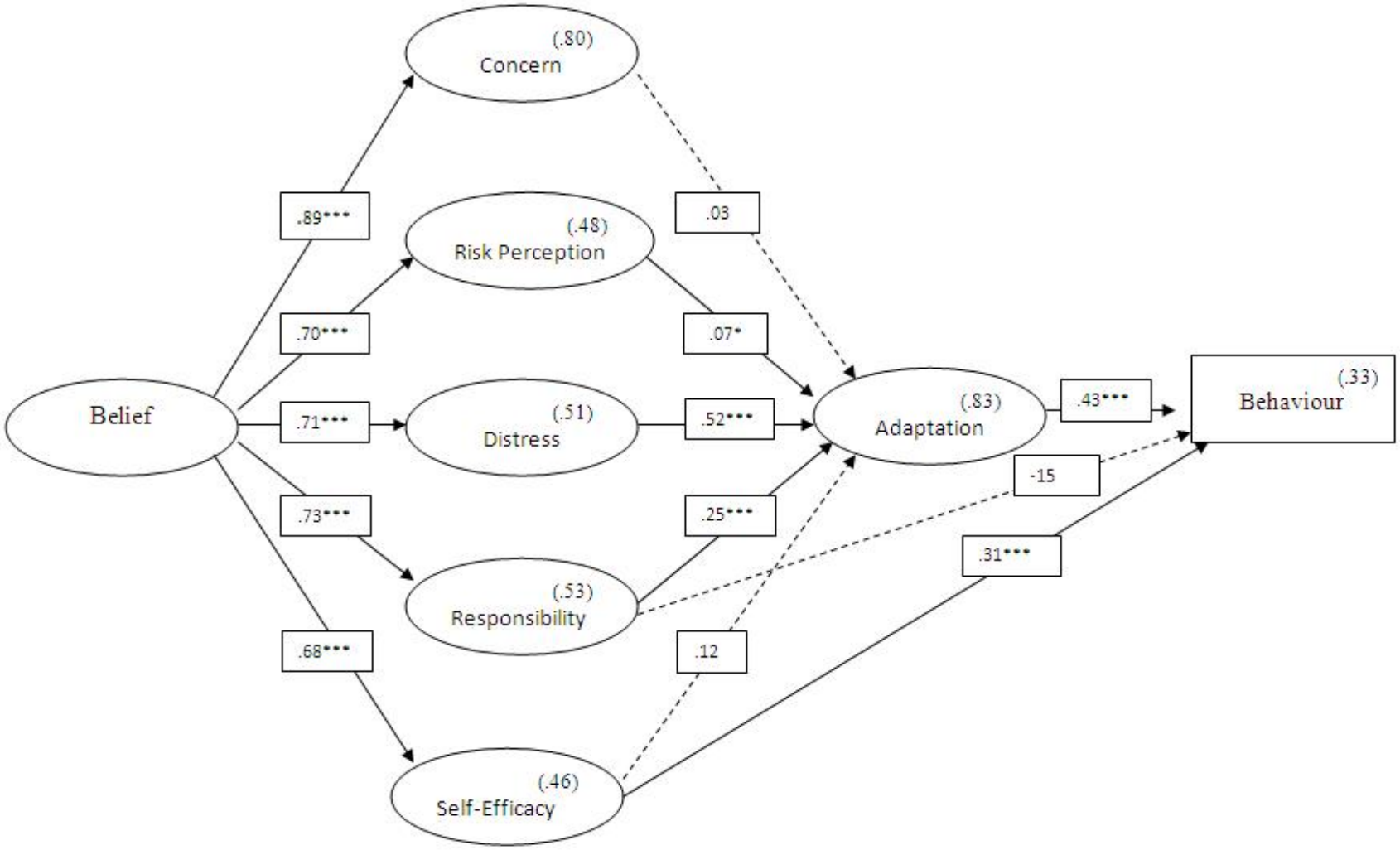


*Figure 37.* Model 2: Hypothesised Model of Antecedents of Climate Change Behaviours

(Standardised parameter estimates on arrow-head lines, *** $p < .001$. * $p < .05$; percentage of variance explained, in parentheses

The SEM analyses help clarify the 'big picture' to emerge from our data. Perhaps most importantly, these analyses highlight the strong pattern of associations between belief in climate change, feelings of distress, psychological adaptation, and engagement in mitigating behaviours. The modelling of the relationships between these variables suggests a metaprocess in which internal cognitive states (beliefs) serve as antecedents to complementary changes in affect (distress reactions) and shifts in attentional, motivational and behavioural tendencies (psychological adaptation), which, in turn, are manifested and realised in overt behavioural engagement. Examination of the final structural model reveals that, while behaviour is directly predicted by three variables (distress, self-efficacy, and psychological adaptation), the most influential of these paths is that through adaptation, with most of the effects of belief, distress, risk perception, felt responsibility to act, and several other variables, all channelled through adaptation. This modelling underscores a theme emphasised throughout this report, namely, that the processes of psychological adaptation are critical to understanding how internalized psychological variables affect overt human responses to global climate change. As important as this point is, however, the reality may be more complex. Thus, while it is tempting to infer causal paths that flow in just this one direction (i.e., from internal processes towards overt behaviour), there is likely to be some reciprocal determination, with distress, self-efficacy, adaptation and behaviour each influencing each other. The next wave of data collection in our ongoing program of research will present longitudinal findings that shed light on these critical interrelationships.

## COMPARISONS WITH OTHER SURVEY FINDINGS

While the numbers of 'climate change' surveys being reported worldwide may seem substantial, the reality with respect to in depth social science surveys is rather different, reflecting in part the very different kinds of surveys being undertaken. Appendix C provides a selective listing of Australian surveys which have included and reported at least several items relating to public perceptions and responses to climate change. The most frequently reported surveys are those from organisations such as Australian Newspoll and News.com.au, which are typically limited telephone surveys relating to a small number of newsworthy items, with few specifics provided concerning survey objectives, content, question framings, response format, or sample. There also exist a number of what are now annual national survey exercises in Australia undertaken by research organisations and commercial enterprises which have included some items on climate change embedded within surveys of more general scope and focus. These would include, for example, the ANUpoll, conducted in 2008, 2009, and 2010 with a national random sample of 1200 respondents, and including four climate change questions out of 47 items in their 2010 survey (Lamberts et al., 2010; McAllister, 2008, 2009). The frequently cited Lowy Institute Poll has been undertaken annually since 2007, with the 2010 survey (Hanson, 2010) including five climate change questions out of a total of 32 questions. Commercial polling companies such as the *Social Research Institute* of Ipsos-Eureka have been running annual climate change focused on-line surveys in Australia since 2007, with the Institute's 2010 survey consisting of 22 exclusively climate change-focused items. Similarly, the company *Thermometer Surveys* provides an updated and climate change-focused 'Thermometer Survey Report' to organisational clients, but without using standardised items or conventional research reporting transparency (Thermometer Survey, 2008). The Australian Bureau of Statistics (ABS) has undertaken several 'Environmental Views and Behaviour' surveys which included some climate change items, as do their periodic 'Environmental Issues' surveys, but with very few climate change-specific items (ABS, 2008). The more substantive and research institution-based climate change surveys have been undertaken by CSIRO, Griffith University (NCCARF), University of Queensland (Global Change Institute), and ANU (ANUpoll). (See Appendix C).

There have been a number of published overviews of social science-based surveys examining public perceptions, attitudes, knowledge, beliefs, understandings, and psychological and behavioural responses to the threat and phenomenon of climate change - and associated policy and political preference considerations. These include a particular history of work relating to public knowledge and understanding of climate change (e.g., Bostrom, Morgan, Fischhoff, & Read, 1994, Bostrom et al.,2012; Read Bostrom, Morgan, Fischhoff, & Smuts, 1994; Reynolds et al., 2010), and more generic reviews of climate change survey research with a broader issue and socio-political focus (e.g., Bord, Fisher, & O'Connor, 1998; Brechin, 2003, 2010; Brulle et al., 2012; Nisbet & Myers, 2007). A very good and insightful review of more qualitative 'survey' research studies examining public risk perceptions and understandings of climate change is that of Wolf and Moser (2011) with this review including several Australian studies. The general conclusions of these generic

overviews relevant to constructs and variables discussed in the context of this report are the following:

- There have been very few authoritative summaries of substantive national social science-based survey work addressing public perceptions and responses to climate change, and their findings and trends, other than those cited here.
- Since 1986 when only 39% of the American public reported having "heard or read anything about the greenhouse effect" public awareness of the phenomenon, threat, and issue has increased dramatically in North America, Europe, and the industrialised world. In 2006 this awareness measure had jumped to 91% in the United States (Pew) (Nisbet & Myers, 2007). Available evidence would suggest that the Australian context is, in many respects, very similar to that in North America and the UK.
- Similarly, public knowledge of the phenomenon and underlying popular science explanation of climate change has grown modestly, though issues relating to what is being measured and how continue, with most surveys employing self report measures of extent of knowledge. Nisbet and Myers, for example, report that 40% of respondents to a Gallup sample in 1992 reported understanding the issue 'very well' or 'fairly well', with this steadily increasing to 76% in 2007. More recent research using objective measures of climate change knowledge suggests that a correct public understanding of current scientific accounts of climate change is relatively modest (Nisbet & Myers, 2007). Brechin, in his 2010 review, concurs that the studies he examined suggested that public understanding of climate change had gradually increased over the past decade, though many remain relatively uninformed.
- With respect to belief or acceptance of the reality of contemporary climate change, figures in North America from as early as 1992 were suggesting that 68% of Americans accepted that global climate change was taking place. Across four ABC News surveys undertaken in 1997, 1998, 2006, and 2007 acceptance figures for the reality of global warming/climate change were 76%, 80%, 85%, and 84% respectively (Nisbet & Myers, 2007).
- In the 2010 review by Brechin specific consideration was given to survey research findings relating to anthropogenic causes of climate change. A very noteworthy international survey (BBC World Service, 2007) finding here was that across the 21 countries surveyed, in response to the question of whether or not human activity was a 'significant' or 'not a significant' cause of climate change, the overall averages were slightly over 75%, i.e., three quarters of these global respondents in 2007 agreed that human beings were playing an important contributing role in climate change.
- With respect to climate change concern, prevailing measures have covered a spectrum of approaches. In the Nisbet and Myers review, consideration was given to assessments of the perceived 'personal importance' of climate change and 'how dangerous' global warming/climate change was. Across the 14 year period examined by Nisbet and Myers, 'extremely' and 'very' importance ratings went from 27% in 1997 to 42% in 2007, and 'extremely' and very' dangerous ratings basically remained level, going from 41% in 1993 to 43% in 2007 (Nisbet & Myers, 2007). Brulle et al. (2012) have a strong focus on the determinants of public concern about climate

change in their major review. They note for example, that in Gallup polls in 2004 in the United States, 26% of respondents reported that they worried 'a great deal' about climate change, by 2004 this percentage of respondents had grown to 41%, but by 2010 this proportion had fallen to 28%, with such observations reflecting a repeated reporting of fluctuating levels of climate change acceptance, causal attributions, and concern by some researchers.

- Brulle et al. (2012) present an intriguing case for the overwhelming importance of political mobilization by elites and advocacy groups in influencing public climate change concern levels and fluctuations, as compared with other well-researched determinants of public concern, namely, extreme weather events, public access to accurate scientific information, and media coverage, with their analysis of 74 surveys over a 9-year period, but based on a very different method of aggregate opinion measures.

Space has allowed for only a brief characterisation of the findings of these reviews in the context of this present report, but this larger picture is arguably quite important when interpreting the Australian and UK findings reported here. It is worth noting that reference to Australia in these largely North American and intermittently global studies is understandably limited, but where such reference is found, it is clear that acceptance, concern, and pessimism levels are high and have remained so. Several final comments by Brechin are salutary:

> What conceptual frameworks best capture the place of global climate change in the hearts and minds of individuals across the globe? Can universal frameworks be found or developed? Or will we find that frameworks are too context specific, that local social, political and cultural experiences are too dominant to be universal? . . . Would we find similar or very different results in other countries? If different, what does that say about individualised factors affecting support for public policy? In short, how local or global can our efforts be in understanding the public's role in shaping the response to climate change? (Brechin, 2010, p. 204)

In addition to these reviews of survey research mentioned, the work of a number of other research teams and centres must be acknowledged, with this work continually informing our own. The Research Centres are the Yale Project on Climate Change Communication at Yale University, the Woods Institute for the Environment at Stanford University, and the Understanding Risk Research Centre at Cardiff University, Wales, and the principal respective lead researchers at each are, Professor Anthony Leiserowitz, Professor Jon Krosnick, and Professor Nick Pidgeon.

Of particular relevance to the current report is a recent summary and overview of principally Australian survey research findings undertaken in 2011. CSIRO researchers undertook a requested review for the Garnaut Climate Change Review team of recent studies (January 2008 to March 2012) examining public views of climate change, beliefs about the role of human activities in producing climate change, and support for various policy responses to climate change (Leviston et al., 2011). The mandated focus included:

- the extent of community views in Australia that climate change is happening,
- whether it is attributable to human activity or is a natural variation,
- whether community views of climate change have altered in recent years,
- differences between sectors of the community (e.g., rural vs. urban) in views about climate change,
- comparability of views in Australia with views in the UK and the USA.

(Leviston et al., 2011, p. 1).

Seventeen of these studies were Australian studies, with nine being from academic and research institutions, and eight constituting national polls and contract research by government agencies, and including one not-for-profit organisation. Five of these studies were from research and academic institutions, and polling and contract research organizations, in the UK, New Zealand and the United States. The stated summary conclusions from the 17 Australian studies examined were the following (Leviston et al., 2011):

- Most Australians believe the climate is changing, but fewer believe that the change is attributable to human activity.
- Belief in climate change and its anthropogenic drivers has waned in recent years, reflecting trends in other countries.
- Responses to questions about climate change vary systematically with question wording and response formatting, but these differences do not negate the overall conclusions above.
- Beliefs about climate change are strongly related to political preferences, voting behaviours and gender, but no clear relationships between these beliefs and location, age or income have emerged.
- Most Australians believe that Australia should take action on climate change without waiting for global consensus.
- There is no clear consensus on what policy actions Australians prefer, such as setting a carbon price or establishing an emissions trading scheme.

This overview of Australian survey findings and selective comparisons with overseas studies has particular salience to the current survey findings in that the Griffith survey and that of our collaborators at Cardiff University were included as two of the studies in this review, which themselves constituted a cross-national study with many identical items. The review is also particularly relevant to the current report and discussions as the above mandate seemingly also separates the issues of acceptance of contemporary climate change from the integrally related matter of an anthropogenic causal contribution. Importantly, this review is very nonspecific in its discussion of these research studies and their respective objectives, contexts, associated parameters, and ultimate findings. Hence, few conclusions about Australian public risk perceptions and responses to climate change can really be drawn. As well, the nonstandardisation and ultimate noncomparability of many procedures, survey item framings, and response options made such a review and overall comparisons challenging

(e.g., Li, 2010). Certainly there does not appear to be a comprehensive, detailed, or in-depth review of Australian survey research findings addressing public risk perceptions and responses to climate change similar to the international reviews reported above. Our own research findings, and our reading of the social science-based survey research literature on climate change, do not accord with the initial summary conclusions of the CSIRO review referred to.

These international and Australian survey findings overall provide a valuable but arguably fragmented and disparate set of findings, and there remain serious challenges to meaningful comparisons as sample selection, mode of presentation, question framings, response formats and options, and survey contexts tend to differ markedly across institutions and organizations. As well, the purpose of the majority of these surveys has been primarily a reporting of 'public opinion' rather than investigating public understandings, risk perceptions, or psychosocial responses or impacts over time. An additional shortcoming, reflecting the nature and purpose of these surveys, is that they rarely include substantive psychometric scales or measures of dispositional or experience-based individual differences. As well, there has not emerged a more standardised convention or agreement for measuring, interpreting, and reporting survey research and findings, and *interpretations* of similar findings can and do vary substantially. The current status quo in Australia is that there does not exist a reference data base or programmatic research and monitoring framework or institution addressing changing public risk perceptions, understandings, and psychological responses and adaptations, relating to climate change, or the associated psychosocial impacts of the threat and unfolding physical environmental impacts of climate change. Such strategic research could document and explore how these changes in public risk perceptions and understandings might be reflecting, and/or themselves mediating, psychological, social, and societal adaptation.

## DISCUSSION

The research reported in this monograph reflects a major project and milestone. This has involved not only a comprehensive national survey undertaken in mid 2010 addressing public risk perceptions, understandings and responses to climate change and natural disasters, involving 3096 respondents, but the development and establishment of a research platform, standardised measures and indicators, and a national data base for monitoring and addressing important human dimensions changes over time. The online survey itself involved 81 numbered questions, with these involving 198 separate items, and with 147 of these comprising psychometric rating scales. A number of these rating scales constituted components of selected psychological measures relating to objective knowledge, risk perception, environmental concern, connection to the natural environment, climate change self-efficacy, climate change distress, and psychological adaptation to climate change, for example. The survey is arguably one of if not the most comprehensive national survey which has been undertaken addressing public perceptions and responses to climate change. A subsequent and selectively modified national survey of similar length undertaken in mid 2011, involving 4347 new respondents and 1037 repeat respondents, provides the first iteration of this national monitoring research program, and longitudinal data for 1037 repeat respondents (Reser et al., 2012c).

In the discussion which follows we have addressed a number of interrelated topics, issues, and findings which benefit from further discussion than that provided in the preceding reporting of results. We have nonetheless attempted, throughout the report, to provide some commentary, and where possible comparative findings, in the context of reporting our specific survey findings. This presentation and reporting format addresses a serious limitation in almost all available substantial survey research reports and articles addressing public risk perceptions and responses to climate change. The discussion section reflects a modest selection of topics and considerations given the scope of this research exercise and the extensive data set which exists from our two national survey undertakings. An important objective has been to communicate the importance of such psychology and social science-based climate change research, and the nature, relevance, and crucial mediating roles of a number of neglected psychological processes and variables. A further aim has been to address a number of underlying conceptual, methodological and cross-disciplinary issues which continue to frustrate critical interdisciplinary and transdisciplinary collaboration (National Research Council, 2010c; Nelson, West & Finan, 2009; Stokols, Hall, Taylor, & Moser, 2008). The discussion topics selected also allow for modest reference to our rich qualitative research findings, which complement the very substantial quantitative methodology conventionally employed in such national surveys, and which together begin to address and explicate public understandings of climate change in Australia.

### 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. But acceptance or 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 'coming to terms' with what is not only 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; 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 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; . 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 such sources, or media representations about this changed and changing condition of atmospheric global weather systems. For most the critical matter and issue is not with respect to the assertion and belief that climate changes, but whether the phenomenon of contemporary climate change is in part the product of human activities and anthropogenic greenhouse gas emissions. But beliefs, in the context of climate change, are 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.

The social science and national survey-based research findings for Australia for acceptance of climate change have been extraordinarily consistent. Refer to Table 16.

*Table 16*. Australian research findings and acceptance of climate change

| Survey findings | Date | Accept/believe | Don't know/unsure | Do not accept |
|---|---|---|---|---|
| Leviston and Walker (CSIRO) | July/Aug, 2010 | 82% | No option | 17% |
| Reser et al. (Griffith University) | June/July 2010 | 74% | 8% | 18% |
| Ashworth et al. (CSIRO) | Oct 2010 | 78% | 15% | 7% |
| Leviston and Walker (CSIRO) | July 2011 | 77% | No option | 23% |
| Reser et al. | July/Aug 2011 | 74% | 8% | 18% |
| **Commercial survey findings** | | | | |
| Newspoll | Feb 2010 | 73% | 5% | 22% |
| Newspoll | Dec 2010 | 77% | 5% | 18% |
| Newspoll | April/May 2011 | 78% | 6% | 16% |

It is important to note that where 'don't know' or 'unsure' response options were available, these figures were relatively high (Reser et al., 2010 survey, DK 8%, Ashworth et al, 2010 survey, DK 15%). Additionally, dichotomous yes/no response options were effectively requiring respondents who were genuinely unsure of their position to choose a response which did not accurately reflect their actual view. While such forced choice response formats are common, and can be very useful, they may be particularly problematic when examining public understandings of a complex and contested matter such as climate change and are not ideal or very sensitive when measuring important but nuanced changes in views and understandings over time (e.g., Bruine de Bruin, 2011; Krosnick & Presser, 2010). This picture from Australia is not very different from that for North America.

> Public opinion about global warming, it turns out, has been remarkably stable for the better part of two decades, despite the recent decline in expressed public confidence in climate science. Roughly two thirds of Americans have consistently told pollsters that global warming is occurring. By about the same majority, most Americans agree that global warming is at least in part human-caused, with this majority equally divided between those believing that global warming is entirely caused by humans and those who believe it to be a combination of human and natural causes. And about the same two thirds majority has consistently supported government action to reduce greenhouse gas emissions since 1989 (Norhaus & Shellenberger, 2009, p. 1).
>
> Despite recent news reports questioning the credibility of climate science, the vast majority of Americans continue to trust the scientists who say that global warming is real, according to new Stanford University study. "In recent months, we have seen a spate of news stories suggesting that the American public is cooling on global warming – that fewer people now believe that the planet has been heating up than they did a year ago", said Jon Krosnick, a professor of communication and of political science at Stanford. "But our work shows that the percentage of Americans who believe in the existence of global warming has only dipped 5 points, from 80% in

> 2008 to 75% in 2009, and that public confidence in climate scientists has remained constant over the past few years… It's really important to recognize that 75 percent is a huge majority of Americans, and 5 percent of Americans shifting is a pretty small movement." (Shwartz, 2010).

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 this significantly different and profoundly consequential 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 organizations (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" (31). The cogent argument for this, however, has very little to do with, and indeed effectively ignores, the social meaning and currency of 'climate change' in everyday language and media coverage, and indeed the specification of climate change in the 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 understanding uncertainties, and some respondents might well be somewhat 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., Max et al., 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 such 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, we would argue strongly that these are an artefact of both question framing and

response option provision, as illustrated in Appendix N, 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; Jordan, 2012; Krosnick, Villar, & MacInnis, 2011; Krosnick & MacInnis, 2011; Romm, 2011; Shwartz, 2010; Villar et al., 2011). See Figure 38.

