International Journal of Innovation, Creativity and Change. www.ijicc.net
Volume 15, Issue 1, 2021 – Special Edition

Weathering the Storm: Community Impact

Danielle J. Rancie, James Cook University, Supervised by Dr Sarah Lutkin

Climate change is a growing concern in today's society and extreme weather events (EWEs) are increasing every year. Attitudes towards climate change and the perception of EWEs on community wellbeing is paramount to mitigating future health risks. The aim of this study was to investigate predictors of climate change attitudes and how this impacts the perceptions of community wellbeing, community resilience, and EWEs. A quantitative study was conducted to measure opinions across the Australian general public with 124 people (76% female), aged between 18-73 years (M = 38.98, SD = 13.36) from rural (53%) or urban (47%) regions of Australia. Participants completed an online survey examining demographics, climate change attitudes, exposure to EWEs, community wellbeing, community resilience, perceptions of severity and harm. Overall, climate change attitudes had significant correlations with gender, age, education level, EWE, perceived severity and global warming concerns. Age, gender, and education accounted for 26% of the variability in climate change attitudes, while an additional 35% was explained by locality, EWE, place attachment, overall community wellbeing, future community wellbeing, community resilience, harm perceptions, perceived severity and global warming concern. Perceived severity being the only significant predictor of climate change attitudes when controlling for age, gender, and education. Climate change attitudes were significantly stronger in urban communities.

Key words: *climate change, extreme weather event, community, resilience, wellbeing, risk perception*

Climate change is an over-arching term for all progressive or severe weather deviations within the Earth's environment and is a growing concern in today's society (Mason & Rigg, 2019). In 2015, the World Health Organisation declared climate change as "the greatest threat to global health in the 21st century" (World Health Organisation, 2015, paragraph 1). The Australian Medical Association echoed those claims and officially recognised climate change as a "health emergency" (Australian Medical Association, 2019, p. 1). Increased prevalence

of extreme weather events (EWEs) is a growing indication of climate change and are defined as any abnormal, unexpected, severe weather variation that causes extensive damage to infrastructure or the potential loss of life (McPhillips et al., 2018). This includes, but is not limited to, droughts, floods, cyclones, heatwaves, and bushfires (Ren et al., 2018).

Globally, EWEs have shown a steady increase since the 1980's (Climate Council, 2018). The prevalence for Australian EWEs has more than tripled in that time (Munich, 2018). Often these events are compounded and do not occur in isolation causing unprecedented damage to infrastructure and communities (Bureau of Meteorology, 2018). For example, severe bushfires due to prolonged drought and excessively dry plant growth. As the frequency and severity of EWEs increases so does the concern around disease, agriculture, and mental health (Zamir, Alpert, & Rilov, 2018). However, climate change beliefs are still polarised among Australian communities (Leviston, Greenhill, & Walker, 2015). Understanding the impact climate change attitudes and EWEs have on the perceptions of wellbeing and resilience of vulnerable communities is paramount in assessing future health risks (Ebi & Bowen, 2016).

CLIMATE CHANGE ATTITUDES

Past research has found that the most consistent predictors of climate change attitudes are age (Lorenzoni, Leiserowitz, De Franca Doria, Poortinga, & Pidgeon, 2006), gender (Xiao & McCright, 2015), and education level (Olofsson & Öhman, 2006). Specifically, these studies reveal significant cross-cultural trends of stronger climate change attitudes in younger people, females and those who are more highly educated (Lewis, Palm, & Feng, 2019). However, one of the most understated implications of climate change attitudes is mere exposure to an EWE. Perceptions of global warming and climate change beliefs are highly dependent on an individuals local climate conditions (Hansen, Sato, & Ruedy, 2012) and recent experience with an EWE (Whitmarsh, 2008). Construal Level Theory (CLT; Trope & Liberman, 2010) purports that psychological distance to an object or event influences abstract and concrete thinking. The more distant an event the more abstract thinking will be regarding it, whereas the closer an event the more concrete a person's thinking. Therefore, firsthand experience with an EWE is likely to shape more concrete beliefs about climate change while individuals not exposed to an EWE are likely to perceive climate change as an abstract or seemingly distal threat, consequently minimising environmental concern (Brugger, Morton, & Dessai, 2016).