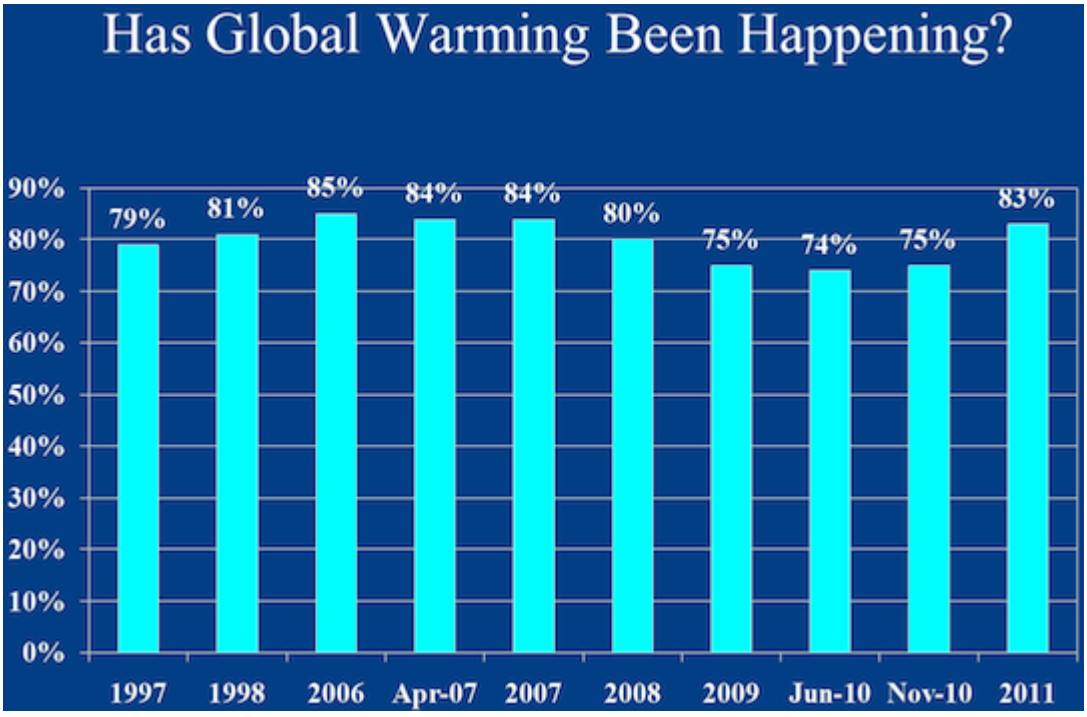


*Figure 38.* Survey of Americans who believe in global warming. (Romm, 2011).

## 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 so easy as what is being referred to in any particular situation or conversation is actually quite complex and fluid, and often simply very 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 in large part 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, as a matter of serious scientific concern with this being seen by the public.

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 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 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, 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 et al., 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, Greene, Fisher, & Baum, 2001; Cuthbertson & Nigg, 1987; Cutter, 1993). This complexity does not relate 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 an

event and set 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. 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 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; 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, 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 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 et al., 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' (e.g., Pidgeon et al., 2003) 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 this apparent temporary decrease in public concern 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; Spence, Pidgeon et al., 2010).

A comparison of broader public perceptions, understandings, and responses to the threat of climate change between Britain and Australia is of particular interest as climate change concern was thought to be on the wane in Britain according to recent survey findings (e.g., Spence et al., 2010), accompanied by an increasing element of climate change scepticism. Climate change concern in Australia on the other hand had arguably become stronger, attributed, in part, to the nature and intensity and human costs of recent extreme weather and natural disaster events in Australia (drought, bushfires, cyclones, floods) over the past few years (e.g., Hanson, 2009; Morrissey & Reser, 2007; Spratt & Sutton, 2008). These considerations invite an expectation that the level of climate change concern in Australia would be quite high and much higher than might be the case in Britain. Indeed in Australia climate change appears to have become a much more evident attribution and explanation for many physical and social environmental changes taking place, and is an ubiquitous part of everyday conversation with respect to everything from the weather, to politics, to the economy, to rural and remote mental health (e.g., Reser, 2010; Reser & Morrissey, 2008).

The 2010 survey findings presented here would indicate that levels of climate change concern are in fact surprisingly similar in Britain and Australia, and arguably quite high. A number of convergent explanations for these findings exist. The explanation for very high concern levels in Australia is quite reasonably related to the extreme disaster events and visually dramatic changes taking place to the landscape in various parts of Australia, along with the saliency of recent urban water shortages, and a continent-wide and decade-long drought which has decimated major river systems and agricultural and pastoral regions. This situation has, of course, been completely altered with the wide-ranging La Niña flood events of 2010-2011, and the dramatic floods and cyclone events of January and February, 2012 (Bureau of Meteorology & CSIRO, 2012). The explanation for comparably high levels of concern in Britain is less clear, although several lines of argument and evidence might be advanced. Media coverage of the climate change phenomenon and threat in Britain, as in much of Europe and North America, has been constant, often dramatic, and with the content, images, and representations being largely global, distant in space and time, and with less reference to local environmental changes, events, or impacts (Butler & Pidgeon, 2009; Hulme, 2009; Pidgeon, 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, Poortinga, & Pidgeon, 2011b: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 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, irrespective 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.

While levels of concern reported by UK respondents are surprisingly similar to those expressed by Australian respondents, it is equally clear that Australian respondents perceived the threat and impacts of climate change as more immediate and closer to home. There was significantly less agreement by Australian respondents that "**Climate change will mostly affect areas that are far away from here**" and significantly more agreement with the statement that "My local area is likely to be affected by climate change". In addition, Australian respondents reported less agreement with the statement that, **"Climate change will mostly affect developing countries**" and more agreement with the statement that "**Climate change is likely to have a big impact on people like me**". This immediacy of the

perceived threat and impacts of global climate change in the context of dramatic acute and chronic natural disaster events, and a visibly changing landscape in many parts of Australia, is not surprising. However, the juxtaposition of very similar and often almost identical climate change concern levels in British and Australian respondents in the context of very different perceptions of the immediacy and local and personal relevance of the threat of climate change is again striking. It must be acknowledged, though, that more recently published research from Britain (e.g., Spence et al., 2011a), and extreme weather events in Britain since our respective early and mid 2010 data collections, including the current drought in the South and Southwest of Britain (Plester, 2012; Vaughn, 2012), would suggest that direct experience with these events, and a strengthening perception that such events and changes might well be linked to climate change (Spence et al., 2011a), is changing the nature of underlying public understandings and the risk domain of climate change for residents of Britain, as would appear to be the case in Australia. It is also likely that more recent media coverage of climate change in Britain, including that in regional newspapers is changing local narratives and understandings (e.g., Brown, Budd, Bell, & Rendell, 2011).

An important aspect of the survey findings which begin to tell us something about local area, and risk proximity, exposure, and vulnerability relates to natural disaster and extreme weather event findings, 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. 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.

The most recent national survey data from the Yale Project on Climate Change Communication (Leiserowitz, Maibach, Roser-Renouf, Smith & Hmielowski, 2012) 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%).

## 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 number of the above reasons, research in this area has tended to restrict itself to addressing and measuring self-reported, and less frequently, objectively determined, 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 indicators for documenting changes in these public risk perceptions, understandings, and psychological responses over time, arguably matters integral to psychological and behavioural adaptation.

While this has been one of the few national studies to address and measure objective 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 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, which in turn are integral to psychological adaptation.

## CLIMATE CHANGE, EXTREME WEATHER EVENTS, AND DISASTERS

> "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)

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 (Reyes & Jacobs, 2006). To what extent can this body of knowledge and best practice be generalised? The more salient and observable manifestations of global climate change are in terms of extreme weather events and natural disasters. Given the global 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 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, yet there has been considerable 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. From a psychological perspective, these findings suggest that climate change adaptation approaches would be well served by more serious consideration of evidence-based psychological applications and insights routinely used in the disaster preparedness and response context as well as in health psychology, such as psychological preparedness, anticipatory coping, the fostering of resilience, and psychological adaptation (e.g., Folkman, 2011: Reser & Morrissey, 2008).

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., 2011). 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 et al., 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 psycho*logical* 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 et al., 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).

## PSYCHOLOGICAL IMPACTS, DISTRESS, AND HEALTH AND WELL BEING

The current research has prioritized the central importance but research gap which exists with respect to the psychological and social impacts of the threat of climate change (Doherty & Clayton, 2011; Morrissey & Reser, 2007; Reser et al., 2011; Reser et al., 2012a). This in turn has reflected a larger and related concern with respect to important changes that are likely taking place in the human environment and landscape with respect to the threat and possibly the unfolding physical environmental impacts of climate change. Such a framing of these matters brings both the social representation and risk communication of this environmental problem and *threat* into clearer view, and also acknowledges the fundamental person-environment interdependencies and reciprocal influences that characterise a more environmental psychological approach to questions relating to perceptions and responses to an environmental phenomenon, threat, and stressor such as climate change (e.g., Gifford, Kormos, & McIntyre, 2011; Stokols et al., 2009; Wapner, Demick, Yanamoto, & Minami, 2000). Clearly there were many candidate variables which might have been examined as sensitive 'indicators' of impacts and/or changes (such as trust, pessimism, perceived control) but those which were selected appeared to resonate best with emerging academic and climate change science salience and interest, as well as health and well being implications. These included risk perception, acceptance/belief, climate change concern, experienced psychological distress, psychological adaptation, and pro-environmental behavioural engagement. Each of these parameters was seen to be linked in particular ways with other possible impacts and associated psychological changes and states, to be readily accessible and meaningful to survey participants, and to be both sensitive to and informative of important changes which might be taking place in the context of climate change, with corresponding adaptation, policy and health implications.

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-focused 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.

One of the strongest and most important findings of the present research is 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 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 SEM analyses and other findings 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 national survey research has specifically addressed these matters, and this data is currently being analysed (Reser et al., 2012c). 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 et al., 2010; 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).

## 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.

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 may be 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 such 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. These findings validate the overall approach we have taken and the value of incorporating these core variables and appropriate measures in a national survey exercise such as that which we

have undertaken, so that we can go beyond descriptive statistics and nominal data, in the documentation of more complex interrelationships, and dynamic adaptation changes, and impacts.

## INTERSECTING CONSIDERATIONS

Clarity emerges and seeming inconsistencies tend to dramatically reduce when convergent and related survey questions and responses are considered together. Responses to an initial and arguably uninfluenced survey question about how concerned respondents were about climate change, with no qualification about where or when, has 66.3% of respondents reporting being very concerned (26.2%) or fairly concerned (40.1%), with 88% reporting some level of concern. When examining responses to the question of "**How serious a problem do you think it will be for Australia, and for the world, if nothing is done to reduce climate change?**", 77.9% and 81.8% of respondents respectively agree that this would be very serious (40%, 49.4%) or somewhat serious (37.9%, 32.4%). The picture that emerges is that respondent concern about the threat of climate change is very high and consistent, and the initial figure of two thirds reporting high to moderate concern is really much closer to 80% when the national and global picture comes into view. The survey included 12 items or questions directly relating to concern about climate change, along with closely related measures of climate change risk perception, general environmental concern, and climate change distress.

The survey design and content was similar for the intertwined matters of 'belief' and certainty with respect to climate change. While responses to the initial question "**Do you personally think the world's climate is changing**?" were 74% yes, and 18% no, with 8% reporting not knowing, 81.4% of respondents either strongly agreed (30.8%) or tended to agree (40.6%) with the strong statement "**I am certain that climate change is really happening**" with only 4.7% 'strongly disagreeing'. When to this we add the fact that 54% of respondents believed that "we are already feeling the effects", 75.2% expected this to be the case in the next 50 years, and 77.8% expected this to be the case in the next 100 years, it becomes clear that acceptance and concern about climate change in Australia are unambiguously very high. It is noteworthy that 12.9% of respondents to the above question indicated that they just 'did not know' while 5.5% ticked 'never', again validating data interpretations and conclusions relating to felt knowledge levels and uncertainty and genuine scepticism and/or disbelief.

Hence what emerges is that multiple and convergent items do provide a much clearer and consistent picture of survey respondent views, and address the inevitable contextual bias of particular question framings and response formats. To the extent that such items are standardised across other genuine research undertakings and reflect established sensitivity and validity, meaningful comparisons with other national and international research findings can be made, again leading to a more convergent and coherent global picture. Those surveys in which climate change questions and items are relatively few, often ambiguous and complex, and being asked in very different contexts, cannot provide a very clear or credible

picture of public risk perceptions, understandings, or responses - or meaningful changes over time.

## PERSISTENT AND CONSEQUENTIAL ISSUES

### QUESTION AND RESPONSE FRAMING

In the context of survey research such as that presented here it is not surprising that question and response framing presented as an important issue (e.g., de Vaus, 2002; Fink, 2003). In many ways nothing is quite as determining as how you ask a question, and what response options are provided (e.g., Schwarz, 1999; Tourangeau et al., 2000). In addition to the matter of survey questions, the larger issue of global climate change is of course subject to myriad 'framings' by media organisations and vested interests (e.g., Dirikx & Gelders, 2010; Morton, Rabinovich, Marshall, & Bretschneider, 2011). Hence it is important to make a few statements about the framing of the survey as a whole as well as its items. Respondents were clearly told in the survey title and in a front page that the research was about "Public understandings, risk perceptions, and responses to climate change and natural disasters". The research was identified with Griffith and Cardiff Universities, and survey panel participants were further told that the aim of the survey was

> … to more fully appreciate how Australian and UK residents think and feel about the threat and possible impacts of climate change and the threat and impacts of natural disasters in their respective countries. The survey questions also ask about how changes taking place in our world today may influence how you see and understand such matters as energy challenges for the future and the importance of other environmental concerns. (Griffith Survey information sheet fronting on-line survey instrument).

Once respondents were embarked on the on-line survey, the more salient framing was carried by the specific questions and items. The survey commenced with an energy futures focus, then moved on to matters more immediately pertinent to climate change and natural disasters, and a spectrum of situational and psychological considerations.

Framing issues that became particularly apparent in the context of our data analyses and reporting of comparative findings were relatively few. In the context of the collaborative partnership with Cardiff, shared items were in almost all instances virtually identical in question framing and response formats. Similarly the selection of items from other researchers was done in such a way as to standardise questions and items where possible, again reducing the problem of differing framings leading to differing findings and interpretations. But the most important and evident 'framing' issue encountered was that with respect to differing response options, and particularly in the case of acceptance of the reality of human-forced climate change. As discussed in the context of scepticism and causal attributions, restricting the range of options to essentially two dichotomous and absolute alternatives with respect to human causation of climate change, i.e., completely human caused or completely naturally caused, does not allow for those options that the majority of respondents would endorse, and hence can distort both the findings and their interpretation.

## PRIOR, DIRECT, AND VIRTUAL AND VICARIOUS EXPOSURE AND EXPERIENCE

The research undertaken, the issues encountered, and the findings themselves would suggest that there are a number of considerations at play which require serious attention when examining public risk perceptions, understandings and responses to 'climate change'. The focus of the research underscored the importance of the threat of climate change from the inception of the project, as the objective physical environmental changes and impacts of climate change are only now becoming more discernable in terms of noteworthy changes and events in one's local environment for many regions of the world, and perhaps most particularly in highly urbanised communities. So there is the clear conceptual distinction between the threat and the unfolding environmental manifestations and impacts, though both are referenced and evoked in casual discussions of 'climate change' or more specific considerations of implications or projected consequences. Yet the nature of climate change as ongoing environmental stressor would seem to encompass both the threat and risk as well as the ensuing reality.

A further and related consideration is that the more common and indeed ubiquitous encounters with 'climate change' for most individuals are indirect, virtual, and/or vicarious, typically through media coverage, popular culture films and documentaries, and arresting images. This is a very 'real' exposure and experience, either with the threat or the coverage of an actual climate change-related event, but do such encounters articulate with conventional notions of direct exposure and experience? The very status of climate change as a threat and risk domain underscores the importance of such considerations, particularly as this media exposure, and associated psychological impacts such as concern, distress, and protection motivation, are very real and consequential impacts of climate change which directly implicate climate change adaptation and behavioural engagement. All of this, of course, also suggests that the psychological and social impacts of climate change are not simply projections of what may happen, but dynamic phenomena that are currently taking place and which constitute powerful determinants of adaptation and mitigation as more conventionally considered. The importance of the 'information environment' in the context of climate change is only beginning to be appreciated.

One of the most interesting findings of the present research is that direct experience with what is perceived to be a possible climate change impact or event appears to powerfully change the salience and importance of many other variables and their interrelationships. Such encounters would appear to be much more influential than direct experience with dramatic extreme weather events, though if these are seen as manifestations of climate change they too seem to be charged with particular significance and implications. That 45% of Australian respondents report having had such experiences is quite impressive, though this finding is actually not so different from survey respondent percentages in the United States (Leiserowitz et al., 2011a). Why is it that such encounters are so powerful and, seemingly, life changing in terms of perceptions, understandings, motivations and behavioural engagement? Do such encounters and experiences make the global phenomenon and threat more personal, more local, more graspable, more significant? Does having such an experience make one's past indirect and virtual encounters more real, more persuasive, more

impactful? An alternative and cogent explanation is of course that believing is seeing, that is, if one already accepts, is concerned about, and on the lookout for evidence of climate change, one is more likely to 'encounter' it. While our current findings cannot resolve this issue, there is little question but that such perceived and experienced encounters with environmental events or conditions or changes which one perceives as being associated with climate change are very powerful, and indeed much more significant in many ways than dramatic direct experience with extreme weather events not deemed to be associated with climate change.

## INTERDISCIPLINARY LITERACY AND COLLABORATION

While there is little argument that the contribution of psychology, and social science generally, to effective climate change policies is crucial (e.g., APA, 2009; Gifford, 2011; Gifford et al., 2011; Hulme, 2009; Lever-Tracy, 2010; National Research Council, 1992; 2010a, 2010b; Swim et al., 2011; Weber & Stern, 2011), a number of interlaced problems continue to frustrate the utilization of highly relevant bodies of work and multi- and interdisciplinary collaborations. Two of the most important would appear to be those of language and meaning issues, and cross-disciplinary literacy. These problems are not new in the context of global environmental change research, but they have become particularly problematic in the contemporary climate change context as core constructs, processes, and terms from the natural and social sciences have been re-glossed and redefined by the IPCC and an associated and emergent culture of use and application in climate change science research. These constructs and processes include climate change 'adaptation', 'exposure', 'vulnerability', 'resilience', and 'impacts' and impacting processes, with these specification and conceptual clarity issues clouding more general considerations and discussions of such matters as risk perception and appraisal, exposure and prior experience, motivation and behavioural responses and changes, and psychological as distinct from environmental significance.

## HISTORY EFFECTS

A final consideration in this report is that of 'history factors' which might plausibly have influenced the survey findings. A number of global and national events and issues might arguably have influenced survey respondents over the course of the two respective national surveys reported here. These can usefully be divided into natural disaster and extreme weather events, local and global; and geopolitical events and issues, both national and international. Noteworthy extreme weather and natural disasters events across the world from January 2010 to mid 2010, at which point the Australian survey was undertaken, are summarised in Appendix F. A number of quite dramatic and extensively covered natural disasters occurred in the years immediately preceding this seven month period, which might also have had a residual effect on a survey addressing public perceptions and understandings of climate change. This is even more probable in the case of the Australian survey, which also addressed public perceptions and responses to natural disasters. As previously discussed, these global events included such events as the Asian tsunami (2004), Hurricane Katrina (2005), and the Pakistan earthquakes (2005, 2008), with global media coverage

reflecting constantly improving and more graphic and immediate information and communication technologies. A number of these global disasters and extreme weather events received widespread and very dramatic media coverage at the time, such as the Haiti and China earthquakes, the Columbia, Poland, and China floods, the Russia heatwaves and fires, the California bushfires, and severe flooding in India and Pakistan. At issue is whether noteworthy global events might have overly influenced both Australian and British survey responses, as well as whether differing country-specific events might plausibly account for any survey differences found.

Appendix G highlights those more immediate extreme weather events for Australia in the 18 month period preceding the Australian survey administration, though we should not dismiss the perceived salience of Asian-Pacific regional events. Clearly this was an eventful period, though not that unusual, in the broader Australian context. As well, a pervasive and continuing 'slow disaster' and chronic environmental stressor was that of a nation-wide Millennium drought, with many Australian cities facing extreme water shortages, and some states not being declared drought free until the latter part of 2010. Arguably the most noteworthy disaster during this period was the Victorian bushfires leading up to and following Black Saturday, with the extensive media coverage of this seemingly apocalyptic event making this a very salient national tragedy (e.g., APS, 2009; McGourty, 2009). Widespread severe flooding in Queensland and New South Wales during the same period, on the back of severe nation-wide drought, gave the impression of a country under siege by convergent natural disasters. Other Australian extreme weather events preceding this 18 month period would include increasingly severe bushfires, and the devastation of Cyclone Larry in North Queensland (2006). Interestingly, Great Britain was also encountering its share of extreme weather events both in the 18 month period leading up to, and during, the survey administration, experiencing severe flooding events over the preceding few years, an extreme winter in 2008/2009, and serious drought in the summers of 2009 and 2010.

What is particularly compelling about the present findings, and their many similarities, is that they suggest that these country-specific historical factors do not constitute plausible explanations for the differences found, given the far greater number of similarities in the findings. It is also worth noting that while the preceding 18 months had been 'eventful', no major disaster coincided with the actual survey period in Australia (i.e., winter is the relatively 'quiet' season). The question of whether global events and issues preceding and at the time of the respective survey administrations might have influenced the survey results remains, but the overall findings suggest that these high concern levels are more plausibly interpreted as robust and understandable findings reflecting more stable public perceptions, appraisals, and concerns.

At the same time, our research data suggests that 'local' extreme weather events and changing weather patterns can and do inform, influence, and 'localise' public risk perceptions and understandings of climate change. This nexus between 'climate change' and extreme weather events in the context of public perceptions, however, does not necessarily change general levels of concern about climate change, as the present data shows, but rather seems to concretise and localise this global phenomenon and risk domain in particular ways,

with clear implications for psychological preparedness and psychological adaptation (e.g., Morrissey & Reser, 2007; Reser & Morrissey, 2008). Ongoing analyses of the current data set, and in particular, extensive qualitative data collected, will hopefully illuminate this perceived interrelatedness between climate change and extreme weather/natural disaster events, and how these public understandings might inform better risk communication and public engagement policies and initiatives.

At the commencement of writing up our findings in September of 2010, immediately following our initial data analyses, the National Oceanic and Atmospheric Administration [NOAA] was reporting that "the planet had just come through the warmest decade, the warmest 12 months, the warmest six months, and the warmest April, May and June on record". To this date, nine nations had set their all time temperature record in 2010, with the drought, heat wave and widespread fires in Russia receiving extensive media coverage, along with the dramatic floods in Pakistan and China. While these global events might arguably have had a slight influence on a small proportion of late return Australian surveys, in reality the dramatic events characterising mid-2010 were post data collection for both countries.

In addition to extreme weather events and natural disasters, public perceptions and responses to the phenomenon and threat of climate change continued to be influenced by other global and national events, including technological disasters, such as the Gulf Oil Spill (2010), and the increasingly heated political debates, nationally and internationally, as the world moved toward the Copenhagen Summit (2009), and Australia and Britain toward decisive changes of government in 2010, with climate change policies and energy futures being very salient political issues and agendas. Clearly direct comparisons between Australia and Great Britain cannot be made with respect to whether political debates in one country were more heated or determining than in the other, and with this potentially influencing participant responses in a national survey such as the one being reported. On balance, this seems unlikely, notwithstanding clear inter-linkages between individual views on climate change and political party affiliation, particularly given the overall similarity of survey findings. Of course, the 'disappointment' of Copenhagen may have fueled the fears of some, whilst bolstering the scepticism of others. In either case the Copenhagen Summit and its outcomes may well have been an important attitude change catalyst.

## THE CURRENT RESEARCH PROGRAM

Following from our 2010 national survey, we completed the data collection for our second national survey in August 2011. Our 2010 survey involved a sample of 3096 respondents stratified geographically and demographically across Australia, and by notional exposure to climate change impacts and natural disaster threat. This survey ran from 6 June to 6 July, 2010, and was undertaken collaboratively with Cardiff University's Understanding Risk Centre national survey of Britain which was undertaken between 6 January and 26 March 2010. Our Australian survey included many additional items that were specific to Australian circumstances and included a number of multi-item, interval level measures of individual difference variables (such as psychological adaptation, psychological distress in the context of climate change, self-efficacy, nature and extent of prior disaster experience). This 2010 survey research was principally funded through the Department of Climate Change and Energy Efficiency (DCCEE) and the Disaster Management NARP of the National Climate Change Adaptation Research Facility (NCCARF).

While our 2011 survey was not collaboratively linked with any other survey, it included many identical items and measures from the 2010 survey and selected standardised items from very credible North American survey programs. The strong focus of the research on public risk perceptions, understandings, and responses to climate change and natural disasters remained in 2011, but the importance of our Griffith University longitudinal research monitoring program documenting psychological processes associated with psychological changes, adaptations, and impacts was also a crucial objective and priority in 2011. This meant that it was important to obtain as many same respondent completions as possible, while also surveying new/replacement respondents. The second phase of our national survey ran from 15 July to 8 August 2011, with the final sample including 1037 repeat 2010 respondents and 4347 new respondents, constituting a separate independent sample for 2011. The sampling framework was the same as in 2010 and the survey was administered through the same service provider, Qualtrics. These substantial respondent numbers allow for a sensitive within-subjects comparison of responses and change scores between 2010 and 2011 for 1037 repeat respondents, and a quite separate independent groups comparison of responses for the 3096 (2010) respondents and the 4347 new (2011) respondents. This longitudinal extension of the research utilising a 'within-subjects' design and methodology, and a separate repeated cross-sectional design and sample, allows for an objective documentation of change at an individual respondent level, and an independent groups comparison level. This also allows for a consideration of the specific roles of psychological adaptation factors and processes which are mediating behavioural adjustment and change (adaptive capacity) and which themselves constitute psychosocial impacts of the threat of climate change and natural disasters (e.g., Reser & Swim, 2011; Reser et al., 2012a).

## CONCLUDING NOTE

The extreme weather and natural disaster events of 2010 and 2011 in Australia have provided for a natural laboratory in the exploration of the roles of direct and indirect experience in the context of perceived climate change encounters for many respondents. This opportunity is exceptional in many respects as a very large database and geographically stratified and representative national sample relating to the present research is available for examining interrelationships between objective and subjective proximity and exposure to climate change and natural disaster threat, direct and indirect respondent experience of such events and impacts, and adaptation responses and processes as well as the psychosocial impacts of these extreme weather events. A further summary report of what will have been a two year research project will be finalised in 2012. A further extension of the survey research program, contingent on funding, will take place over the 24 month period from January 2013 to December 2014, with a possibility of this longitudinal research continuing over a longer period of time.

**Queries relating to this report and research program can be directed to Michelle Ellul m.ellul@griffith.edu.au or Joseph Reser j.reser@griffith.edu.au**

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## APPENDIX A: DEMOGRAPHIC CHARACTERISTICS OF BRITISH AND AUSTRALIAN RESPONDENTS

| | | UK (n=1822) % | AU (n=3096) % |
|---|---|---|---|
| **Gender** | Male | 48 | 47 |
| | Female | 52 | 53 |
| **Age** | 15-17 | 3 | 1 |
| | 18-24 | 12 | 7 |
| | 25-34 | 14 | 19 |
| | 34-44 | 18 | 20 |
| | 45-54 | 17 | 21 |
| | 55-64 | 14 | 20 |
| | 65-74 | 13 | 10 |
| | 75 and older | 9 | 2 |
| **Employment Status** | Working (full time) | 36 | 38 |
| | Working (part time) | 13 | 20 |
| | Unemployed | 8 | |
| | Unemployed – seeking work | | 3 |
| | Unemployed – not seeking work | | 1 |
| | Retired | 27 | 15 |
| | Looking after house/children | 7 | 8 |
| | Disabled | 3 | 4 |
| | Student | 7 | 6 |
| | Other | | 4 |
| **Level of education** | No formal qualifications | 18 | |
| | Year 10 or less | | 13 |
| | Year 11 | | 5 |
| | Year 12 | | 17 |
| | GCSE/O-level/CSE | 19 | |
| | Vocational qualification | 11 | |
| | A-level or equivalent | 18 | |
| | College Certificate or Diploma | | 21 |
| | Trade qualification/Apprenticeship | | 12 |
| | Bachelors degree or equivalent | 19 | 19 |
| | Postgraduate degree | 6 | 11 |
| | Still studying | 1 | |
| | Other | 8 | 1.2 |
| | Don’t know | | |

## APPENDIX B: AUSTRALIAN SAMPLE DISTRIBUTION ACROSS POPULATION CENTRES

**Australian Demographic Statistics, March 2010**

| Region | Population |
|---|---|
| New South Wales | 7,221,000 |
| Victoria | 5,529,400 |
| Queensland | 4,498,900 |
| South Australia | 1,640,700 |
| Western Australia | 2,286,100 |
| Tasmania | 507,100 |
| Northern Territory | 228,500 |
| Australian Capital Territory | 357,700 |
| **Australia** | **22,271,900** |

**Selected Population Centres**

| | Population | Sample # |
|---|---|---|
| **New South Wales** | | |
| Sydney | 4,399,722 | 319 |
| Albury | 53,507 | 45 |
| Port Macquarie | 42,900 | 100 |
| Ballina | 41,677 | 77 |
| Singleton | 23,458 | 51 |
| Bourke | 3,091 | 34 |
| **Total** | | **626** |
| | | |
| **Queensland** | | |
| Brisbane | 1,945,639 | 268 |
| Gold Coast | 497,848 | 280 |
| Sunshine Coast | 312,801 | 100 |
| Mackay | 167,666 | 10 |
| Townsville | 162,730 | 76 |
| Cairns | 142,001 | 85 |
| Toowoomba | 125,339 | 72 |
| Mount Isa | 21,570 | 16 |
| Longreach | 3,703 | 7 |
| Charleville | | 3 |
| **Total** | | **917** |
| | | |
| **Western Australia** | | |
| Perth | 1,602,559 | 315 |
| Bunbury | 63,202 | 36 |
| Geraldton | 35,361 | 5 |
| Albany | 34,667 | 14 |
| Broome | 15,386 | 7 |
| Laverton | 757 | 3 |
| **Total** | | **380** |

| | Population | Sample # |
|---|---|---|
| **Australian Capital Territory** | | |
| Canberra | 345,257 | 82 |
| | | |
| **Victoria** | | |
| Melbourne | 3,892,419 | 348 |
| Bendigo | 100,054 | 66 |
| Shepparton | 61,014 | 24 |
| Mildura | 49,280 | 23 |
| Morwell | 22,765 | 14 |
| Bright | 358 | 19 |
| **Total** | | **494** |
| | | |
| **South Australia** | | |
| Adelaide | 1,172,105 | 311 |
| Port Pirie | 26,023 | 6 |
| Ceduna | 3,731 | 2 |
| General state-wide | | 100 |
| **Total** | | **419** |
| | | |
| **Tasmania** | | |
| Hobart | 209,287 | 98 |
| Launceston | 65,222 | 36 |
| **Total** | | **134** |
| | | |
| **Northern Territory** | | |
| Darwin | 120,652 | 37 |
| Alice Springs | 27,481 | 9 |
| Katherine | 9,912 | 1 |
| **Total** | | **47** |

## APPENDIX C: AUSTRALIAN SURVEY RESEARCH ADDRESSING CLIMATE CHANGE

| Date data collected | Source | Survey | Sampling Method | N |
|---|---|---|---|---|
| Jul-Aug 2011 | **Griffith University** Reser, Bradley, Glendon, & Ellul (2012) | Second survey addressing Public risk perceptions, understandings and responses to climate change: | National online survey | 4347 |
| Jul-Aug 2011 | **CSIRO** Leviston, & Walker (2011) | Second annual survey of Australian attitudes to climate change: Interim report | National online survey | 5030 |
| Apr -May 2011 | **Newspoll. The Australian** | Climate change | National telephone survey | 1201 |
| Mar-Apr 2011 | **Lowy Institute Poll** Hanson (2010) | Australia and the world. Public opinion and foreign policy. | National opinion survey | 1002 |
| Feb-Apr 2011 | **University of Newcastle** Higginbotham, Connor, Baker, & Albrecht (2012) | Regional risk perceptions: Longitudinal study of climate change adaptation in coastal versus agricultural areas of the Hunter Valley, NSW | Telephone survey | 947 |
| 2010 | **Queensland University of Technology** Buys, Miller, & van Megen (2011). | Conceptualising climate change in rural Australia: Community perceptions, attitudes and (in) actions | Face-to-face interview | 23 |
| Dec 2010 | **Newspoll. The Australian** | Climate change | National telephone survey | 1200 |
| Oct 2010 | **CSIRO** Ashworth, Jeanneret, Gardner, & Shaw (2011). | Communication and climate change: What the Australian public thinks | Online national survey | 1602 |
| Oct 2010 | **Ipsos-Eureka Social Research Institute** Wise (2010). | Climate change report 2010 | National online survey | 1050 |
| Jun-Jul 2010 | **Griffith University** Reser, Pidgeon, Spence, Bradley, Glendon, & Ellul (2011) | Public risk perceptions, understandings and responses to climate change: Interim Report and Full Report | National online survey | 3096 |
| Apr-Jun 2010 | **The Climate Institute. Auspoll** | Climate of the Nation | Four- phase research program which included online survey questionnaires and focus groups. | 2000 |
| July-Aug 2010 | **CSIRO** Leviston, & Walker (2011). | Baseline survey of Australian attitudes to climate change: Preliminary report | National online survey | 5036 |
| Jun 2010 | **The Australian National University** ANUpoll. Lamberts, Grant, & Martin (2010). | Public opinion about science | National telephone survey | 1200 |
| Mar 2010 | **Lowy Institute Poll** Hanson (2010) | Australia and the world. Public opinion and foreign policy. | National opinion survey | 1001 |
| Feb 2010 | Lewandowsky (2011) | Pupular consensus: Climate change is set to continue | Convenience sample of pedestrians in a downtown mall in Perth, WA. | 200 |
| Feb 2010 | **Newspoll. The Australian** | Climate change | National telephone survey | 1200 |
| Dec 2009 | **Water in drylands collaborative research program (Widcorp)** | Understanding farmer knowledge and attitudes to climate change, climate variability, and greenhouse gas emissions | Multi-mode survey (Victorian farmers) | 1503 |
| Nov | **Sweeney Research/NCCARF** | Community attitudes to climate change | CATI and national online surveys | 3000 |

| | | | | |
|---|---|---|---|---|
| 2009 | | | | |
| Nov 2009 | **Australian Housing and Urban Research Institute (AHURI)** Fielding, Thompson, Winnifred, Warren (2010). | Environmental Sustainability: Understanding the attitudes and behaviour of Australian households | Brisbane n = 593,Melbourne n = 601 | 1194 |
| Oct 2009 | **The Australian National University** ANUpoll. McAllister (2009). | Public opinion towards rural & regional Australia | National telephone survey | 1200 |
| Oct 2009 | **Institute for Social Science Research, The University of Queensland** Hoegh-Guldberg, Head, Western, Fielding, & Laffan, (2010). | Political leaders and climate change | National online survey | 311 |
| Sep 2009 | **The United States Studies Centre, University of Sydney** Jackman (2009) | Australians, Americans and climate change | National telephone survey | 800 |
| Sep 2009 | **Mobium Group** | Living LOHAS3 Report | National survey and qualitative in-depth discussions | 2012 |
| Aug 2009 | **Ipsos-Eureka Social Research Institute** Wise (2009) | Climate change report 2009 | National online survey | 1048 |
| Jul 2009 | **The Department of Environment, Climate Change and Water NSW** | Who cares about the environment in 2009? | NSW-telephone survey plus focus groups. | 2003 |
| Sep -Dec 2008 | **Carbon Down** Elborough, & Zosel (2009) | Victorian businesses climate change knowledge, attitudes and behaviors | 13 Focus Groups, and CATI | 1012 |
| Oct-Dec 2008 | **Institute for Social Science Research, The University of Queensland** Fielding (2009). | Youth and the environment survey. A report on the environmental attitudes, knowledge and practices of 12 to 24 year old Queenslanders | Online survey - Queensland | 4540 |
| Oct 2008 | **The Australian National University** ANUpoll. McAllister (2008). | Public opinion towards the environment | National telephone survey | 1000 |
| Sept 2008 | **Murdoch University** Genovese (Honours project completed in May 2009) | Attitudes towards government policies to address climate change | Questionnaire – Perth | 286 |
| Aug-Sep 2008 | **Thermometer Survey** (2008) | Our community's response to climate change | National online survey questionnaire and qualitative in-depth group discussion | 1606 |
| Mar 2008 | **CSIRO** Ashworth, Quezada, van Kasteren,Boughen, Paxton, Carr-Cornish, & Booth (2009). | Perceptions of low emission technologies: Results from a Brisbane large group workshop | Workshop | 60 |
| Mar2007 -2008 | **The Climate Institute. Auspoll** (2008) | Climate of the nation. Australians' attitudes towards climate change and its solutions | Four- phase research program which included online survey questionnaires and focus groups. | 1005 |
| Jul 2008 Jun 2007 | **Australian Bureau of Statistics** (2008) | Environmental views and behaviour survey | National telephone survey | 13,527 |

## APPENDIX D: SELECTED UK SURVEYS ADDRESSING CLIMATE CHANGE

| Date | Source | Survey | Method | N |
|---|---|---|---|---|
| **May 2010** | **YouGov/EDF** | Energy survey results | | 4262 |
| **Feb 2010** | **Populus** | BBC climate change poll | National telephone survey | 1001 |
| **Jan-Mar 2010** | **Cardiff University** Understanding Risk Group Working Paper | Public perceptions of climate change and energy futures in Britain | National survey, face-to-face interviews | 1822 |
| **Mar 2010** | **Department for Environment Food and Rural Affairs** | 2010 Omnibus survey on public attitudes and behaviours towards the environment | National survey, face-to-face interviews | 1700 |
| **2009 (Previous surveys from 1986–2007)** | **Department for Environment Food and Rural Affairs.** | 2009 Survey of public attitudes and behaviours towards the environment | Face-to-face interviews | 2009 1772 |
| **Sep-Oct 2009** | **BBC Cymru Wales**. Beaufort Research | Green Wales report | Telephone survey Discussion groups | 1004 Six discussion groups |
| **2008 2007 2006** | **U.K. Department of Transport** | Public attitudes towards climate change and the impact of transport | Face-to-face interviews | 2008 (n=1102) 2008 (n=1095) 2007 (n=1083) 2006 (n=1238) |
| **May 2008** | **Ipsos Mori** | Public attitudes to climate change, 2008: Concerned but still unconvinced | Face-to-face interviews | 1039 |
| **Jun 2007** | **Ipsos Mori** | Climate change survey | Face-to-face interviews | 2031 |

## APPENDIX E: SELECTED U.S. SURVEYS ADDRESSING CLIMATE CHANGE

| Date | Source | Measure | Method | N |
|---|---|---|---|---|
| **Jun-Jul 2010** | **Yale Project on Climate Change Communication** Leiserowitz, Smith, & Marlon | American's knowledge of climate change | National survey online panel | 2030 |
| **May-Jun 2010** | **Yale Univeristy, George mason University** Leiserowitz, Maibach, Roser-Renouf, & Smith | Climate change in the American mind: Americans' global warming beliefs and attitudes in June 2010 | National survey online panel | 1024 |
| **Jun 2010** | **Stanford University** Krosnick, & Villar | Stanford global warming poll | National survey telephone poll | 1000 |
| **Jan 2010** | **Pew Research Centre** | Energy concerns fall, deficit concerns rise. Public's priorities for 2010: Economy, jobs, terrorism | National survey, telephone interview | 1504 |
| **Dec 2009-Jan 2010** | **Yale Univeristy, George mason University** Leiserowitz, Maibach, & Roser-Renouf | Climate change in the American mind: Americans' global warming beliefs and attitudes in January 2010 | National survey online panel | 1001 |
| **Nov 2009** | **GfK Roper Public Affairs & Media Stanford University** | The Associated press-Stanford University Environment Poll. | National survey telephone poll | 1005 |
| **Sep-Oct 2009** | **Pew Research Centre** | Global warming and public opinion | National survey, telephone interview | 1500 |
| **Sep-Nov 2009** | **Muhlenberg College Institute of Public Opinion, Gerald Ford School of Public Policy at the University of Michigan.** | The climate of belief: American public opinion on climate change | National telephone survey | 988 |
| **Sep-Oct 2008** | **Yale Univeristy, George mason University** Maibach, Roser-Renouf, & Leiserowitz | Global warming's six Americas 2009: An audience segmentation analysis | National survey online panel | 2164 |
| **Jul 2008** | **The Woods Institute for the Environment at Stanford University** Krosnick | ABC News, Planet Green, Stanford University Poll | National survey telephone poll | 1000 |
| **Apr 2008** | **Pew Research Centre** | Global warming and public opinion | National survey, telephone interview | 1502 |
| **Mar-Apr 2008** | **SRIC-BI, Alliance for Climate Protection, Dept of Conservation. The Nature Conservancy** | American climate values survey | - | - |
| **Apr 2007** | **The Woods Institute for the Environment at Stanford University** Krosnick | ABC News, Washington Post, Stanford University | National survey telephone poll | 1002 |
| **Jan 2007** | **Pew Research Centre** | Global warming: A divide on causes and solutions | National survey, telephone interview | 1708 |
| **Mar 2006** | **The Woods Institute for the Environment at Stanford University** Krosnick | ABC News, Time, Stanford University | National survey, telephone interview | 1002 |
| **Jul-Aug 2004** | Kellstedt, Zahran, & Vedlitz | Personal efficacy, the information environment, and attitudes toward global warming and climate change in the United States | National telephone survey | 1093 |

## APPENDIX F: GLOBAL – REPRESENTATIVE NATURAL DISASTERS AND EXTREME WEATHER EVENTS JAN 2010 – JULY 2010

| Date | Location | Event | Death Toll | Number of people affected |
|---|---|---|---|---|
| **July/August 2010** | Pakistan | Severe floods | 1,985 | 18,102,237 |
| **June/July** | Russia | Heatwave | 55,736 | - |
| **July** | India | Severe floods | 98 | 523,000 |
| **July** | Benin | Flood | 46 | 831,000 |
| **July** | Cameroon | Flood | 13 | 3,095 |
| **July** | Central African Rep | Flood | 3 | 1,585 |
| **July** | Burkina Faso | Flood | 16 | 133,362 |
| **July** | Sudan | Flood | 36 | 138,397 |
| **July** | Southern California | Bushfires | | - |
| **July** | Eastern U.S and Canada | Heatwave | Approx 300 | - |
| **July** | China | Heatwave, flood | - | - |
| **July** | Philippines | Cyclone | 146 | 585,474 |
| **June** | Brazil | Flood | 72 | 157,000 |
| **June** | Mexico | Cyclone | 22 | 170,000 |
| **June** | South America | Cold wave | - | - |
| **June** | Ghana | Flood | 45 | 7,500 |
| **June** | Romania | Flood | 26 | 12,237 |
| **June** | El Salvador | Cyclone | 6 | 500 |
| **June** | Ukraine | Flood | 6 | 40,059 |
| **May/June** | China | Flood/storm | 1,691 | 134,000,000 |
| **May** | Pakistan | Heatwave | - | - |
| **May** | Zaire/Congo Dem Rep | Landslide | 46 | 1,167 |
| **May** | India | Cyclone | 52 | - |
| **May** | Guatemala | Cyclone | 187 | 397,962 |
| **May** | El Salvador | Cyclone | 10 | 11,520 |
| **May** | Honduras | Cyclone | 18 | 24,675 |
| **May** | Poland | Flood | 16 | 100,000 |
| **April** | India | Cyclone | 114 | 500,000 |
| **April** | Colombia | Flood | 363 | 2,217,518 |
| **April** | Mexico | Earthquake | 2 | 25,232 |
| **April** | China | Earthquake | 2,968 | 112,000 |
| **April** | Brazil | Flood | 256 | 74,938 |
| **April** | Ecuador | Flood | 2 | 6,440 |
| **March** | India | Heatwave | 250 | - |
| **March** | Iceland | Volcanic eruption | - | - |
| **March** | Angola | Flood | 7 | 185,886 |
| **March** | Zaire/Congo Dem Rep | Flood | - | 67,500 |
| **March** | Madagascar | Cyclone | 40 | 211,611 |
| **March** | Kenya | Flood | 94 | - |
| **March** | Fiji | Cyclone | - | - |
| **March** | Russia | Flood | - | 3,250 |
| **Feb** | France | Cyclone (winter storm) | 53 | 500,079 |
| **Feb** | Chile | Earthquake | 562 | 2,671,556 |
| **Feb** | Brazil | Heatwave | 32 | - |
| **Feb** | Haiti | Flood | 27 | 22,085 |
| **Jan** | India | Cold wave | 100 | - |
| **Jan** | Romania | Cold wave | 52 | - |
| **Jan** | Serbia | Cold wave | 3 | - |
| **Jan** | Bulgaria | Cold wave | 3 | - |
| **Jan** | Haiti | Earthquake | 222,570 | 3,700,000 |
| **Jan** | Mexico | Flood | 41 | 20,000 |
| **Jan** | Bolivia | Flood | 26 | 227,860 |
| **Jan 2010** | Russia | Cold wave | 13 | - |

## APPENDIX G: DISASTER/EXTREME WEATHER EVENTS IN AUSTRALIA JAN 2009 – JULY 2010[2]

| Date | Location | Event | Death toll | Injured | Property impacts |
|---|---|---|---|---|---|
| **June 2010** | Lennox Head-NSW | Tornado | | Several injuries | Homes damaged or destroyed – 30+ |
| **March 2010** | Cape Shield NT | Cyclone Paul Category 2 | | | Minor damage to infrastructure, Disruptions to power, phone and sewerage |
| **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** | 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** | 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 |
| **Feb-Mar 2010** | Western, Southern Qld, Northern NSW | Severe floods | | | Major damage to infrastructure |
| **Jan 2010** | Cairns Gulf Country | Cyclone Olga Category 1 | | | Minor damage to infrastructure |
| **Jan 2010** | Kuri Bay WA | Cyclone Magda Category 3 | | | Minor damage to infrastructure |
| **Dec 2009** | Wallal WA | Cyclone Laurence Category 5 | | 1 | Considerable damage to properties. |
| **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. |
| **Aug 2009** | Victoria | Severe thunderstorm and wind event | | | Residential and commercial properties damaged |
| **May 2009** | South East QLD/ Northern NSW | Severe floods | 1 | | |
| **March/ April 2009** | Tamworth - NSW | Severe floods | | | Residential and commercial properties damaged |
| **Feb 2009** | Victoria | Black Saturday Bushfires | 173 | 414 | Homes destroyed – 2,298<br>Business destroyed - 61 |
| **Jan 2009** | Onslow WA | Cyclone Dominic Category 2 | | | Minor structural damage |
| **Jan 2009** | Northern QLD | Severe floods | 1 | | Residential and commercial properties damaged |
| **Jan/Feb 2009** | South Eastern Australia<br>VIC<br>SA<br>TAS<br>NSW | Severe Heatwave | 404 | Increased admissions to emergency wards | Widespread power outages.<br><br>Disruptions to trains services |

[2] The information provided has been primarily sourced from the Australian Emergency Management Institute, Disasters Database and the Bureau of Meteorology, Severe Weather Events.

## APPENDIX H: ANNOTATION OF ITEM ADDITIONS TO AUSTRALIA/CARDIFF CLIMATE CHANGE SURVEY, AUSTRALIAN VERSION 25 MAY 2010

This 2010 survey has incorporated items from Cardiff University's national survey as well as including many Australia specific survey items. In each instance an annotation of survey constructs and operationalised measures was developed, and used to clearly specify and synchronise items for the collaborative Australia survey exercise.

Part one, Cardiff section,

Item #22 has essentially been substituted for the nonessential **values scale** in the Cardiff survey, which was based on a 10 item values scale from Schwartz plus additional biospheric values items taken from De Groot & Steg.(2007). This scale from Schultz (2001, 2002, and Schultz, Shriver, Tabanico, & Khazian, 2004) is widely used, and is also framed as an 'environmental values' as well as environmental concern scale. The scale from Schultz better aligns with the broader environmental canvas of the Australian study, allows for a more specific examination of **public understandings of climate change**, and articulates more strategically with a central and convergent focus on **environmental concern**. The decision dilemma here in part reflected the conceptual, theoretical, and measurement confusion in the literature across environmental values and concern(s) on the one hand and with respect to 'environmental' risk perception and appraisal on the other (e.g., Reser & Bentrupperbäumer, 2005). It was deemed that the Schultz scale gave us our best comparison options; the scale has excellent psychometric properties, and has its own, straightforward face validity for respondents, in the context of the survey, as contrasted with the Schwartz scale (e.g., 1992). Finally this scale provides a widely used individual difference measure with much in common with other environmental values and concerns scales (e.g., Clayton & Opotow, 2003; Hawcroft & Milfont, 2010; Stern & Dietz, 1994). The scale essentially involves a three-factor model (egoistic, altruistic, and biospheric concerns) and hence three distinct subsections and scores; there is no overall meaningful score.

Item #10 is taken from Krosnick (2008) and overlaps with the Cardiff survey question 13g (omitted). This item, along with the immediately following item 11 addresses **climate change risk perceptions and concerns**, and brings in the **local** (national) and **global** spatial framing which Uzzell (e.g., 2000) and Gifford et al. (2009) and others (e.g., Lima & Castro, 2005; Zube, 1991) have documented as being of particular importance. This section of the Cardiff/Griffith survey suits this item as both spatial and temporal considerations are addressed. The item also addresses the interesting findings with respect to greater pessimism in Australia relating to the future impacts of climate change (Gifford et al.) and allows for direct comparison with the United States and the UK, with such comparisons (also encompassing other items) allowing for a contemporary comparison and explanation of the Gifford et al. findings. Selected Krosnick items (Krosnick, 2006, 2007, 2008; Malka et al., 2009) interspersed in the survey allow for comparisons with North American survey findings in the context of a highly credible and long standing research program for which the items, methodology, and data are fully available. Hence, for the sake of comparability and standardisation, and in seeking to use established best practice (e.g., Li, 2010) we have included a number of Krosnick survey items and measures which have dovetailed with our needs.

Part 2, Australian specific survey items

Item #23 addresses a number of commitments with respect to project research funding through the Department of Climate Change, under the aegis of their Disaster Management Research Plan. In this item we are seeking to better appreciate **how public risk perceptions, understandings, and concerns relating to specific natural disaster threats in Australia compare with other 'environmental threats'** *of* and *to* the environment, and to the phenomenon/threat of climate change. Each of these risks can be considered independently or overall as a rank ordering and relative comparison of these threats and in the context of the nexus between natural disaster risk perception and appraisal and climate change risk perception and appraisal (e.g., Reser & Morrissey, 2008). These items provide an indication of the relative salience, seriousness, and implied adverse consequences of these risk domains, with climate change also considered as a separate risk domain. There is also the possibility of examining these items in the context of a multidimensional scaling exercise in which we might consider where and how climate change sits vis-à-vis other risks. Climate change was deliberately placed as the last risk domain in the series so that this would invite a more reflective rating, taking other environmental threats and risks into consideration.

Item #24 The logic of this item follows from the preceding item and attempts to compare and contrast **the threat of climate change vis a vis other largely 'non-environmental' risk domains**. Again this provides both a rank ordering of relative perceived risk and/or concern, with climate change again being one of the risk domains evaluated. Many studies have reported the changing relative salience and urgency of the climate change threat relative to other salient risks and threats, though this of course can depend greatly on framing and context. Nonetheless items 23 and 24 allow for a considered examination of the relative importance of climate change risk appraisal and concern.

Item #25 is taken from Krosnick, where '**importance**' is used as a single item measure of what has been a consistently important parameter and predictor variable, with some arguable overlap with values. As with belief in climate change and the credibility of scientists, Krosnik views self-reported importance as a necessary but not itself sufficient precursor to taking mitigation action in the context of climate change.

Item #26 addresses **level of knowledge concerning climate change**. Many researchers have shown that this domain is important to climate change concern(s) and behaviour (including intentions, decisions, and actions) (e.g., Krosnick, Leiserowitz, Kellstedt). Knowledge of consequences also comes up frequently in the literature, overlapping with concern and risk appraisal. Our focus on 'public understandings' makes knowledge a very important domain. But the procedure of Krosnik, Kellstedt, and others (e.g., Roser-Renouf & Nisbet, 2008) using self-reported level of knowledge is open to criticism and their findings are surprising (i.e., the more information a person has about climate change, the less responsible he or she feels about it and the less concerned he or she is, (Malka et al., 2009), so we have gone with ten true/false items based on the work of Sundblad et al. (2007) (objective knowledge across three knowledge domains) followed by a confidence rating about the correctness of respondents' answers. This allows for comparisons with Krosnick's self-report knowledge item.

Item #27 addresses the matter of **public trust** which has been related by many studies to concern levels, motivational processes, and behavioural responses. This is a very important construct and domain, with a very substantial research literature (e.g., Barnett et al., 2007; Earl & Cvetkovich, 1995; Poortinga & Pidgeon, 2003), which is also addressed in item 47. Krosnick argues that public trust in scientists and science reporting is a necessary but not sufficient precursor to taking personal action in addressing one's own carbon footprint.

Item #28 addresses the related matter of whether respondents believe that **scientists generally agree on the reality of climate change** and its threat status. The item is modified from Krosnick (2008). This item also addresses the matter of **uncertainty** with respect to the climate change threat, which is presumably strongly mediated by the public's perception of the level of agreement among scientists.

Item #29 measures felt **connectedness to the natural environment** and derives from Mayer and Frantz's 14 item Connectedness to Nature Scale (2004). The scale used is essentially the same as the modified 7-item version of this scale (minus one item) used by Gosling and Williams with an Australia population of rural residents (2010) addressing connectedness to nature, place attachment and conservation behaviour among farmers. Several elements of this modified scale also reflected the work and measure of Dutcher, Finley, Luloff, & Johnson (2007). While other versions of similar scales and current critiques were considered (e.g., Hinds & Sparks, 2008; Perkins, 2010; Perrin & Benassi, 2009), it was thought that the modified items of Gosling and Williams offered a simple and pre-tested scale in the Australian context with good psychometrics, and the possibility of useful comparisons with the present Australian sample. Again, this scale provided an important individual difference measure to be factored into this investigation of public understandings of and concerns about climate change.

Item #30 addresses the **nature and extent of respondents' personal and direct experience** with the natural environment. A substantial literature suggests that personal and direct experience with natural environment, and prior experience with natural disasters, are important factors in moderating pro-environmental behaviours and in influencing specific risk perceptions and concern levels (e.g., Reser, 2010). As well it is clear that for most people in the world today, and for urban-based Australians, people will have had very limited direct experience with noteworthy natural environmental change or the perceived impacts of climate change. Rather people's exposure to and encounters with climate change have been largely indirect, virtual, and mediated by information and communication technologies and the vantage point and storylines of journalists and editors. These items were largely created for this survey exercise, though modelled on pre-tested items from prior environmental research of the authors. The survey has sampled respondents from across Australia, with a substantial representation of rural and peri-urban areas, where it is expected that respondents will have more extensive experience of and exposure to the natural environment.

Item #31 addresses respondents' perceptions of the **condition of the natural environment in the world today**. This is essentially a **global risk perception and judgment** in the present context.

Item #32 frames the issue of climate change as an environmental problem, with the respondent judging the **seriousness of the problem right now**. This item also comes from Krosnick (Malka et al., 2009) with 'global warming' changed to 'climate change', and is therefore useful for direct comparison. This and the preceding item continue with a focus on the present and/or the foreseeable future in the Australian items of the survey. The item may be used as a component of a composite risk perception and/or climate change concern score.

Item #33, also from Krosnick, shifts the content of item 35 to the **condition of the natural environment in one's local region**, with this being a **local risk perception and judgment** in the present context. This is an important item to consider when looking at differences in public risk perceptions and levels of concern across differing regions of Australia and differing levels of exposure to climate change impacts. It is important to stress that public perceptions of climate change are, at one level, about perceptions of changes in the natural environment, whether relating to climatic changes or to the impacts of other causal factors.

Item #34 relates to **actual behaviours engaged in** by respondents. While many such lists exist, we have opted to use the items employed by Krosnick (2008) as they are reasonably straightforward, they were asked in the context of climate change and reducing one's carbon footprint, and they preceded important items by Krosnik and used by ourselves relating to self-reported motivations for engaging or not engaging in these behaviours. This item represents a logical outcome measure in terms of strategic multiple regression analyses which may be undertaken to establish the putative mediating and moderating roles of other variables examined.

Item #35 provides an **open-ended item** and opportunity for respondents to say something about their **own motivations and/or rationale for engaging** in particular pro-environmental actions. The question also allows for a determination of whether the above actions appear to relate to psychologically significant as well as environmentally significant considerations. The accompanying document discussing the construct domains explored in the survey discusses the matter of motivational processes and existing measures in more detail.

Item #36 follows on from item #39 but specifically **addresses self-reported reasons and or motivations or barriers for *not* engaging** in many of the behavioural responses to climate change listed in item #34. While a considerable research literature addresses barriers to taking action (e.g., APA, 2009; Gifford, 2011; Gifford et al., 2011), the preferred and modest focus in the present survey has been to more directly focus on motivational processes underlying particular behavioural responses and inaction, and respondents' **overall psychological response** to the climate change phenomenon and threat. Some useful Australian survey data exists which addresses these matters.

Item #37, a-f, addresses perceptions of **control, agency and self efficacy** with respect to environmental problems and climate change mitigation. The items constitute Kellstedt et al.'s self efficacy scale (2008) used in the context of climate change, and supplemented by several developed items reflecting other sources. Two of these items also directly address **causal and responsibility attributions.** Several items also address the **perceived inevitability** of climate change and the perceived futility of trying to mitigate the impacts now in train.

Item #38 addresses the **perceived accuracy and credibility of media coverage**, and the stories and information provided by news organisations. This Krosnick item was used in the compilation of a composite source credibility and trust score. This matter of media credibility is arguably of fundamental importance as for most individuals their knowledge about and exposure to climate change has been almost exclusively virtual and indirect, through the media (e.g., Reser, 2010).

Item #39, also from Krosnick, addresses both **information search and selective attention**, with both of these being often-used measures in the climate change context. This could also be seen as an item relating directly to public interest as well as public understanding of the climate change phenomenon and threat.

Item #40, again from Krosnick, provides some information about **the salience of climate change as a concern** and possibly preoccupation, and again says something about its issue status and its putative emergence as an explanatory frame of reference for myriad issues and problems.

Item #41 constitutes **an objective knowledge scale** relating to the phenomenon of climate change. The 10 item true/false statements can be compared with the self-reported knowledge level at item 30. A number of these items were modified from Sundblad et al. (2007) while others were constructed by the present researchers for the purpose of this Australian survey. It was anticipated that this knowledge score would greatly assist in exploration of public understandings, and more readily addresses Kellstedt's surprising findings relating to knowledge levels and concern levels.

Item #42 ask respondents to rate their **own certainty with respect to the correctness of their knowledge item responses**. This item was taken from Sundblad et al., 2007, where it has been used in tandem with his objective knowledge items. Hence with items #30, #41, and #42 it was possible to more adequately assess the extent and role of both subjective and objective knowledge levels as these relate to other variables of interest and public understandings.

Item #43, a-g. The items for the **psychological impacts/experienced distress** section address a much neglected area in the context of climate change research, and indeed with respect to the stress of environmental change (e.g., Aldwin & Stokols, 1988). There are few extant measures which can be readily transferred from research domains such as those addressing the chronic stress of living near degraded or contaminated or potentially dangerous sites, or recurrent natural or technological disaster threat (e.g., Lima, 2004; Rogan, O'Connor & Horwitz, 2005; Santiago-Rivera et al., 2007). A substantial review of the measurement of key behavioural science constructs in climate change research does not really address this domain (Roser-Renouf & Nisbet, 2008). While considerable discussion and speculation has taken place with respect to the impacts of climate change in the context of rural and remote mental health, for example, very little systematic research has been undertaken (e.g., Berry et al., 2008; Fritze et al., 2008; Morrissey & Reser, 2007). The one scale which has been developed (in Australia) which has addressed this type of environmental distress is the *Environmental Distress Scale* (EDS) (Higginbotham et al., 2007). While careful consideration was given to the use of this scale in the present context, and while a 'solastalgia' subscale has been used in previous related research (Ellul, 2009), the scale items were not specific enough or in other respects deemed sufficiently appropriate to the climate change and

natural disaster focus of the present survey exercise. Hence 7 items were developed which address the increasingly discussed mental health and quality of life impacts of both the threat and the directly experienced salient environmental alteration and change attributed to climate change and its unfolding environmental impacts. These items attempt to capture a number of the dimensions of the experienced distress and other psychological responses and reactions to the threat of and/or directly experienced environmental impacts of climate change, such as concern, felt powerlessness, experienced responsibility, loss, and possible forced relocation. Following the employment of these items and composite index in the present survey research exercise, a more systematic examination of the psychometric integrity and general utility of these items can be undertaken and a potential scale can be given careful consideration.

Item #44 has been inserted by Qualtrics to check whether respondents are actually reading through and thinking about the survey items. If they are not, these respondents are deleted.

Item #45, a-g. The items addressing **psychological adaptation** in the context of climate change similarly reflect the seeming absence of any existing scales or measures which would appear to address this aspect of within-individual psychological adjustment. The exception is arguably that literature which has addressed stress and coping in the context of environmental stress, environmental change, disaster threat and impacts, and climate change (e.g., Homburg et al., 2007; Reser & Morrissey, 2008; Reser & Swim, 2011). The climate change science literature generally has introduced a particular gloss for adaptation which effectively ignores the fact that adaptation is a core multi-level and multi-faceted construct and process within psychology and the health sciences which encompasses crucially relevant intrapsychic as well as extra-individual adjustments and responses. While stress and coping inventories are not entirely inappropriate, it was decided to maximise the face validity and currency of a set of transparent items which might directly address and explore the matter of *psychological* adaptation in the context of the climate change threat. The items will ideally serve **to document and explore the nature of those putative changes in the way individuals are framing, thinking about, and feeling about, the threat and unfolding impacts of climate change and with respect to the adjustments to their lives** which these environmental changes and impacts will require. The survey also includes a behavioural response inventory (item 34) which identifies particular actions and behaviours which individuals and/or are taking in the context of sustainability considerations and the threat of climate change, with these also being acknowledged as 'adaptation' responses.

Item #46 addresses respondents' **overall feelings with respect to the threat of climate change** and underlying optimism, self-efficacy, and frustration. The items are taken from a recent national survey by the Australian Conservation Society addressed principally to its members. We thought it interesting that this organisation was using a number of psychological items in their survey and we decided that these selected items were particularly appropriate for our Australian respondents and articulated in interesting ways with other constructs and issues being addressed, including psychological distress, risk-as-feelings, etc.

Items #47 and #48 address **whether respondents have personally seen or experienced any noteworthy changes or events in their local environment over the past decade which they think might be due to climate change**. These items taps into personal experience, threat versus

unfolding impacts, causal attributions, and the extent to which climate change is being used as both cause and account of noteworthy changes. Given that the focus of the survey is on climate change, it is important to have some measure of the extent to which respondents have personally noticed environmental changes, including changes in climate weather patterns, which they attribute to 'climate change'. It is also important to examine the extent to which climate change and natural disasters overlap and interact as a risk domain. It will be interesting to see whether the changes and events mentioned are in effect extreme weather events or natural disasters, but now perhaps increasingly viewed as manifestations of climate change. Item 48 has an open-ended response format allowing for respondents to describe these changes and/or impacts in their own words.

Items #49 and #59 further explore this matter, but now in the context of **the national and the global**, again with an open-ended format at item 49.

Item #51 also addresses the perceived nexus between climate change and natural disasters, in the context of an open-ended response format, in this case asking **whether climate change is seen as a causal factor with respect to the frequency and intensity of extreme weather events** in Australia.

Items through #52 through #55 address respondents' **personal experience with natural disaster events** and the nature and magnitude of both the event and their psychological response to the event.

Item #56 is essentially a logical follow-through of the preceding question, but framed in terms of **risk perception and perceived vulnerability**. This item, along with others, can provide a composite index or score relating to perceived seriousness of natural disaster threat in one's own region.

Item #57 moves from natural disaster vulnerability to **climate change vulnerability**, with responses ideally shedding some light on the perceived nexus between climate change and natural disasters in terms of own region exposure and vulnerability. Importantly this item, as with other items, is seeking **respondent's perceptions and *appraisals*** as distinct from the risk and vulnerability *assessments* relating to physical environment and system parameters

Item #58 examines respondents' indirect or virtual encounters with the phenomenon of climate change through their **self-reported exposure to a spectrum of films, mini-series, and documentaries relating to climate change**. These responses provide some measure of the extent to which such virtual presentations of climate change have been viewed, and the influence which (exposure) to such media products might have on respondents' risk perceptions, understandings, and psychological and behavioural responses to climate change.

Item #59 includes a number of statements from Kellstedt et al (2008) relating to their much discussed study addressing **personal efficacy, the information environment, and attitudes toward climate change**. The statements are framed by Kellstedt and his colleagues as a 'public concern for global warming' measure and we decide to include these both as a criterion measure for our other measures of climate change concern, and in order to further investigate the surprising

findings of this study concerning public understandings, knowledge and concerns. The measure also provides a recent and direct comparison opportunity with U.S findings.

Item #60 was designed to assess respondents' **own perspective on whether their level of climate change concern has changed over the past two years**. An ABS survey conducted in 2007/2008 asked respondents about their level of concern. It was of interest to see whether respondents feel that their concern levels have increased, stayed the same or decreased over what has been a very turbulent two year period in terms of public debate and international events with respect to climate change. In the absence of longitudinal data this also provides and important self-report measure of change and psychological impact.

Item #61 simply provides an open-ended opportunity for respondents to indicate why their level of concern and/or views on climate change might have changed, if they have.

Item #62, the final substantive survey item preceding the demographic information section, provides respondents with an opportunity **to offer their view or comment on any aspect of climate change or natural disasters** in Australia which they may care to make. We have included this as an opportunity to pick up on other matters not canvassed in the survey but of importance to the participant.

Items #63 through #81 cover **demographic information** from respondents, with item 81 ascertaining whether the respondent has participated in a survey addressing environmental issues or climate change in the past two years.

**Summary statement of survey research objectives for collaborative research exercise with Cardiff University's Understanding Risk Research Group national survey on Public Perceptions of Climate Change: Australian Survey Exercise Expanded Objectives:**

1. To provide Australian comparison data with respect to the UK national survey addressing public risk perceptions and energy futures being undertaken by Cardiff University's Understanding Risk Research Group.
2. To provide an in-depth documentation of Australian risk perceptions, public understandings, and psychosocial and behavioural responses to 'climate change' and natural disasters.
3. To provide a national data base with respect to climate change risk perceptions, understandings, and psychosocial and behavioural responses.
4. To provide a credible survey protocol and set of items and measures, reflecting standardised best practice where possible, which can be utilised in future studies to document important changes in risk perceptions, public understandings, and responses to climate change over time in Australia, with standardised items and measures allowing for comparison with North American and European research findings.
5. To establish and document how these risk perceptions and understandings differ from risk perceptions and understandings regarding natural disasters and other salient risk domains, and to more extensively explore the nexus between climate change and other disaster risk domains in public risk perceptions and understandings.
6. To research and document how differing mediating and moderating parameters and processes appear to be influencing climate change risk perceptions, understandings, and

responses, with particular attention being given to both established and less-researched aspects of strategic importance to climate change adaptation and mitigation. [These include knowledge, risk appraisal, spatial and temporal distance, direct versus indirect experience, personal importance, environmental values, environmental concern, self-efficacy, experienced distress, *psychological* adaptation, belief/scepticism, trust, political affiliation, and motivational processes generally.]

7. To establish and differentiate where possible the role and impacts of media coverage and social representations of 'climate change' in Australia (i.e., indirect, virtual, vicarious exposure to and 'experience' of the threat and unfolding impacts) as distinct from direct exposure and experience with environmental events or phenomenon perceived and understood as manifestations and/or consequences of climate change.
8. To assess and document the self-reported *psychological impacts* of the perceived threat and unfolding impacts of climate change to compare and contrast with widely reported but largely anecdotal accounts of climate change anxiety and distress.
9. To examine whether there exist noteworthy differences across Australia's geographic and urban-rural regions with respect to risk perceptions, public understandings, and responses to climate change, with consideration also given to conventional socio-economic and demographic parameters (age, education, gender, income, national origin, residential status and duration, occupation).
10. To provide a more comprehensive examination and data base of risk perceptions, public understandings, and responses to climate change in the Southeast corner of Queensland, (through oversampling, face-to-face interviews following survey completion, and focus-group exploration) to address current under-emphases in other ongoing Griffith Climate Change Response Program and NCCARF research initiatives with respect to psychological considerations generally, and to enhance collaborative and comparative research options and reported study findings syntheses.

## APPENDIX I: SURVEY ITEMS AND DESCRIPTIVE STATISTICS

Note. In this Appendix, percentage figures refer to the proportion of respondents who have selected a particular rating or response option. Where there is no data provided for British respondents, the survey item was only included in the Australian survey. In virtually all instances the greater the scale rating, the greater the indicated agreement, concern, seriousness, etc. In most instances a Mann-Whitney indication of significant difference between Australia and British distributed rating responses or response option selections (*U*) is provided, in addition to conventional rating scale mean comparisons and significance levels, given the ordinal rather than interval character of most response formats. Note that "no opinion" and similar non-committal responses are not included in computation of item means. Given the large samples, effect sizes (indicated by *r*) are more meaningful than significance levels.

**Q1. How favourable or unfavourable are your overall opinions or impressions of the following energy sources for producing electricity currently?**

| | | 5. Very favourable % | 4. Mainly favourable % | 3. Neither favourable nor unfavourable % | 2. Mainly unfavourable % | 1. Very unfavourable % | Never heard of it % | No opinion/ Don't know % | *M* | *U* | *p*< | *r* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a.Biomass, that is wood, energy crops, and human and animal waste | Australia | 8.6 | 28.2 | 26.7 | 12.8 | 5.7 | 10.0 | 8.0 | 3.26 | | | |
| | GB | 23.7 | 33.8 | 18.6 | 9.3 | 4.7 | 6.8 | 3.0 | 3.71 | 1565646.0 | .001 | .22 |
| b.Coal | Australia | 2.0 | 13.9 | 24.4 | 34.4 | 22.2 | 0.2 | 3.0 | 2.37 | | | |
| | GB | 9.3 | 26.8 | 19.0 | 29.7 | 13.1 | 0.5 | 2.0 | 2.94 | 1995882.5 | .001 | .22 |
| c.Gas | Australia | 9.3 | 43.8 | 26.3 | 14.8 | 3.7 | 0.1 | 2.0 | 3.41 | | | |
| | GB | 14.1 | 41.8 | 20.0 | 17.8 | 4.1 | 0.4 | 2.0 | 3.47 | 2589999.0 | .01 | .04 |
| d.Hydroelectric power | Australia | 35.4 | 44.7 | 11.0 | 3.4 | 1.5 | 1.3 | 3.0 | 4.14 | | | |
| | GB | 39.3 | 36.5 | 12.6 | 2.6 | 1.0 | 4.9 | 3.0 | 4.23 | 2345125.0 | .001 | .05 |
| e.Nuclear power | Australia | 11.9 | 19.1 | 17.3 | 16.8 | 30.9 | 0.4 | 4.0 | 2.63 | | | |
| | GB | 10.4 | 24.1 | 20.4 | 21.2 | 20.0 | 1.0 | 3.0 | 2.83 | 2369629.5 | .001 | .08 |
| f.Oil | Australia | 1.5 | 9.6 | 24.7 | 34.7 | 26.5 | 0.4 | 3.0 | 2.23 | | | |
| | GB | 5.4 | 27.5 | 26.5 | 27.6 | 9.9 | 0.9 | 2.0 | 2.95 | 1694824.0 | .001 | .31 |
| g.Sun/ Solar power | Australia | 72.5 | 22.6 | 2.8 | 0.7 | 0.6 | 0.1 | 1.0 | 4.67 | | | |
| | GB | 55.6 | 32.2 | 6.2 | 3.3 | 0.9 | 0.4 | 1.0 | 4.41 | 2260942.5 | .001 | .18 |
| h.Wind power | Australia | 63.7 | 27.3 | 5.0 | 1.8 | 1.2 | 0.0 | 1.0 | 4.52 | | | |
| | GB | 48.7 | 33.2 | 8.6 | 4.8 | 3.1 | 0.6 | 1.0 | 4.20 | 2257721.0 | .001 | .17 |

**Q2. From what you know or have heard about using nuclear power for generating electricity in Australia/Britain, on balance, which of these statements, if any, most closely reflects your own opinion?**

| | | Australia % | GB % |
|---|---|---|---|
| 5 | The benefits of nuclear power far outweigh the risks | 20.4 | 16.2 |
| 4 | The benefits of nuclear power slightly outweigh the risks | 16.0 | 21.2 |
| 3 | The benefits and risks of nuclear power are about the same | 10.1 | 17.0 |
| 2 | The risks of nuclear power slightly outweigh the benefits | 13.7 | 19.5 |
| 1 | The risks of nuclear power far outweigh the benefits | 28.7 | 18.3 |
| | None of these | 0.9 | 1.3 |
| | Don't know | 10.1 | 6.6 |

| | *M* | *U* | *p*< | *r* |
|---|---|---|---|---|
| Australia | 2.84 | | | |
| GB | 2.97 | 2189553.5 | .001 | .03 |

**Q3. Do you favour or oppose the construction of nuclear power stations in Australia?**

| | Australia % |
|---|---|
| Favour | 36.9 |
| Oppose | 47.9 |
| Don't know | 15.2 |

**Q4. How concerned, if at all, are you about nuclear power? (in Australia)**

| | | Australia % | GB % |
|---|---|---|---|
| 4 | Very concerned | 20.7 | 16.6 |
| 3 | Fairly concerned | 36.1 | 38.3 |
| 2 | Not very concerned | 26.8 | 30.1 |
| 1 | Not at all concerned | 12.6 | 11.7 |
| | Don't know | 2.4 | 1.6 |
| | No opinion | 1.4 | 1.6 |

| | *M* | *U* | *p*< | *r* |
|---|---|---|---|---|
| Australia | 2.67 | | | |
| GB | 2.62 | 2530408 | .03 | .03 |

**Q5. To what extent do you agree or disagree with each of the following statements about nuclear power?**

| | | 5.Strongly agree % | 4.Tend to agree % | 3.Neither agree nor disagree % | 2.Tend to disagree % | 1.Strongly disagree % | No opinion % | Don't know % | *M* | *U* | *p*< | *r* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a.There are risks to people in Australia/Britian from nuclear power | Australia | 22.3 | 43.1 | 13.1 | 13.3 | 4.6 | 0.5 | 2.9 | 3.68 | | | |
| | GB | 17.0 | 44.1 | 15.9 | 14.7 | 3.3 | 1.5 | 3.5 | 3.61 | 2477001.0 | .001 | .04 |
| b.I feel confident that the Australian/ British Government adequately regulates nuclear power | Australia | 7.1 | 28.7 | 22.2 | 22.6 | 12.7 | 1.0 | 5.8 | 2.95 | | | |
| | GB | 6.6 | 32.6 | 21.5 | 19.7 | 11.8 | 1.9 | 5.7 | 3.03 | 2337625.5 | .01 | .04 |
| c.There are benefits to people in Australia/Britian for nuclear power | Australia | 19.4 | 35.0 | 16.4 | 14.9 | 9.1 | 0.6 | 4.4 | 3.43 | | | |
| | GB | 15.6 | 44.2 | 16.5 | 11.8 | 6.1 | 0.8 | 5.0 | 3.53 | 2445437.0 | .05 | .03 |
| d.I have mixed feelings about nuclear power | Australia | 14.7 | 32.9 | 17.5 | 17.1 | 15.1 | 1.5 | 1.3 | 3.15 | | | |
| | GB | 13.0 | 39.5 | 16.3 | 17.9 | 10.8 | 1.2 | 1.5 | 3.27 | 2559630.5 | .01 | .04 |
| e.I don't really like the idea of nuclear power, but I reluctantly accept that we will need it to help combat climate change and improve energy security (i.e. a reliable supply of affordable energy) in Australia/GB | Australia | 7.6 | 32.9 | 17.3 | 18.8 | 19.4 | 1.2 | 2.8 | 2.90 | | | |
| | GB | 12.7 | 44.2 | 14.3 | 15.6 | 9.5 | 2.2 | 1.5 | 3.36 | 2089659.0 | .001 | .17 |
| f.I don't trust the nuclear industry to run nuclear power stations safely | Australia | 21.4 | 24.4 | 18.6 | 19.7 | 11.9 | 1.2 | 2.8 | 3.25 | | | |
| | GB | 11.5 | 23.4 | 21.5 | 26.7 | 12.0 | 1.1 | 3.8 | 2.97 | 2266749.0 | .001 | .11 |
| g.I have strong opinions about nuclear power | Australia | 17.5 | 23.6 | 37.9 | 13.1 | 3.6 | 2.2 | 2.1 | 3.40 | | | |
| | GB | 17.7 | 27.0 | 30.8 | 17.0 | 4.4 | 1.8 | 1.2 | 3.39 | 2619753.5 | .93 | .00 |

**Q6. How concerned, if at all, are you that in the future...**

| | | 4.Not at all concerned % | 3.Not very concerned % | 2.Fairly concerned % | 1.Very concerned % | No opinion % | Don't know % | *M* | *U* | *p*< | *r* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| …electricity will become unaffordable? | Australia | 2.0 | 11.0 | 41.0 | 44.0 | 0.5 | 0.8 | 3.29 | | | |
| | GB | 2.7 | 17.7 | 38.4 | 39.7 | 0.6 | 1.0 | 3.17 | 2545281.5 | .001 | .06 |
| … electricity will be rationed? | Australia | 6.0 | 26.0 | 39.0 | 25.0 | 1.1 | 2.6 | 2.86 | | | |
| | GB | 5.0 | 25.1 | 36.4 | 29.5 | 1.4 | 2.7 | 2.94 | 2480909.0 | .001 | .05 |
| ...Australia/Britain will become too dependent on energy from other countries? | Australia | 12.0 | 29.0 | 31.0 | 22.0 | 1.4 | 4.1 | 2.67 | | | |
| | GB | 2.2 | 14.0 | 35.7 | 44.8 | 0.4 | 2.9 | 3.28 | 1675988.0 | .001 | .31 |
| …terrorist attacks will cause interruptions to electricity supplies? | Australia | 21.0 | 41.0 | 21.0 | 12.0 | 2.2 | 3.2 | 2.25 | | | |
| | GB | 7.0 | 28.7 | 35.5 | 23.5 | 1.6 | 3.8 | 2.83 | 1683632.0 | .001 | .29 |
| …supplies of fossil fuels (e.g. coal and gas) will run out? | Australia | 7.0 | 18.0 | 42.0 | 30.0 | 0.8 | 1.8 | 2.97 | | | |
| | GB | 4.3 | 14.8 | 38.3 | 40.0 | 0.8 | 1.8 | 3.17 | 2345126.5 | .001 | .11 |
| …there will be power cuts | Australia | 5.0 | 24.0 | 43.0 | 25.0 | 1.0 | 2.2 | 2.91 | | | |
| | GB | 3.5 | 24.6 | 41.1 | 27.7 | 1.0 | 2.2 | 2.97 | 2545884.0 | .02 | .03 |

**Q7. How concerned, if at all, are you about climate change, sometimes referred to as 'global warming'?**

| | | Australia % | GB % |
|---|---|---|---|
| 4 | Very concerned | 26.2 | 28.5 |
| 3 | Fairly concerned | 40.1 | 42.5 |
| 2 | Not very concerned | 21.7 | 18.7 |
| 1 | Not at all concerned | 10.3 | 8.7 |
| | Don't know | 1.1 | 0.9 |
| | No opinion | 0.5 | 0.8 |

| | *M* | *U* | *p*< | *r* |
|---|---|---|---|---|
| Australia | 2.84 | | | |
| GB | 2.92 | 2590773 | .001 | .04 |

**Q8. As far as you know, do you personally think the world's climate is changing, or not?**

| | % | % |
|---|---|---|
| Yes | 73.9 | 78.3 |
| No | 18.2 | 15.3 |
| Don't know | 7.8 | 6.4 |

| | *M* | *U* | *p*< | *r* |
|---|---|---|---|---|
| Australia | 1.80 | | | |
| GB | 1.84 | 2349657.50 | 0.00 | 0.04 |

**Q9. Thinking about the causes of climate change, which, if any, of the following best describes your opinion?**

| | | Australia % | GB % |
|---|---|---|---|
| 1 | Climate change is entirely caused by natural processes | 4.9 | 5.6 |
| 2 | Climate change is mainly caused by natural processes | 12.6 | 12.2 |
| 3 | Climate change is partly caused by natural processes and partly caused by human activity | 45.8 | 46.3 |
| 4 | Climate change is mainly caused by human activity | 27.6 | 24.3 |
| 5 | Climate change is entirely caused by human activity | 4.2 | 6.5 |
| | I think there is no such thing as climate change | 2.7 | 2.2 |
| | Don't know | 1.9 | 2.5 |
| | No opinion | 0.4 | 0.4 |

| | *M* | *U* | *p*< | *r* |
|---|---|---|---|---|
| Australia | 3.14 | | | |
| GB | 3.15 | 2535031.5 | .86 | .00 |

**Q10. If nothing is done to reduce climate change in the future, how serious a problem do you think it will be for Australia?**

| | | Australia % | *M* |
|---|---|---|---|
| 4 | Very serious | 40.0 | 3.1 |
| 3 | Somewhat serious | 37.9 | |
| 2 | Not so serious | 16.8 | |
| 1 | Not serious at all | 5.3 | |

**Q11. If nothing is done to reduce climate change in the future, how serious a problem do you think it will be for the world?**

| | | Australia % | *M* |
|---|---|---|---|
| 4 | Very serious | 49.4 | 3.3 |
| 3 | Somewhat serious | 32.4 | |
| 2 | Not so serious | 13.7 | |
| 1 | Not serious at all | 4.5 | |

**Q12. To what extent do you agree or disagree with each of the following statements about climate change?**

| | | 5.Strongly agree % | 4.Tend to agree % | 3.Neither agree nor disagree % | 2.Tend to disagree % | 1.Strongly disagree % | No opinion % | Don't know % | *M* | *U* | *p*< | *r* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a.*I am certain that climate change is really happening | Australia | 30.8 | 40.6 | 12.2 | 10.1 | 4.7 | 0.3 | 1.2 | 3.84 | | | |
| | GB | 24.0 | 35.0 | 12.0 | 22.0 | 6.0 | 0.8 | 0.4 | 3.48 | 2302054.5 | .001 | .14 |
| b.There are risks to peope in Australia/Britain from climate change | Australia | 25.7 | 42.1 | 14.4 | 10.3 | 5.4 | 0.5 | 1.5 | 3.74 | | | |
| | GB | 19.1 | 47.1 | 14.2 | 12.4 | 4.0 | 0.7 | 2.4 | 3.68 | 2555897.0 | .001 | .04 |
| c.There are benefits to people in Australia/Britian from climate change | Australia | 1.3 | 9.8 | 26.8 | 34.1 | 22.2 | 2.1 | 3.6 | 2.30 | | | |
| | GB | 1.5 | 16.4 | 24.7 | 34.7 | 17.9 | 1.4 | 3.4 | 2.47 | 2310980.0 | .001 | .08 |
| d.I have mixed feelings about climate change | Australia | 4.4 | 31.6 | 25.1 | 21.1 | 15.7 | 1.3 | 0.9 | 2.88 | | | |
| | GB | 8.8 | 40.0 | 18.3 | 20.7 | 9.9 | 1.6 | 0.8 | 3.16 | 2320924.5 | .001 | .12 |
| e.I have strong opinions about climate change | Australia | 16.4 | 28.9 | 32.7 | 16.9 | 3.0 | 1.4 | 0.7 | 3.40 | | | |
| | GB | 19.3 | 31.9 | 25.3 | 18.3 | 4.1 | 1.1 | 0.1 | 3.44 | 2641369.0 | .05 | .03 |
| f.My emotions relating to climate change are quite strong | Australia | 12.9 | 25.4 | 33.5 | 20.9 | 5.4 | 1.4 | 0.6 | 3.20 | | | |
| | GB | 16.4 | 32.6 | 23.4 | 22.3 | 3.9 | 1.0 | 0.3 | 3.36 | 2504480.0 | .001 | .07 |
| g.I trust the Australian/British Government to take appropriate action against climate change | Australia | 2.6 | 13.1 | 17.2 | 33.7 | 30.6 | 1.2 | 1.5 | 2.21 | | | |
| | GB | 5.6 | 25.1 | 16.1 | 28.0 | 23.1 | 0.9 | 1.2 | 2.62 | 2202613.0 | .001 | .16 |
| h.The seriousness of climate change is exaggerated | Australia | 12.2 | 23.6 | 17.8 | 26.0 | 17.9 | 0.4 | 2.2 | 2.86 | | | |
| | GB | 12.0 | 27.6 | 15.0 | 28.3 | 13.9 | 0.7 | 2.4 | 2.93 | 2587840.0 | .07 | .02 |
| i.Most scientists agree that humans are causing climate change | Australia | 13.0 | 38.2 | 23.6 | 13.3 | 5.5 | 1.2 | 5.1 | 3.43 | | | |
| | GB | 14.5 | 42.2 | 17.1 | 16.4 | 4.3 | 1.4 | 4.0 | 3.49 | 2414630.5 | .03 | .03 |
| j.It is uncertain what the effects of climate change will be | Australia | 9.8 | 46.0 | 20.1 | 15.4 | 5.7 | 1.1 | 1.9 | 3.40 | | | |
| | GB | 13.9 | 55.6 | 12.3 | 11.3 | 3.9 | 0.9 | 2.2 | 3.64 | 2281965.0 | .001 | .12 |
| k.I am confident that science will find an answer to climate change before it becomes too big a problem | Australia | 2.7 | 19.1 | 29.3 | 30.2 | 13.3 | 1.9 | 3.3 | 2.66 | | | |
| l.There is enough common sense and goodwill in society to prevent climate change having any serious impact | Australia | 2.8 | 15.6 | 20.1 | 34.0 | 24.0 | 1.7 | 1.8 | 2.37 | | | |

*Note.* *The British survey framed the first item as 'uncertain' rather than 'certain', hence the scale percentages have been reversed in the table to align with the Australian results.

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

| | | 5.Strongly agree % | 4.Tend to agree % | 3.Neither agree nor disagree % | 2.Tend to disagree % | 1.Strongly disagree % | No opinion % | Don't know % | *M* | *U* | *p<* | *r* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a.I can personally help to reduce climate change by changing my behaviour | Australia | 18.1 | 47.1 | 17.7 | 10.0 | 5.4 | 0.7 | 1.0 | 3.64 | | | |
| | GB | 17.4 | 46.0 | 11.5 | 16.6 | 7.0 | 0.7 | 0.8 | 3.49 | 2585178.0 | 0.001 | .05 |
| b.A variety of external factors make it difficult for me to take actions that help to reduce climate change | Australia | 7.1 | 35.2 | 28.7 | 21.2 | 4.5 | 1.6 | 1.5 | 3.20 | | | |
| | GB | 14.2 | 43.3 | 18.2 | 17.7 | 3.4 | 2.2 | 1.0 | 3.47 | 2242286.5 | 0.001 | .14 |
| c.It is hard to take action against climate change even if I want to | Australia | 5.7 | 29.8 | 24.9 | 31.1 | 6.3 | 1.1 | 1.1 | 2.97 | | | |
| | GB | 10.5 | 44.0 | 11.8 | 25.2 | 6.1 | 1.0 | 1.4 | 3.29 | 2256482.0 | 0.001 | .14 |
| d.I personally feel that I can make a difference with regard to climate change | Australia | 9.5 | 38.4 | 25.4 | 17.9 | 6.5 | 1.1 | 1.2 | 3.27 | | | |
| | GB | 11.0 | 41.6 | 15.2 | 20.9 | 9.9 | 0.7 | 0.7 | 3.20 | 2671882.5 | 0.22 | .02 |
| e.I feel a sense of urgency to change my behaviour to help to reduce climate change | Australia | 8.6 | 27.0 | 32.6 | 20.8 | 9.3 | 1.1 | 0.6 | 3.05 | | | |
| | GB | 9.8 | 32.1 | 20.5 | 25.5 | 10.9 | 0.7 | 0.5 | 3.03 | 2742516.5 | 0.96 | .00 |
| f.It is my responsibility to help to do something about climate change | Australia | 16.4 | 43.7 | 24.3 | 7.9 | 5.9 | 1.0 | 0.8 | 3.58 | | | |
| | GB | 20.2 | 50.3 | 13.5 | 9.5 | 5.4 | 0.6 | 0.4 | 3.70 | 2515810.5 | 0.001 | .07 |
| g.I think that climate change is likely to be a serious problem for Britain | GB | 21.7 | 40.3 | 16.1 | 14.6 | 4.3 | 0.4 | 2.6 | 3.62 | | | |

**Q14. When, if at all, do you think Australia/Britain will start feeling the effects of climate change?**

| | | Australia % | GB % |
|---|---|---|---|
| 1 | We are already feeling the effects | 54.0 | 41.4 |
| 2 | In the next 10 years | 9.2 | 13.5 |
| 3 | In the next 25 years | 7.5 | 13.9 |
| 4 | In the next 50 years | 4.5 | 10.9 |
| 5 | In the next 100 years | 2.3 | 4.9 |
| 6 | Beyond the next 100 years | 2.6 | 4.3 |
| 7 | Never | 5.5 | 3.6 |
| | Don't know | 12.9 | 7.1 |
| | No opinion | 1.5 | 0.3 |

| | *M* | *U* | *p<* | *r* |
|---|---|---|---|---|
| Australia | 2.09 | | | |
| GB | 2.48 | 1848880 | .001 | .16 |

**Q15. To what extent do you agree or disagree with each of the following statements about climate change?**

| | | 5.Strongly agree % | 4.Tend to agree % | 3.Neither agree nor disagree % | 2.Tend to disagree % | 1.Strongly disagree % | No opinion % | Don't know % | *M* | *U* | *p*< | *r* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a.Climate change will mostly affect areas that are far away from here | Australia | 1.4 | 7.1 | 17.7 | 39.5 | 28.0 | 1.8 | 4.4 | 2.09 | | | |
| | GB | 6.9 | 25.2 | 15.1 | 33.4 | 15.2 | 0.9 | 3.2 | 2.73 | 1782804 | .001 | .26 |
| b.My local area is likely to be affected by climate | Australia | 15.8 | 44.8 | 18.4 | 10.2 | 4.6 | 1.0 | 5.2 | 3.61 | | | |
| | GB | 12.7 | 39.9 | 16.4 | 20.6 | 6.4 | 0.5 | 3.4 | 3.31 | 2174787 | .001 | .12 |
| c.Climate change will mostly affect developing countries | Australia | 5.0 | 17.7 | 20.6 | 28.6 | 21.4 | 1.3 | 5.3 | 2.53 | | | |
| | GB | 13.6 | 32.2 | 14.6 | 24.8 | 11.3 | 0.9 | 2.5 | 3.11 | 1886004 | .001 | .22 |
| d.Climate change is likely to have a big impact on people like me | Australia | 12.7 | 32.9 | 29.4 | 13.5 | 6.0 | 0.9 | 4.5 | 3.35 | | | |
| | GB | 11.0 | 33.6 | 19.9 | 24.6 | 7.7 | 0.6 | 2.5 | 3.14 | 2345238 | .001 | .08 |

**Q16. Considering any potential effects of climate change that might affect <u>you personally,</u> how concerned, if at all, are you about climate change?**

| | | Australia % | GB % |
|---|---|---|---|
| 4 | Very concerned | 19.6 | 16.8 |
| 3 | Fairly concerned | 42.2 | 43.0 |
| 2 | Not very concerned | 25.7 | 27.6 |
| 1 | Not at all concerned | 10.7 | 11.7 |
| | Don't know | 1.3 | 0.5 |
| | No opinion | 0.5 | 0.4 |

| | *M* | *U* | *p*< | *r* |
|---|---|---|---|---|
| Australia | 2.72 | | | |
| GB | 2.66 | 2635630.5 | .01 | .03 |

**Q17. Considering any potential effects of climate change that there might be on <u>society in general,</u> how concerned are you about climate change?**

| | | Australia % | GB % |
|---|---|---|---|
| 4 | Very concerned | 25.8 | 18.6 |
| 3 | Fairly concerned | 42.8 | 47.8 |
| 2 | Not very concerned | 20.9 | 23.3 |
| 1 | Not at all concerned | 8.7 | 8.0 |
| | Don't know | 1.3 | 1.4 |
| | No opinion | 0.5 | 1.0 |

| | *M* | *U* | *p*< | *r* |
|---|---|---|---|---|
| Australia | 2.87 | | | |
| GB | 2.79 | 2542147.5 | .001 | .05 |

**Q18. Which of the following do you think should be mainly responsible for taking action against climate change? (Australia - multiple options). Which one, if any, of these do you think should be mainly responsible for taking action against climate change? (GB - single option)**

| | Australia % | GB % |
|---|---|---|
| Environmental groups | 42.4 | 3.2 |
| Individuals and their families | 59.1 | 9.4 |
| Industry/ Companies | 74.5 | 15.2 |
| Local authorities | 52.3 | 3.1 |
| State Government | 63.1 | * |
| National Governments | 77.2 | 32.3 |
| The international community | 71.3 | 30.4 |
| None of these | 4.7 | 3.3 |
| Don't know | 3.6 | 2.2 |
| Other (please specify) | 4.6 | 0.9 |

**Q19. If you were to vote today, how do you think you would be likely to vote in relation to the following?**

| | | 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* | *U* | *p*< | *r* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a.Whether to build new nuclear power stations in Australia/Britain | Australia | 26.6 | 21.2 | 23.3 | 17.8 | 2.1 | 1.6 | 7.3 | 2.42 | | | |
| | GB | 26.0 | 20.0 | 24.9 | 16.6 | 6.7 | 2.1 | 3.7 | 2.57 | 2294185.5 | .001 | .05 |
| b.Whether to build new wind farms in Australia/Britain | Australia | 1.2 | 3.1 | 23.8 | 68.3 | 0.7 | 0.9 | 1.9 | 3.66 | | | |
| | GB | 4.9 | 6.8 | 29.5 | 52.2 | 3.0 | 1.3 | 2.3 | 3.42 | 2271087.0 | .000 | .14 |
| c.Whether to build new coal fired power stations in Australia/Britain | Australia | 23.4 | 37.9 | 19.4 | 4.7 | 1.8 | 2.8 | 9.9 | 2.12 | | | |
| | GB | 17.7 | 32.5 | 26.3 | 9.8 | 6.4 | 2.8 | 4.6 | 2.54 | 1813518.5 | .000 | .18 |
| d.Whether to spend taxpayers money on Australian/British projects designed to tackle climate | Australia | 9.9 | 12.2 | 37.7 | 29.7 | 2.1 | 2.2 | 6.1 | 3.02 | | | |
| | GB | 7.1 | 13.4 | 41.0 | 27.2 | 4.9 | 2.8 | 3.7 | 3.10 | 2358068.0 | .085 | .02 |

**Q.20 To what extent do you agree or disagree with the following statements?**

| | | 5.Strongly agree % | 4.Tend to agree % | 3.Neither agree nor disagree % | 2.Tend to disagree % | 1.Strongly disagree % | No opinion % | Don't know % | *M* | *U* | *p*< | *r* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a.I am prepared to greatly reduce my energy use to help tackle climate change | Australia | 18.0 | 46.2 | 16.9 | 12.0 | 5.6 | 0.5 | 0.8 | 3.60 | | | |
| | GB | 15.1 | 49.8 | 16.1 | 12.1 | 5.1 | 0.8 | 1.0 | 3.58 | 2701030.0 | .43 | .01 |
| b.I am prepared to pay significantly more money for energy efficient products | Australia | 3.6 | 19.6 | 20.7 | 29.7 | 24.6 | 0.5 | 1.3 | 2.47 | | | |
| | GB | 8.0 | 36.2 | 17.5 | 22.7 | 13.2 | 0.9 | 1.6 | 3.05 | 1993924.5 | .001 | .23 |

**Q21. To what extent do you agree or disagree with each of the following statements?**

| | | 5.Strongly agree % | 4.Tend to agree % | 3.Neither agree nor disagree % | 2.Tend to disagree % | 1.Strongly disagree % | No opinion % | Don't know % | *M* | *U* | *p<* | *r* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a.I think of myself as someone who is very concerned with environmental issues | Australia | 13.8 | 41.0 | 27.7 | 13.2 | 3.2 | 0.6 | 0.4 | 3.50 | | | |
| | GB | 16.4 | 40.0 | 22.3 | 15.9 | 4.1 | 0.9 | 0.4 | 3.49 | 2733160.5 | .51 | .01 |
| b.Being environmentally friendly is an important part of who I am | Australia | 14.3 | 41.3 | 28.1 | 11.5 | 3.7 | 0.7 | 0.4 | 3.51 | | | |
| | GB | 17.7 | 41.5 | 20.3 | 15.5 | 4.3 | 0.5 | 0.2 | 3.54 | 2686739.0 | .07 | .02 |
| c.I identify with the aims of environmental groups such as Greenpeace and Friends of the Earth | Australia | 11.0 | 30.5 | 28.4 | 16.9 | 9.7 | 1.9 | 1.5 | 3.17 | | | |
| | GB | 14.1 | 39.3 | 21.6 | 14.7 | 6.8 | 1.8 | 1.7 | 3.41 | 2302774.0 | .001 | .11 |

**Q22. I am concerned about environmental problems because of the consequences for_____**

| | 7.Extremely concerned | | | | | | 1.Not at all concerned | |
|---|---|---|---|---|---|---|---|---|
| | % | % | % | % | % | % | % | *M* |
| Plants | 24.9 | 24.0 | 22.8 | 15.3 | 5.8 | 3.9 | 3.2 | 5.22 |
| Me | 16.9 | 25.9 | 24.3 | 16.9 | 6.5 | 4.9 | 4.5 | 4.97 |
| People in the community | 17.5 | 25.7 | 26.3 | 16.4 | 5.9 | 4.0 | 4.2 | 5.04 |
| Marine life | 36.9 | 28.4 | 18.5 | 8.7 | 3.0 | 2.1 | 2.3 | 5.72 |
| My lifestyle | 10.0 | 18.1 | 26.9 | 23.5 | 9.9 | 5.9 | 5.7 | 4.54 |
| All people | 23.1 | 26.6 | 23.0 | 14.6 | 4.7 | 4.0 | 3.9 | 5.21 |
| Birds | 29.2 | 27.4 | 21.7 | 11.6 | 4.4 | 2.7 | 2.9 | 5.46 |
| My health | 22.1 | 26.9 | 21.6 | 14.7 | 5.6 | 4.5 | 4.6 | 5.14 |
| Children | 40.7 | 25.6 | 14.3 | 9.5 | 3.3 | 2.8 | 3.7 | 5.68 |
| Animals | 26.3 | 27.6 | 18.6 | 9.1 | 3.1 | 2.8 | 2.5 | 5.67 |
| My future | 18.7 | 25.7 | 23.2 | 17.0 | 5.7 | 4.4 | 5.3 | 5.00 |
| Future generations | 45.4 | 24.9 | 13.0 | 7.3 | 3.3 | 2.6 | 3.5 | 5.80 |

**Q23. 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?**

| | 6.Very concerned | | | | | 1.Not at all concerned | |
|---|---|---|---|---|---|---|---|
| | % | % | % | % | % | % | *M* |
| Bushfires | 26.9 | 25.7 | 20.6 | 10.2 | 9.9 | 6.7 | 4.29 |
| Cyclones | 16.9 | 19.7 | 21.4 | 15.4 | 14.6 | 12.0 | 3.73 |
| Floods (Coastal & Inland) | 20.1 | 24.3 | 22.2 | 14.6 | 11.1 | 7.7 | 4.05 |
| Sea level rise | 20.9 | 23.3 | 21.4 | 13.7 | 10.8 | 10.0 | 4.00 |
| Drought | 38.1 | 30.7 | 17.7 | 6.9 | 4.1 | 2.5 | 4.84 |
| Heatwaves | 32.6 | 30.3 | 19.0 | 8.8 | 5.8 | 3.6 | 4.64 |
| Water scarcity | 49.6 | 28.2 | 12.0 | 5.3 | 2.9 | 2.1 | 5.10 |
| Health threats relating to environmental changes/conditions | 22.9 | 30.5 | 24.9 | 10.4 | 6.8 | 4.5 | 4.39 |
| Species extinctions (e.g., biodiversity/habitat loss) | 38.0 | 28.2 | 17.9 | 8.1 | 4.4 | 3.3 | 4.77 |
| Threatened environmental quality and sustainability (e.g., land degredation, salinity, erosion, urban development) | 35.8 | 32.7 | 18.5 | 7.4 | 3.2 | 2.5 | 4.83 |
| Severe storm activity | 26.7 | 32.7 | 21.8 | 9.3 | 6.0 | 3.5 | 4.54 |
| Technological disasters (e.g., power plant accidents) | 28.9 | 26.2 | 22.2 | 11.2 | 8.0 | 3.5 | 4.46 |
| Impacts of climate change | 27.6 | 28.4 | 22.2 | 9.3 | 6.7 | 5.7 | 4.44 |

**Q24. How concerned are you that each of the additional issues and threats may adversely affect you or your family in the foreseeable future?**

| | 6.Very concerned | | | | | 1.Not at all concerned | |
|---|---|---|---|---|---|---|---|
| | % | % | % | % | % | % | *M* |
| Global financial crisis | 26.9 | 33.7 | 21.2 | 9.8 | 5.2 | 3.3 | 4.57 |
| Unemployment | 24.1 | 29.9 | 21.4 | 11.4 | 7.6 | 5.7 | 4.35 |
| Terrorism | 20.1 | 22.3 | 24.0 | 16 | 11.2 | 6.5 | 4.05 |
| Population growth pressures and developments | 28.1 | 29.7 | 23.4 | 10.9 | 4.8 | 3.0 | 4.56 |
| Serious health problems | 24.1 | 32.2 | 25.5 | 9.9 | 5.7 | 2.6 | 4.51 |
| International conflicts and security threats | 20.3 | 26.5 | 27.2 | 14.8 | 7.3 | 4.0 | 4.26 |
| Crime | 31.4 | 31.1 | 23.2 | 8.4 | 3.9 | 1.9 | 4.72 |
| Family pressures/crises | 21.5 | 28.2 | 26.6 | 12.9 | 7.0 | 3.9 | 4.32 |
| Natural disasters (e.g., bushfires, cyclones, floods, storms, drought) | 26.9 | 31.1 | 23.3 | 10.3 | 5.8 | 2.7 | 4.55 |
| Impacts of climate change | 24.5 | 27.5 | 22.8 | 10.9 | 7.8 | 6.6 | 4.30 |

**Q25. How important is the issue of climate change to you personally?**

| | % | *M* |
|---|---|---|
| Extremely important (6) | 18.1 | 4.14 |
| | 29.6 | |
| | 24.9 | |
| | 10.9 | |
| | 8.8 | |
| Not at all important (1) | 7.7 | |

**Q26. How much do you feel you know about climate change?**

| | % | *M* |
|---|---|---|
| A lot (6) | 8.1 | 4.07 |
| | 27.6 | |
| | 37.8 | |
| | 17.1 | |
| | 8.0 | |
| Nothing (1) | 1.3 | |

**Q27. How much do you trust what different sources say about the environment?**

| | 6.Completely | | | | | 1.Not at all | |
|---|---|---|---|---|---|---|---|
| | % | % | % | % | % | % | *M* |
| Scientists | 8.8 | 40.5 | 30.0 | 11.6 | 6.1 | 3.0 | 4.25 |
| Media | 0.3 | 4.2 | 21.7 | 26.0 | 27.9 | 19.8 | 2.64 |
| Government | 0.6 | 7.6 | 27.3 | 26.8 | 21.2 | 16.4 | 2.90 |

**Q28. How much agreement do you think there is among scientists that climate change is happening?**

| | % | *M* |
|---|---|---|
| Nearly all agree (6) | 8.5 | 3.61 |
| | 22.5 | |
| | 26.8 | |
| | 17.4 | |
| | 13.4 | |
| Considerable disagreement (1) | 11.4 | |

**Q29. Please answer each of these questions in terms of the way you generally feel when being in or thinking about the natural environment.**

| | 6.Strongly agree % | % | % | % | % | 1.Strongly disagree % | *M* |
|---|---|---|---|---|---|---|---|
| I often feel that I am a part of nature | 14.8 | 25.6 | 29.7 | 17.1 | 9.2 | 3.7 | 4.09 |
| I often feel close to the natural world around me | 14.8 | 27.1 | 28.6 | 17.0 | 9.0 | 3.6 | 4.11 |
| I often feel a personal bond with things in my natural surroundings, like trees, wildlife or the view on the horizon | 16.8 | 26.5 | 25.6 | 15.6 | 10.7 | 4.9 | 4.08 |
| I often feel connected to nature | 14.9 | 26.5 | 27.1 | 16.8 | 10.5 | 4.3 | 4.05 |
| My own welfare is linked to the welfare of the natural world | 21.2 | 27.1 | 25.5 | 14.9 | 7.7 | 3.6 | 4.28 |
| I recognise and appreciate the intelligence of other living things | 32.6 | 35.7 | 19.8 | 7.4 | 2.8 | 1.6 | 4.83 |

**Q30. In the following statements, natural environments refer to natural areas that are familiar to you and which you may have visited and spent some time in regularly or occasionally (e.g., national or state parks, coastal areas, woodlands, rivers, mountains, lakes, countryside and rural areas).**

| | 6.Strongly agree % | % | % | % | % | 1.Strongly disagree % | *M* |
|---|---|---|---|---|---|---|---|
| I frequently engage in activities that are located in the natural environment | 16.2 | 26.8 | 26.5 | 15.8 | 10.4 | 4.4 | 4.09 |
| My employment is such that I am often working or traveling outdoors in natural settings | 5.7 | 7.3 | 13.1 | 15.5 | 23.0 | 35.3 | 2.51 |
| I have resided for part of my life in the country | 32.4 | 19.4 | 12.7 | 7.3 | 11.2 | 17.0 | 4.03 |
| I often spend time with family and friends relaxing in the natural environment | 17.3 | 26.5 | 25.2 | 14.7 | 11.1 | 5.2 | 4.08 |
| I prefer to spend my time in the country rather than the city | 33.6 | 21.9 | 18.7 | 12.2 | 8.6 | 5.2 | 4.44 |

**Q31. How would you rate the condition of the natural environment in the world today?**

| | % | *M* |
|---|---|---|
| Excellent (6) | 1 | 3.44 |
| | 11.9 | |
| | 38.6 | |
| | 30.9 | |
| | 14 | |
| Very poor (1) | 3.7 | |

**Q32. How serious a problem do you think climate change is right now?**

| | % | *M* |
|---|---|---|
| Very serious (6) | 19.4 | 4.10 |
| | 25.2 | |
| | 24.8 | |
| | 13.7 | |
| | 10.2 | |
| Not serious at all (1) | 6.7 | |

**Q33. How would you rate the condition of the natural environment in your own local region of Australia?**

| | % | *M* |
|---|---|---|
| Excellent (6) | 6.0 | 4.12 |
| | 32.0 | |
| | 38.5 | |
| | 16.3 | |
| | 5.7 | |
| Very poor (1) | 1.6 | |

**Q34. What actions are you currently taking to reduce your carbon footprint? (Please tick any that apply)**

| | % |
|---|---|
| Using less electricity | 79.6 |
| Using compact florescent light bulbs | 82.8 |
| Using less water | 79.7 |
| Buying energy from renewable sources/hydro/wind/solar power | 17.9 |
| Driving less | 48.4 |
| Using less petrol | 48.4 |
| Buying/using smaller/fuel efficient car | 34.0 |
| Carpooling | 9.8 |
| Walking/bicycling/scootering | 40.3 |
| Reducing travel/vacation travel | 24.1 |
| Using trains/buses/subways/other public transport/mass transit | 25.9 |
| Recycling | 88.2 |
| Buying local food/organic food/growing own food | 39.9 |
| Buying carbon offsets | 5.8 |
| Reducing air travel | 17.8 |
| Nothing | 2.8 |
| Other (please specify) | 3.9 |

**Q35. What do you think are the main reasons why you are taking these actions?**

Qualitative analysis

**Q36. Why do you think you are not taking more actions than you are to address climate change? What are the main reasons for you? (Please tick all those that apply for you)**

| | % |
|---|---|
| Not necessary/not worth it | 8.9 |
| Lack of interest/awareness/motivation | 10.5 |
| Don't think it's necessary | 13.0 |
| Too expensive | 52.7 |
| Don't believe climate change is happening | 10.3 |
| Too inconvienient/too much effort | 15.9 |
| Too big a problem for me/for one person/for individual action to have any impact | 16.6 |
| Don't think it'll do any good | 10.6 |
| Don't know what to do | 14.8 |
| No opinion | 8.4 |
| Other (please specify) | 14.9 |

**Q37. Please click the response that best indicates your level of agreement with each statement below.**

| | 6.Strongly agree | | | | | 1.Strongly disagree | |
|---|---|---|---|---|---|---|---|
| | % | % | % | % | % | % | *M* |
| I believe my actions have an influence on climate change | 9.3 | 22.2 | 32.7 | 16.2 | 11.1 | 8.5 | 3.77 |
| I believe my actions have a positive influence on how I am feeling and thinking about climate change and environmental problems generally | 11.6 | 31.8 | 32.5 | 13.4 | 6.4 | 4.4 | 4.16 |
| 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 | 6.3 | 20.8 | 29.2 | 19.9 | 14.0 | 9.8 | 3.56 |
| Human beings are responsible for global warming and climate change | 18.9 | 25.5 | 23.2 | 12.4 | 10.2 | 9.8 | 4.01 |
| Humans have little control over the forces of nature such as climate change | 12.0 | 18.8 | 19.8 | 21.2 | 16.6 | 11.7 | 3.54 |
| I believe that climate change is inevitable, no matter what we try and do to stop it | 8.3 | 13.8 | 17.7 | 28.0 | 20.6 | 11.6 | 3.26 |

**Q38. How much of the information provided in the stories written and broadcast by news organisations would you say is accurate?**

| | % | *M* |
|---|---|---|
| Most of it (6) | 1.5 | 3.15 |
| | 10.0 | |
| | 31.2 | |
| | 26.3 | |
| | 20.5 | |
| Very little of it (1) | 10.4 | |

**Q39. How closely are you following news about the environment these days?**

| | % | *M* |
|---|---|---|
| A great deal (6) | 8.9 | 3.79 |
| | 24.3 | |
| | 28.3 | |
| | 19.8 | |
| | 13.3 | |
| Not at all (1) | 5.5 | |

**Q40. How often do you find yourself thinking about the issue of climate change?**

| | % | *M* |
|---|---|---|
| A great deal (6) | 6.5 | 3.54 |
| | 20.2 | |
| | 28.2 | |
| | 18.9 | |
| | 18.5 | |
| Not at all (1) | 7.8 | |

**Q41. Please indicate whether you think the following statements are true of false. If you do not know, just click on "Don't know", rather than asking someone else.**[3]

| | TRUE % | FALSE % | DON'T KNOW % |
|---|---|---|---|
| The projected average sea level rise provided by the IPCC for the remainder of this century (2010-2099) is between 18-59 cm's | 35.5 | 10.2 | 54.3 |
| Australia is one of the most exposed nations with respect to projected impacts of climate change | 44.3 | 24.1 | 31.6 |
| Climate change will increase the risk in Australia for diseases transmitted by water and mosquitoes over the next 100 years | 39.8 | 23.3 | 37.0 |
| Globally, the current burning of fossil fuels accounts for 80-85% (CO2) emissions added to the atmosphere | 47.1 | 15.0 | 37.9 |
| Methane is emitted mainly from fossil fuels | 16.9 | 49.8 | 33.3 |
| Climate change is mainly caused by the hole in the ozone layer | 20.6 | 57.8 | 21.6 |
| Australia produces about 5.5% of the planet's carbon emissions | 23.4 | 17.8 | 58.7 |
| Australia's average temperature has increased by approximately 1°C from 1910 to 2002 | 59.4 | 12.9 | 27.6 |
| The change in global temperature for the last 100 years is greater than for the last 1000 years | 46.8 | 14.9 | 38.3 |
| The number of weather-related disasters around the world has doubled since the mid 1990s | 47.4 | 15.6 | 37.0 |

[3] The highlighted text indicates the correct responses to the knowledge statements.

**Q42. How certain are you about the correctness of the answers you have given to the above true/false statements?**

| | % | *M* |
|---|---|---|
| Certain (6) | 10.6 | 3.82 |
| | 24.4 | |
| | 27.8 | |
| | 17.4 | |
| | 13.3 | |
| Uncertain (1) | 6.4 | |

**Q43. Please indicate the extent to which each of the following statements reflects your own response to the threat of climate change.**

| | 6.Strongly agree % | % | % | % | % | 1.Strongly disagree % | *M* |
|---|---|---|---|---|---|---|---|
| I experience some distress each time I see or read media coverage of the likely impacts and consequences of climate change | 5.6 | 18.0 | 27.6 | 17.7 | 19.2 | 11.9 | 3.37 |
| At times I find myself thinking and worrying about what the world will really be like for future generations because of climate change | 12.9 | 24.7 | 22.9 | 13.9 | 14.5 | 11.1 | 3.74 |
| 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 | 5.1 | 16.4 | 22.7 | 18.9 | 19.9 | 16.9 | 3.17 |
| It upsets me that there seems to be so little that I can do to address environmental problems such as climate change | 6.0 | 16.8 | 26.3 | 20.3 | 17.8 | 12.9 | 3.34 |
| At times I feel some personal responsibility for the problems and unfolding impacts of climate change | 2.8 | 9.4 | 21.4 | 19.9 | 23.8 | 22.6 | 2.79 |
| The threat of climate change is affecting my quality of life and my assessment of environmental quality more generally | 1.7 | 7.7 | 19.2 | 23.1 | 27.3 | 21.1 | 2.70 |
| I feel some sense of loss because of climate change impacts that are becoming apparent in my local area | 3.1 | 9.0 | 18.0 | 22.9 | 26.4 | 20.7 | 2.77 |

**Q45. Please indicate the extent to which each of the following statements best describes your own response to the threat of climate change.**

| | 6.Strongly agree % | % | % | % | % | 1.Strongly disagree % | *M* |
|---|---|---|---|---|---|---|---|
| I have changed the way I think about the seriousness of environmental problems because of climate change | 7.4 | 23.5 | 26.4 | 16.8 | 15.8 | 10.1 | 3.59 |
| Increasingly I find myself less likely to attend to media reports, articles and discussions about the nature or impacts of climate change | 8.2 | 17.7 | 22.9 | 23.2 | 19.2 | 8.7 | 3.46 |
| I have seriously thought about alternative places to live because of the increasingly evident impacts of climate change | 4.0 | 7.0 | 10.2 | 11.0 | 25.5 | 42.2 | 2.26 |
| 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 | 9.0 | 22.0 | 24.7 | 14.3 | 16.6 | 13.2 | 3.53 |
| I have often discussed my thoughts and feelings about climate change with others over the past several years | 11.1 | 22.3 | 20.6 | 15.1 | 17.9 | 13.0 | 3.54 |
| 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 | 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 | 18.8 | 30.4 | 23.7 | 12.6 | 7.9 | 6.7 | 4.20 |

**Q46. Which of the following statements best describes how you feel about climate change?**

| | % |
|---|---|
| The issue is overwhelming and I feel helpless | 6.8 |
| I am frustrated that not enough is being done | 25.1 |
| I am hopeful that if we take action now, we can stop it | 34.6 |
| I am tired of hearing about it and I want to see some action taken | 33.5 |

**Q47. 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?**

| | % |
|---|---|
| Yes | 35.7 |
| No | 64.3 |

**Q48. Can you briefly indicate what these changes or events were or are?**

Qualitative analysis

**Q49. Have you directly experienced any other noteworthy environmental changes, circumstances, or events elsewhere in Australia or the world which you think might be due to climate change?**

| | % |
|---|---|
| Yes | 24.5 |
| No | 75.5 |

**Q50. Can you briefly indicate what and where these circumstances or events were?**

Qualitative analysis

**Q51. Overall, how much do you think climate change is influencing the frequency and intensity of weather events like storms and droughts?**

| | % | *M* |
|---|---|---|
| A good deal (6) | 19.3 | 4.14 |
| | 28.6 | |
| | 22.9 | |
| | 11.5 | |
| | 10.9 | |
| Not at all (1) | 6.8 | |

**Q52. Have you ever experienced a natural disaster warning or natural disaster impact situation?**

| | % |
|---|---|
| Yes | 37.4 |
| No | 62.6 |

**Q53. If yes, please indicate the type of event(s) and the approximate number of times you may have experienced such an event?**

| | Cyclone | | Bushfire | | Drought | | Flood | | Other (please specify) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Frequency | % | Frequency | % | Frequency | % | Frequency | % | Frequency | % |
| 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 |

**Q54. Overall how much property damage did you experience in this or these situations?**

| | % | *M* |
|---|---|---|
| Considerable damage (6) | 2.9 | 2.71 |
| | 4.4 | |
| | 5.0 | |
| | 4.1 | |
| | 8.4 | |
| No damage (1) | 12.5 | |
| Not applicable | 62.6 | |

**Q55. Overall how much anxiety and stress did you experience in this or these situations?**

| | % | *M* |
|---|---|---|
| Considerable stress (6) | 7.0 | 4.12 |
| | 10.8 | |
| | 7.9 | |
| | 5.4 | |
| | 4.2 | |
| No stress (1) | 2.1 | |
| Not applicable | 62.6 | |

**Q56. How vulnerable do you think the region where you live is to natural disasters (e.g., floods, droughts, cyclones, and bushfires)?**

| | % | *M* |
|---|---|---|
| Very vulnerable (6) | 15.0 | 3.78 |
| | 22.5 | |
| | 22.2 | |
| | 13.9 | |
| | 18.2 | |
| Not vulnerable (1) | 8.2 | |

**Q57. How vulnerable do you think the region where you live is to the impacts of climate change?**

| | % | *M* |
|---|---|---|
| Very vulnerable (6) | 10.4 | 3.72 |
| | 22.6 | |
| | 26.1 | |
| | 18.1 | |
| | 14.6 | |
| Not vulnerable (1) | 8.2 | |

**Q58. There have been a number of films, television mini-series, and documentaries addressing climate change over the past few years. (Please indicate which of the following you may have seen)**

| | Yes % | No % | No response % |
|---|---|---|---|
| The Day after Tomorrow (Commercial film) | 51.3 | 45.6 | 3.2 |
| An Inconvenient Truth - Al Gore | 29.6 | 66.3 | 4.2 |
| Burn Up Canadian (ABC mini-series 25 April and 2 May, 2010) | 1.0 | 92.0 | 7.0 |
| Six Degrees (National Geographic documentary) | 6.8 | 86.8 | 6.4 |
| The 11th Hour (Narrated by Leonardo DiCapricio) | 6.5 | 86.8 | 6.8 |
| Catalyst (ABC program about Antarctica 29 April 2010) | 22.1 | 72.3 | 5.6 |
| State of the Planet (BBC David Attenborough documentary series) | 18.4 | 76.2 | 5.5 |
| Earth 2100 (ABC mini series) | 5.6 | 87.9 | 6.5 |
| Home (You Tube) | 1.4 | 91.6 | 7.0 |
| Not Evil Just Wrong (Commercial film) | 0.5 | 92.4 | 7.1 |
| The Great Warming (Narrated by Keanu Reeves & Alanis Morrisette) | 2.9 | 90.1 | 6.9 |
| Age of Stupid (Commercial film) | 1.0 | 91.8 | 7.2 |
| Everything's Cool (Documentary film) | 0.5 | 92.2 | 7.2 |
| No Impact Man (Documentary film) | 0.8 | 91.5 | 7.7 |
| Other (please indicate any other films, documentaries or mini-series you have watched (undergoing analysis) | | | |

**Q59. Please indicate the extent to which you agree or disagree with each of the following statements.**

| | 6.Strongly agree % | % | % | % | % | 1.Strongly disagree % | *M* |
|---|---|---|---|---|---|---|---|
| Climate change will have a noticeable negative impact on my health (over the next 25 years) | 6.2 | 15.4 | 28.8 | 18.5 | 18.9 | 12.2 | 3.35 |
| Climate change will have a noticeable negative impact on my economic and financial situation (over the next 25 years) | 11.6 | 28.5 | 25.9 | 13.8 | 12.8 | 7.3 | 3.90 |
| Climate change will have a noticeably negative impact on the environment in which my family and I live | 13.9 | 28.1 | 25.8 | 13.0 | 12.0 | 7.3 | 3.97 |
| | High risk % | | | | | No risk % | |
| In your opinion, what is the risk of climate change exerting a significant impact on public health in your state? | 7.5 | 22.6 | 30.4 | 18.7 | 13.8 | 7.0 | 4.02 |
| In your opinion, what is the risk of climate change exerting a significant impact on economic development in your state? | 11.2 | 30.5 | 28.1 | 14.5 | 10.1 | 5.6 | 4.13 |
| In your opinion, what is the risk of climate change exerting a significant impact on the environment in your state? | 15.3 | 32.0 | 24.9 | 12.1 | 9.9 | 5.8 | 3.95 |

**Q60. 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?**[4]

| | % | *M* |
|---|---|---|
| Increased substantially (6) | 7.5 | 3.95 |
| | 19.2 | |
| | 44.3 | |
| | 21.9 | |
| | 4.3 | |
| Decreased substantially (1) | 2.9 | |

**Q61. If your views have changed at all could you briefly explain why and how they have changed?**

Qualitative analysis

**Q62. Is there anything you would like to say about your views on climate change or natural disasters which the survey has not addressed?**

Qualitative analysis

[4] In point of fact the ABS survey item relating to climate change concern levels was not included in the census survey but in a separate survey 'Environmental Views and Behaviour 2007-2008'.

**Q63. In what year were you born?**

| Age range | % |
|---|---|
| 15-17 | 1 |
| 18-24 | 7 |
| 25-34 | 19 |
| 34-44 | 20 |
| 45-54 | 21 |
| 55-64 | 20 |
| 65-74 | 10 |
| 75 and older | 2 |

**Q64. What is your current employment status?**

| | % |
|---|---|
| Working – full time (30 + hrs per week) | 38.2 |
| Working – part time (up to 30 hrs per week) | 19.6 |
| Unemployed – seeking work | 3.1 |
| Unemployed – not seeking work | .8 |
| Not working – retired | 15.4 |
| Not working – looking after house/children | 8.0 |
| Not working – disabled | 4.2 |
| Student | 6.1 |
| Other | 4.2 |

**Q65. Please indicate the highest level of education you have completed?**

| | % |
|---|---|
| Year 10 or less | 13.1 |
| Year 11 | 4.8 |
| Year 12 | 17.1 |
| College certificate or diploma | 21.4 |
| Trade qualification/apprenticeship | 12.0 |
| Undergraduate degree | 19.4 |
| Postgraduate degree | 10.9 |
| Other | 1.2 |

**Q66. What is your current (or last) main occupation?**

| | % |
|---|---|
| Manager | 12.0 |
| Professional | 22.2 |
| Technician/Trade worker | 7.5 |
| Community & Personal service | 4.2 |
| Domestic duties | 4.0 |
| Labourer | 3.9 |
| Machinery operator/driver | 3.1 |
| Sales worker | 7.0 |
| Clerical/Admin | 16.6 |
| Retired | 5.7 |
| Other | 13.4 |

**Q67. Do you have children or grandchildren?**

| | % |
|---|---|
| Yes | 67.8 |
| No | 31.8 |

**Q68. How many do you have?**

| **Children** | **%** |
|---|---|
| One | 13.0 |
| Two | 28.9 |
| Three | 15.0 |
| Four | 6.4 |
| Five or more | 4.1 |

| **Grandchildren** | **%** |
|---|---|
| One to three | 13.1 |
| Four to six | 7.4 |
| Seven to nine | 3.4 |
| Ten to twelve | 1.0 |
| Thirteen to fifteen | .6 |
| Sixteen or more | .5 |

**Q69. Which of the following would best describe the residential circumstance that you have had for most of your life?**

| | % |
|---|---|
| Urban | 12.4 |
| Suburban | 57.8 |
| Country town | 18.3 |
| Rural | 6.5 |
| Rural residential | 5.1 |

**Q70. How would you describe your current residential circumstances?**

| | % |
|---|---|
| Urban | 13.9 |
| Suburban | 56.8 |
| Country town | 16.8 |
| Rural | 7.3 |
| Rural residential | 5.2 |

**Q71. What is the name of the closest city or town to where you currently reside?**
(Qualitative analysis)

**Q72. Approximately, how far in km's is your house from the town centre or central business district (CBD)?**

| | % |
|---|---|
| 0 - 25kms | 85.4 |
| 26 - 50kms | 12.8 |
| 51 – 100 kms | 1.5 |
| 101 – 250 kms | .2 |
| Over 250 kms | .1 |

**Q73. How close do you live to areas frequently affected by extreme weather events or natural disasters?**

| | % |
|---|---|
| 0 - 25kms | 34.9 |
| 26 - 50kms | 13.0 |
| 51 – 100 kms | 12.0 |
| 101 – 250 kms | 12.8 |
| Over 250 kms | 27.3 |

**Q74. Approximately, how many km's do you live from the nearest Australian coastline?**

| | % |
|---|---|
| 0 - 25kms | 61.2 |
| 26 - 50kms | 16.4 |
| 51 – 100 kms | 7.3 |
| 101 – 250 kms | 9.2 |
| Over 250 kms | 5.9 |

**Q75. How would you vote if there was a Federal Election tomorrow?**

| | % |
|---|---|
| Labor | 29.6 |
| Liberal | 33.6 |
| National Party | 3.4 |
| Greens | 14.5 |
| Independent | 7.9 |
| Other | 11.0 |

**Q76. What is your country of birth?**

| | % |
|---|---|
| Australia | 74.6 |
| Other | 25.4 |

**Q77. If born outside of Australia, for how many years have you lived in Australia?**

| | % |
|---|---|
| 0 – 10 years | 29.9 |
| 11 - 20 years | 12 |
| 21 – 30 years | 14.9 |
| 31 – 40 years | 17.5 |
| 41 to 50 years | 15.5 |
| More than 50 years | 10.2 |

**Q78. For how many years have you lived in the general area that you are now living?**

| | % |
|---|---|
| 0 – 10 years | 42.9 |
| 11 - 20 years | 22.2 |
| 21 – 30 years | 16.1 |
| 31 – 40 years | 8.6 |
| 41 to 50 years | 4.7 |
| More than 50 years | 2.6 |

**Q79. What are your current living arrangements?**

| | % |
|---|---|
| Buying with mortgage/loan | 35.9 |
| Own home outright | 27.9 |
| Part rent/part mortgage | 3.3 |
| Renting (including rents paid by housing benefit) | 26.6 |
| Living here rent free | 5.7 |

**Q80. Please indicate your approximate annual combined household income (before tax).**

| | % |
|---|---|
| $40,000 or less | 26.6 |
| $40,001 - $60,000 | 16.9 |
| $60,001 - $80,000 | 16.1 |
| $80,001 - $$100,000 | 14.8 |
| $100,001 - $150,000 | 17.5 |
| $150,001 - $200,000 | 4.3 |
| Greater than $200,000 | 1.7 |

**Q81. Have you completed a survey over the last two years addressing environmental issues and/or climate change?**

| | % |
|---|---|
| Yes | 11.2 |
| No | 88.3 |

## APPENDIX J: COMPOSITE MEASURES[5]

| Variable | No of items | Items | Illustrative item | Range | *M* | *SD* | α |
|---|---|---|---|---|---|---|---|
| **Residential exposure** | 3 | 56, 57, 73 | 57. How vulnerable do you think the region where you live is to the impacts of climate change. | 3 - 17 | 10.64 | 3.57 | .66 |
| **Objective knowledge** | 10 | 41a-j | 41h. Australia's average temperature has increased by approximately 1°C from 1910 to 2002. | -7 - 10 | 2.69 | 2.91 | - |
| **[6]Connection to nature** | 6 | 29a - f | 29b. I often feel close to the natural world around me. | 6 - 36 | 25.44 | 6.92 | .94 |
| **Green identity** | 3 | 21a - c | 21a. I think of myself as someone who is very concerned with environmental issues. | 3 - 15 | 10.16 | 2.74 | .85 |
| **Trust** | 4 | 12g, 27a - c | 12. I trust the Australian Government to take appropriate action against climate change | 4 – 23 | 12.03 | 3.45 | .73 |
| **Media exposure** | 14 | 58a - n | 58a. Please indicate which of the following you may have seen – The Day after Tomorrow | 0 - 14 | 1.48 | 1.53 | - |
| **[7]Belief in climate change** | 4 | 8, 9, 12a, 14 | 12a. I am certain that climate change is happening | 4 - 20 | 15.90 | 4.16 | .85 |
| **Climate change concern** | 7 | 7,16,17,10,11, 23m,32 | 7. How concerned, it at all, are you about climate change, sometimes referred to as 'global warming'? | 7 - 32 | 23.34 | 6.61 | .95 |
| **[8]Risk perception** | 5 | 59a - e | 59a. Climate change will have a noticeably negative impact on my health (over the next 25 years) | 5 - 30 | 18.94 | 5.90 | .90 |
| **Distress** | 7 | 43a - g | 43b. At times I find myself thinking and worrying about what the world will really be like for future generations because of climate change | 7 - 42 | 21.90 | 8.31 | .93 |
| **Felt personal responsibility and willingness to act** | 4 | 13e – f, 20a - b | 13e. I feel a sense of urgency to change my behaviour to help to reduce climate change. | 4 – 20 | 12.69 | 3.54 | .82 |
| **Self-efficacy** | 5 | 13a,d, 37a,b,c | 13a. I can personally help to reduce climate change by changing my behaviour. | 5-28 | 18.38 | 5.13 | .89 |
| **Adaptation** | 8 | 45a,c,d,e,f,g, 39,40 | 43e. I have often discussed my thoughts and feelings about climate change with others over the past several years | 8 – 48 | 28.65 | 8.69 | .89 |
| **Behaviour** | 15 | 34a – 0 | 34 l, m. What actions are you currently taking to reduce your carbon footprint? Recycling, buying local food/organic food/growing own food. | 0 - 15 | 6.43 | 2.89 | |

[5] A number of survey items included the response option of 'don't know' and/or 'no opinion'. These items were recoded back to the mid-point before computing the composite variable.

6 The scale is based on Gosling and Williams's (2010) connectedness to nature scale, originally developed by Mayer and Frantz (2004) and Dutcher, Finley, Luloff and Johnson (2007).

[7] This scale is based on respondents who answered "yes" to question 8, selected "climate change is mainly/entirely caused by human activity" for #9, either "tend to agree" or "strongly agree" with item 12a, and selected "we are already feeling the effects" to question 14.

[8] This scale is based on Kellsted et al's., (2008) climate change risk perception measure.

## APPENDIX K: CORRELATION TABLE

| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1**. Prior disaster Experience | .07* | .12** | .20** | .16** | .14** | .13** | .20** | .15** | .25** | .19** | .01 | .03 | .09** | .13** | .14** | .12** | .01 | .14** | .04 | .02 |
| **2**. Belief in CC | | .82** | .60** | .62** | .60** | .62** | .59** | .34** | .38** | .33** | .48** | .52** | .16** | .47** | .17** | .41** | .15** | - .14** | .08** | .02 |
| **3**. CC Concern | | | .73** | .78** | .73** | .76** | .73** | .44** | .46** | .45** | .55** | .53** | .21** | .61** | .21** | .43** | .19** | -.13** | .08** | .04* |
| **4**. Risk Appraisal | | | | .71** | .59** | .57** | .64** | .37** | .45** | .40** | .43** | .44** | .19** | .45** | .19** | .39** | .15** | -.13** | .05** | .04* |
| **5**. Distress | | | | | .66** | .68** | .78** | .42** | .42** | .51** | .49** | .47** | .26** | .59** | .23** | .39** | .14** | -.14** | .07** | .04* |
| **6**. Self-efficacy | | | | | | .79** | .69** | .50** | .38** | .51** | .49** | .40** | .24** | .61** | .20** | .35** | .18** | -.09** | .08** | .02 |
| **7**. Responsibility | | | | | | | .69** | .48** | .36** | .45** | .48** | .43** | .22** | .63** | .23** | .35** | .17** | -.09** | .09** | .03 |
| **8**. Adaptation | | | | | | | | .53** | .46** | .63** | .42** | .46** | .42** | .70** | .32** | .44** | .11** | -.02 | .12** | .06** |
| **9**. Behaviour | | | | | | | | | .26** | .42** | .24** | .30** | .25** | .48** | .28** | .26** | .09** | .07** | .08** | .06** |
| **10**. Residential Exposure | | | | | | | | | | .34** | .23** | .31** | .16** | .33** | .15** | .35** | .13** | -.01 | .03 | .05** |
| **11**. Connection to nature | | | | | | | | | | | .25** | .28** | .40** | .62** | .22** | .29** | .10** | .07** | .09** | .08** |
| **12**. Trust | | | | | | | | | | | | .31** | .14** | .34** | .13** | .24** | .14** | -.14** | .01 | -.13* |
| **13**. Objective Knowledge | | | | | | | | | | | | | .19** | .36** | .19** | .31** | .04* | -.09** | .11** | .002 |
| **14**. Subjective Knowledge | | | | | | | | | | | | | | .39** | .25** | .19** | -.11** | .06** | .11** | .01 |
| **15**. Green Self Identity | | | | | | | | | | | | | | | .27** | .34** | .15** | .01 | .08** | .09** |
| **16**. Media Exposure | | | | | | | | | | | | | | | | .22** | -.05* | -.01 | .11** | -.001 |
| **17**. Direct Experience CC | | | | | | | | | | | | | | | | | .05** | -.04* | .05** | .03 |
| **18**. Gender | | | | | | | | | | | | | | | | | | -.14** | .02 | .09** |
| **19**.Age | | | | | | | | | | | | | | | | | | | -.05** | -.05** |
| **20**. Education | | | | | | | | | | | | | | | | | | | | .01 |
| **21**.Voting Intention | | | | | | | | | | | | | | | | | | | | |

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

| CC Variable | Gender | | Age (in years) | | | Educational Attainment | | | (Grand) Parental Status | | Employment Status | | Residential Status | | Voting Intention | | Country of Birth | | Home Ownership | | Income (household $000 p.a.) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M | F | < 35 | 35 - 54 | 55+ | HS | Trade / Cert | Uni | Yes | No | Emp | Not Emp | Urban | Rural | Green / Labor | All other | Aus | No-Aus | Yes | No | <$60 | $60-$100 | > $100 |
| *N* ≤ | *1455* | *1641* | *819* | *1301* | *976* | *1087* | *1070* | *939* | *2098* | *984* | *1791* | *1169* | *2190* | *906* | *1358* | *1738* | *2309* | *777* | *2079* | *1002* | *1345* | *955* | *730* |
| Residential exposure | 10.2 | 11.1*** | 10.5 b | 10.9*** | 10.4 b | 10.4b | 10.9*** | 10.6 | 10.7 | 10.6 | 10.6 | 10.6 | 10.2 | 11.7*** | 11.1*** | 10.3 | 10.7 | 10.7 | 10.6 | 10.7 | 10.9*** | 10.6 | 10.3 a |
| Lifestyle exposure | 15.0 | 15.1 | 14.1 b | 15.3 | 15.6*** | 14.8b | 15.6*** | 14.8 b | 15.5*** | 14.2 | 15.0 | 15.0 | 13.8 | 18.2*** | 15.1 | 15.0 | 15.3*** | 14.5 | 15.2 | 14.9 | 15.7*** | 14.8 b | 14.2 a |
| Prior adverse. experience | 6.6 | 6.6 | 6.1 b | 6.7 | 6.9*** | 6.1 a | 6.9*** | 6.8 | 6.8** | 6.2 | 6.5 | 6.5 | 6.2 | 7.5*** | 6.8 | 6.5 | 6.6 | 6.4 | 6.6 | 6.5 | 6.7 | 6.5 | 6.5 |
| Connection to nature | 24.7 | 26.1*** | 24.5 b | 25.7 | 25.9*** | 24.6a | 25.8 | 26.1*** | 25.4 | 25.5 | 25.2 | 25.6 | 25.0 | 26.6*** | 26.5*** | 24.6 | 25.2 | 26.3*** | 25.4 | 25.5 | 26.1*** | 25.3 b | 24.7 b |
| Trust | 11.6 | 12.4*** | 12.8*** | 12.0 b | 11.5 a | 12.0 | 11.9 | 12.1 | 11.8 | 12.5*** | 12.0 | 12.1 | 12.2 | 11.7*** | 13.0*** | 11.2 | 11.9 | 12.3** | 11.9 | 12.3** | 12.2 | 12.0 | 11.9 |
| Objective knowledge | 2.6 | 2.8* | 3.1*** | 2.7 b | 2.4 a | 2.4 b | 2.6 b | 3.1*** | 2.6 | 3.0*** | 2.8 | 2.5 | 2.7 | 2.6 | 3.3*** | 2.2 | 2.7 | 2.8 | 2.6 | 2.9** | 2.7 | 2.7 | 2.8 |
| Subjective knowledge | 4.2*** | 4.0 | 4.0 b | 4.1 | 4.2** | 3.9 a | 4.1 b | 4.2*** | 4.1 | 4.1 | 4.1 | 4.1 | 4.0 | 4.1* | 4.2*** | 4.0 | 4.1 | 4.1 | 4.1 | 4.1 | 4.1 | 4.1 | 4.1 |
| Biospheric values | 20.9 | 23.1*** | 21.9 b | 22.6*** | 21.5 b | 21.6a | 22.4*** | 22.3 | 22.0 | 22.1 | 22.0 | 22.1 | 22.0 | 22.2 | 23.1*** | 21.2 | 21.9 | 22.4* | 22.1 | 22.1 | 22.3 | 22.0 | 21.7 |
| Altruistic values | 20.5 | 22.8*** | 22.2*** | 22.1 | 20.8 a | 21.4 | 21.9 | 22.0 | 21.9* | 21.4 | 21.7 | 21.7 | 21.7 | 21.7 | 23.0*** | 20.8 | 21.6 | 22.0 | 21.7 | 21.7 | 21.8 | 21.8 | 21.6 |
| Egoisitic values | 18.6 | 20.6*** | 20.5*** | 20.0 b | 18.5 a | 19.7 | 19.6 | 19.7 | 19.6 | 19.9 | 19.7 | 19.5 | 19.7 | 19.6 | 20.5*** | 19.0 | 19.6 | 19.9 | 19.6 | 19.7 | 19.7 | 19.8 | 19.6 |
| Green identity | 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 | 10.1 | 10.1 | 10.3* | 10.9*** | 9.6 | 10.1 | 10.3 | 10.1 | 10.2 | 10.4*** | 10.1 b | 9.9 b |
| Media Exposure | 1.6** | 1.4 | 1.5 | 1.5 | 1.5 | 1.3 a | 1.5 b | 1.7*** | 1.5 | 1.5 | 1.4 | 1.5 | 1.5 | 1.5 | 1.7*** | 1.3 | 1.4 | 1.6* | 1.4 | 1.5 | 1.5 | 1.5 | 1.4 |
| Belief | 15.2 | 16.5* | 16.5 | 16.1 | 15.1 | 15.8b | 15.9 | 17.0 | 15.7 | 16.4 | 15.9 | 15.9 | 16.1 | 15.5 | 17.1 | 14.9 | 15.8 | 16.1 | 15.7 | 16.2 | 15.8 | 16.0 | 16.0 |

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ** | *** | b | a | | b | *** | | *** | | | *** | | *** | | | | ** | | | |
| Importance | 3.9 | 4.4 *** | 4.2 *** | 4.2 | 4.0 a | 4.1 b | 4.1 | 4.3 ** | 4.1 | 4.2 * | 4.1 | 4.1 | 4.2 | 4.1 | 4.6 *** | 3.8 | 4.1 | 4.3 * | 4.1 | 4.2 | 4.2 | 4.1 | 4.1 |
| Climate change concern | 22.0 | 24.5** | 24.3 *** | 23.8 | 22.0 a | 22.9b | 23.1 b | 24.2 *** | 23.0 | 24.1 *** | 23.4 | 23.2 | 23.5 * | 22.9 | 25.5 *** | 21.7 | 23.2 | 23.7 | 23.1 | 23.8 ** | 23.4 | 23.5 | 23.2 |
| Risk Perception | 18.0 | 19.8** | 19.8 *** | 19.2 b | 17.8 a | 18.6b | 18.9 | 19.4 * | 18.8 | 19.3 * | 18.9 | 18.9 | 19.0 | 18.9 | 20.2 *** | 17.9 | 18.9 | 19.1 | 18.8 | 19.3 * | 19.2 * | 19.0 | 18.5 a |
| Distress | 20.7 | 23.0** | 23.2 *** | 22.3 b | 20.3 a | 21.3b | 21.7 b | 22.8 *** | 21.6 | 22.5 ** | 22.0 | 21.5 | 22.0 | 21.7 | 24.1 *** | 20.2 | 21.7 | 22.7 ** | 21.5 | 22.7 *** | 22.2 | 22.0 | 21.6 |
| Self-efficacy | 17.4 | 19.2 *** | 18.8 *** | 18.6 | 17.7 a | 17.9a | 18.4 | 18.9 *** | 18.2 | 18.7 * | 18.5 * | 18.1 | 18.4 | 18.4 | 19.7 *** | 17.4 | 18.3 | 18.5 | 18.3 | 18.4 | 18.5 | 18.4 | 18.2 |
| Personal responsibility | 12.1 | 13.3** | 13.1 *** | 12.8 b | 12.2 a | 12.3b | 12.6 b | 13.2 *** | 12.6 | 13.0 ** | 12.8 | 12.5 | 12.7 | 12.6 | 13.8 *** | 11.9 | 12.6 | 12.8 | 12.6 | 12.8 | 12.7 | 12.6 | 12.8 |
| Direct Experience_CC | .42 | .47 *** | .47 | .46 | .42 | .41 b | .46 | .47 ** | .43 | .50 *** | .45 | .45 | .44 | .47 | .53 *** | .39 | .44 | .47 | .44 | .47 | .48 | .45 | .42 |
| Prior Disaster experience | 8.98 | 9.03 *** | 8.12 a | 9.24 | 9.32 | 8.77 | 9.16 | 9.04 | 9.23 *** | 8.37 | 8.92 | 9.04 | 8.74 | 9.45 *** | 9.03 | 8.98 | 9.10 | 8.76 | 9.09 | 8.82 | 9.13 | 8.81 | 9.02 |
| Psychological adaptation | 27.6 | 29.6** | 28.4 | 29.2 * | 28.1 b | 27.3a | 28.9 b | 29.9 *** | 28.5 | 28.9 | 28.6 | 28.5 | 28.5 | 28.9 | 30.9 *** | 26.9 | 28.5 | 29.2 | 28.7 | 28.8 | 28.9 | 28.6 | 28.5 |
| Behaviours | 6.2 | 6.6 *** | 6.1 a | 6.4 | 6.6 ** | 6.2 b | 6.5 | 6.7 *** | 6.4 | 6.4 | 6.2 | 6.7 *** | 6.5 | 6.3 | 6.9 *** | 6.1 | 6.4 | 6.6 | 6.5 | 6.4 | 6.7 *** | 6.2 b | 6.1 b |

*Note*: For details of the items used to construct each of the climate change variables, see Appendix I

Prior Adv. Exp. = Prior adverse experience of climate change-related or natural disaster events; Connecn. Nature = Connection to nature; Biospheric = Biospheric values (Schultz, 2001); Altruistic = Altruistic values (Schultz, 2001); Egoistic = Egoistic values (Schultz, 2001); Media Exposure = Film media exposure; Pers. Responsib.= Felt personal responsibility to act on climate change.

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

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

Asterisks are placed beneath highest group mean. Differences between means are expressed as: * $p < .05$. ** $p < .01$. *** $p < .001$. The absence of asterisks in a cell indicates that these means are not significantly different from each other.

## APPENDIX M: QUALITATIVE RESPONSES TO ITEMS #47 AND #48

**#47 "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?" #48 "Can you briefly indicate what these changes or events were or are?"**

| Broad category | Sub categories | Frequency |
|---|---|---|
| **Weather and seasonal changes** | **Unpredictable/different/changed/more extreme weather; Different temperatures** e.g., "The weather is not as predictable as in the past and the seasons are not as definable" (Sydney, female). | 51 |
| | **Rising average temperatures/hotter** e.g.," Hotter weather, less water" (Sydney, female) | 70 |
| | **Cooler** e.g., "The weather its getting hotter in summer and spring and colder winter" (Brisbane, female) | 9 |
| | **Wetter** e.g., "Hotter summer months and wetter autumn" (Sydney, male) | 10 |
| | **Drier** e.g., "Reduction of local rainfall by 12 - 20% since 1975" (Perth, male) | 47 |
| | **Increased humidity** e.g., "Increasingly hot humid weather without the Southerly changes coming for relief that I remember as a kid" (Sydney, female) | 6 |
| | **Seasons changing** e.g., "Seasons seem to be shifting. Winter rain coming later in the year (Aug/Sept) instead of June/July - also hotter weather occurring later in the year (march) rather than Dec/Jan: (Perth, female) | 46 |
| | **Tides higher / sea level increase** e.g., "All the beaches are getting eroded away by higher tides, the sand dunes are disappearing" (Sunshine Coast, Qld, female) | 50 |
| | **Stronger winds** e.g., "More storms and heavier rains, stronger winds, etc" (Perth, female) | 3 |
| | **Total** | **292** |
| **Extreme weather events and natural disasters** | **Droughts prolonged** e.g.," Drought has become much worse and rainfall, obviously, has dropped" (Sydney, female) | 14 |
| | **Heatwaves including more prevalent and intense** e.g., "Temperatures have risen - more regular heat waves and the seasons seem to be moving" (South Australia, female) | 14 |
| | **Greater storm - dust, thunder, rain, hail - freq and or intensity** e.g., "Hailstones and most serious storm history in Perth" (Perth, male) | 36 |
| | **Floods and flash floods** e.g., "Severe hail storm and flooding. Extreme heat waves, drought" (Melbourne, female) | 19 |
| | **Cyclone number or distribution increased** e.g., "There appear to be more category 4 & 5 cyclones lately" (Cairns, Qld, male) | 7 |
| | **Bushfire increased intensity / damage** e.g., "Flood in Melbourne in Jan 10, where the city of Melbourne was turned into a river in the matter of an afternoon. Black Saturday, the heat on that day was unusually high and that caused that catastrophic fire" (Melbourne, female) | 34 |
| | **Volcanic activity and earth tremors increased** e.g.," We experienced a drought, which in not that unusual for Australia except that is longer than what they usually are. We have also experienced a lot more earth tremors in recent years also" (Melbourne, female) | 2 |
| | **Erosion from extreme weather events** e.g., "Beach erosion due to severe oceanic weather and very dry countryside due to lack of rain" (Gold Coast, Qld, female) | 4 |
| | **Damage from the event** e.g., "Hailstorm which caused serious damage in the city and was classified a natural disaster. Historical buildings were damaged, vegetable crops were destroyed, cars were written-off, houses were flooded, etc" (Perth, male) | 4 |
| | **Natural disasters / severe weather events** e.g., "Whilst Australia has always been a country of extremes in regard to climate I think there has been an increase in extreme weather conditions over the past several years - more wild weather and prolonged severe drought than I can recall from my earlier | 9 |

| | | |
|---|---|---|
| | years" (Sydney, female) | |
| | **Tornado** e.g., "Recent tornado in my area" (Ballina, NSW, female) | 1 |
| | **Total** | **144** |
| **No changes** | **None that I am aware of** e.g., "I personally have not seen any changes in my local area" (Adelaide, male) | 131 |
| | **Might not be due to CC / CC not happening** e.g., "None due to climate change" (Toowoomba, Qld, female) | 3 |
| | **Weather cycles unavoidable** e.g., "Nothing. There has all ways been drought and the like over years it comes and go's" (Albury, NSW, male) | 1 |
| | **Not in the area for that long** e.g., "Have not lived here long enough" (Melbourne, male) | 4 |
| | **Due to another cause, e.g., mismanagement** e.g., "none - the only change is lack of water because our idiot greenie governments won't build a new dam on the Mitchell River, which floods every two years" (Melbourne, female) | 1 |
| | **Total** | **140** |
| **Water scarcity** | **Less water...in creeks/rivers/ dams** e.g., "The local river has not flooded for nearly five years which usually happens annually, but there has not been as much snow in the alps for the past three years for there to be a large thaw" (Bright, Vic, female) | 42 |
| | **Drought / Drought in SEQ** e.g., "The drought in SE Qld. Especially the Darling Downs area" (Toowoomba, Qld, female) | 61 |
| | **Water restrictions** e.g., "Increased drought, heat wave and dying of trees and water restrictions" (Adelaide, male) | 24 |
| | **Effects from water scarcity - salinity, erosion, vegie gardens, tourism** e.g., "Water shortages and restrictions, increased salinity" (Adelaide, female) | 9 |
| | **Total** | **136** |
| **Environmental degradation/ biospheric effects** | **Damage to iconic landscapes** e.g., "The Murray River is almost beyond repair, human impact on water ways globally needs to be addressed NOW!" (Adelaide, male) | 5 |
| | **Damage to landscapes** e.g., "Living in a beachside area I have noticed the height of high tide has changed noticeably. The loss of sand dunes in the coastal area is noticeable" (Adelaide, female) | 15 |
| | **Increased pollution / rubbish** e.g., "Most noticeable for me is the seawater and beaches. The colour of the water seems unnatural and the amount of rubbish that washes up on the sand worries me. Too much waste is being offset into our water" (Melbourne, female) | 9 |
| | **Effects on animals** e.g., "I see birds with their mouths hanging open in the heat, saw a dead bird on a hot day" (Sydney, female) | 18 |
| | **Effects on plants** e.g., "Plants and trees are struggling to survive. We have had many old trees die or be blown down in storms. Everything seems dry and dusty for so many months of the year" (Melbourne, female) | 35 |
| | **Garden** e.g., "Water restrictions have had an effect on the beauty and vitality of parks and gardens in my local area" (Melbourne, male) | 13 |
| | **Park** e.g., "Local parks and sporting grounds dying from a lack of water due to water restrictions because of drought" (Adelaide, male) | 4 |
| | **Increased pests** e.g., "Hot summers causing dryness and trees dying and garden plants dying. Wetter wet times causing more biting insects" (Brisbane, female) | 6 |
| | **Habitat changes for animals** e.g., "All of our local creeks are unable to sustain wild life. I grew up in this area and when I was little we used see rabbits frogs lizards snakes foxes and the like all of the time, now you would lucky to see any of them" (Sydney, male) | 19 |
| | **Total** | **124** |
| **Change in behaviour of** | **Recycle** e.g., "We now have recycle bins" (Launceston, Tas, female) | 13 |
| | **Wetlands** e.g., "Yes we have a very good wetlands and we are showing the world how to save and clean stormwater in my council city of Salisbury, | 3 |

| | | |
|---|---|---|
| **individuals/ council /government / society** | south Australia" (Adelaide, male) | |
| | **Alternative energy - wind, solar, gas, cars, bike** e.g., "Water tanks in households, energy efficient fridges, washing machines, etc.. solar panels in households" (Melbourne, female) | 13 |
| | **Water saving - retention/desalination** e.g., "Showers turned off at each when there was a fear of not enough water, not allowed to water garden every day, building of desalination plant" (Gold Coast, Qld, female) | 12 |
| | **More environmental awareness** e.g., "Recycling bins, green bins, gas run, public transport, correct disposal of chemicals, organic/sustainable productions, carbon offsetting, environmentally safe products, changes in attitude to the environment" (Adelaide, female) | 9 |
| | **More trees planted including drought resistant plants** e.g., "Local ponds have dried up and you cannot hear frogs as much as previous years. People are paving where lawns were once growing. You can see more water tanks. Different plants are being planted that are drought resistant" (Melbourne, female) | 6 |
| | **Lack of care by government** e.g., "Lack of water provided to the community. Lack of environmental care by government" (Melbourne, male) | 1 |
| | **Total** | **57** |
| **Impacts on humans** | **Restricted water availability for human consumption** e.g., "Drought caused by climate change has limited the amount of water available for houses and parks" (Adelaide, female) | 12 |
| | **Structural damage** e.g., "The movement in the land due to drought. Walls and concrete cracking only after a short period of time. Green grass hardly to be seen except when artificial" (Melbourne, female) | 2 |
| | **Effects to human health (physical and mental)** e.g., "Higher sea levels at some of the local Sydney beaches. Increased adverse weather conditions - - hot temperatures, increased electrical storms. Increased cancer risk due to hole in the ozone layer" (Sydney, female) | 3 |
| | **Effects to lifestyle and or livelihood** e.g., "Drought related destruction of the environment, more expensive power and water, water restrictions destroying lifestyles" (Adelaide, female) | 5 |
| | **Increase in food prices** e.g., "The most disturbing change I have seen is the dryness of the land. There is a creek that runs close to where I live. About 10 years ago, this creek always has running water but in the last few years, the creek has run dry. Of course it has overrun lately due to the rain we have been having which is really good news. In my own backyard, a couple of trees have died due to lack of rain. Also, the bushfires I believe have become more ferocious in the last couple of years. The price of food has gone up, especially seafood. Fish used to be cheaper about 10 years ago but now, it is the most expensive due to scarcity" (Melbourne, female) | 1 |
| | **Total** | **23** |
| **Increase in population, urbanisation** | **Clearing vegetation** e.g. "The one thing is the increase in population creating more urban sprawl, in turn clearing vegetation" (Melbourne, male) | 7 |
| | **Over-consumption of resources** e.g., "Too many private swimming pools for the upper crust. Not enough water for a pensioner to grow his own vegetables Far too many high rise buildings each unit would have e.g., air-conditioning, clothes dryer, some with spa bath, elevators Car parks all burning electricity in congested areas. and no Trees or park lands in the areas" (Sydney, male) | 2 |
| | **More houses/cars/traffic** e.g., "More cars, more houses less water higher electricity - mass land clearing nil tree replacement" (Brisbane, female) | 9 |
| | **More phone towers** e.g., "Too many over exposed mobile phone towers" (Adelaide, female) | 1 |
| | **Total** | **19** |
| **Aesthetics** | **Change in the aesthetics of the landscape** e.g., "Drought. In my home town there are lakes that have dried up that we used to swim and boat in when I | 11 |

| | | |
|---|---|---|
| | was a child. There is not much grass and what there is, is harsher. Gardens, what ones there are, are different, there are more low water gardens. Kids can't play under sprinklers or have backyard pools. You don't see people washing cars on the nature strip or front lawn because of water restrictions. There whole place just feels a lot less lush and living seems harder" (Melbourne, female) | |
| | **Total** | **11** |
| **More media, advertising and education** | **Media / advertising** e.g., "more media, advertising, education" (Perth, female) | 2 |
| | **Total** | **2** |

## APPENDIX N. COMPARING EXTENT OF BELIEF/ACCEPTANCE OF CLIMATE CHANGE WITH OTHER NATIONAL SURVEY RESEARCH FINDINGS

| Item | Griffith University<br>Australia<br>2010<br>N = 3096 | CSIRO<br>Australia<br>2010<br>N = 5036 | Newspoll<br>Australia<br>2010<br>N = 1200 | Ipsos Eureka<br>Australia<br>2010<br>N = 1050 | Cardiff University<br>UK<br>2010<br>N = 1822 | Krosnick<br>U.S.<br>2010<br>N = 1000 | Leiserowitz<br>U.S.<br>2010<br>N = 2030 |
|---|---|---|---|---|---|---|---|
| Belief in climate change | As far as you know, do you personally think that the world's climate is changing? | Do you think climate change is happening? | Thinking now about climate change. Do you personally believe or not believe that climate change is currently occurring? | I have serious doubts about whether climate change is occurring | As far as you know, do you personally think that the world's climate is changing? | You may have heard about the idea that the world's temperature may have been going up slowly over the past 100 years. What is your personal opinion on this? | What do you think? Do you think global warming is happening? |
| Response option and results | Yes 73.9%<br>No 18.2%<br>Don't know 7.8% | Yes 82.8%<br>No 17.2% | Yes/believe 73%<br>No/Not believe 22%<br>Uncommitted 4% | Strongly/somewhat agree 24% | Yes 78.3%<br>No 15.3%<br>Don't know 6.4% | Probably been happening 74%<br>Probably not been happening 24%<br>Don't know 2% | Yes 63%<br>No 19%<br>Don't know 19% |

## APPENDIX O. COMPARING CAUSAL ATTRIBUTIONS AND BELIEFS

| Item | Griffith University<br>Australia<br>2010<br>N = 3096 | CSIRO<br>Australia<br>2010<br>N = 5036 | Newspoll<br>Australia<br>2010<br>N = 1200 | Ipsos Eureka<br>Australia<br>2010<br>N = 1050 | Cardiff University<br>UK<br>2010<br>N = 1822 | Krosnick<br>U.S.<br>2010<br>N = 1000 | Leiserowitz<br>U.S.<br>2010<br>N = 2030 |
|---|---|---|---|---|---|---|---|
| **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 . . . ?[9] | 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?10 | Assuming global warming is happening, do you think it is . . . |
| **Response options and results** | CC is entirely caused by natural processes 4.9%<br>CC is mainly caused by natural processes 12.6%<br>CC is partly caused by natural, partly by human activity 45.8%<br>CC is mainly caused by human activity 27.6%<br>CC is entirely caused by human activity 4.2%<br>I think there is no such thing as cc 2.7%<br>Don't know 1.9%<br>No opinion 0.4% | I think that cc is happening, and I think that humans are largely causing it 50.4%<br>I think that cc is happening, but it's just a natural fluctuation in Earths temperatures 40.2%<br>I have no idea whether cc is happening or not 3.8%<br>I don't think that cc is happening 5.6% | Entirely caused by human activity 24%<br>Partly caused by human activity 70%<br>Or, do you believe climate change is not caused by human activity at all 5%<br>Uncommitted 1% | Climate change is entirely caused by natural processes 5%<br>Climate change is mainly caused by natural processes 9%<br>CC is partly caused by natural processes and partly caused by human activity 41%<br>CC is mainly caused by human activity 26%<br>CC entirely caused by human activity 10%<br>There is no such thing as CC 3%<br>Don't know 5% | CC is entirely caused by natural processes 5.6%<br>CC is mainly caused by natural processes 12.2%<br>CC is partly caused by natural, partly by human activity 46.3%<br>CC is mainly caused by human activity 24.3%<br>CC is entirely caused by human activity 6.5%<br>I think there is no such thing as cc 2.2%<br>Don't know 2.5%<br>No opinion 0.4% | Natural causes 25%<br>Both equally 45%<br>Things people do 30% | Caused mostly by natural changes in the environment 35%<br>Caused by both human activities and natural changes 6%<br>Caused mostly by human activities 50%<br>None of the above because global warming isn't happening 7%<br>Other 2%<br>Don't know 1% |

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

[10] 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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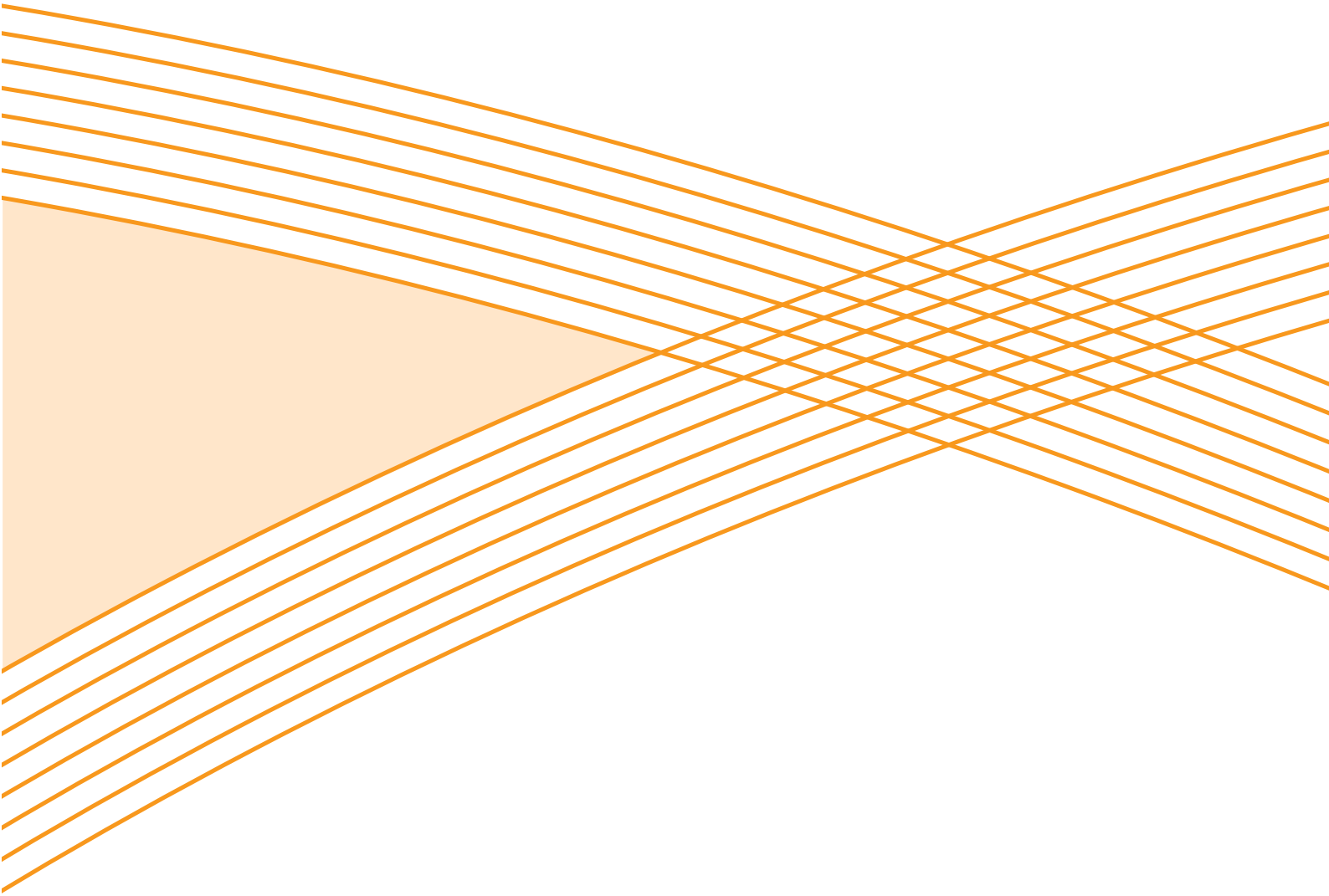

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