Cognitive-Experiential Self-Theory (Epstein, 1990) further suggests that people tend to form stronger opinions through experiential learning rather than analytical processing (Marx et al., 2007). Therefore, where a person has personally experienced an EWE it would be expected that their perspective on climate change and community wellbeing would be influenced. Past studies have found evidence for increased certainty for both climate change belief or denial following exposure to an EWE (Hart & Nisbet, 2012; Myers, Maibach, Roser-Renouf,

Akerlof, & Leiserowitz, 2013). It could be inferred then that a bi-directional confirmation bias exists in climate change attitude formation. This could be explained by theories of Motivated Reasoning (Kunda, 1990) which propose that people are more motivated to strategically reason and process information that is consistent with a desired belief or outcome. Thus highlighting people's propensity to seek out information that is congruent with their existing belief constructs.

Additionally, attachment to a place or region is linked with personal fulfilment and place identity, which provides a sense of belonging and purpose (Lemée, Fleury-Bahi, & Navarro, 2019). When that identity is threatened, coping strategies will often reflect adaptive behaviours that favour attitudes to handle the perceived threat (i.e., enhance or minimise threat). Therefore, climate change attitudes may be formed based on the perceived threat to place identity rather than a true appraisal of actual risk. Thus, differences in climate change attitudes between rural and urban populations can depend on the locality of the person and their attachment to place (Scannell & Gifford, 2013). The influence of locality on climate change attitudes in Australian populations has produced mixed results and the current study aims to further investigate this relationship.

RISK PERCEPTIONS

Researchers have also found strong correlations between climate change attitudes and EWE risk perceptions in samples from Britain (Linden, 2014; Reser, Bradley, Glendon, Ellul, & Callaghan, 2012), Italy (Menapace, Colson, & Raffaelli, 2015), America (Mase, Gramig, & Prokopy, 2017), and China (Lee, Markowitz, Howe, Ko, & Leiserowitz, 2015). Studies on specific EWEs have also demonstrated positive associations between climate change attitudes and increased risk perceptions after exposure to heatwaves (Akompab et al., 2013), floods (Demski, Capstick, Pidgeon, Sposato, & Spence, 2017), cyclones (Hamilton-Webb, Manning, Naylor, & Conway, 2017), and drought (Carlton et al., 2016). This is congruent with the theoretical underpinnings of the Health Belief Model (HBM; Rosenstock, Strecher, & Becker, 1988) and Protection Motivation Theory (PMT; Rogers, 1975) which purports that people assess situations via a threat and coping appraisal response; the greater the threat, the greater the perceived severity of the situation. Subsequent responses to the threat are then evaluated in proportion to a person's perceived self-efficacy to carry out proactive behaviours to cope with the threat (Geiger, Swim, & Fraser, 2017). Therefore, people with stronger climate change attitudes are likely to perceive EWEs as more severe due to a greater perceived threat or personal experience. Conversely, some studies have also reported that individuals who do not believe in global warming show a strong bias to minimise perceived risk of local EWEs (Howe & Leiserowitz, 2013). Limited research has been conducted within an Australian context that assesses real life exposure to EWEs.

COMMUNITY WELLBEING AND RESILIENCE

Prolonged changes to one's environment can alter how effectively people cope, subsequently impacting the wellbeing and resilience of communities in the wake of natural disasters (Lemée et al., 2019; Willox et al., 2012). Determinants of community wellbeing include employment, housing, transport, food/water supply, health support and social connectedness (Wiseman & Edwards, 2009). Access to these resources can be compromised in the aftermath of an EWE, thereby putting vulnerable communities at risk (Amundsen, 2012). Exposure to EWEs has been linked with an increase in drug and alcohol use (Caruana, 2010), suicide (Nicholls et al., 2006), depression (Tang, Liu, Liu, Xue, & Zhang, 2014), and post-traumatic stress disorder (Simpson, Weissbecker, & Sephton, 2011). The impact this has on communities is far-reaching as resources become scarce, disease spreads, psychopathology increases, and long-term sustainability of the community is jeopardised (Foley et al., 2005). Furthermore, an individual's perceived control and self-efficacy following an EWE is also compromised and one's ability to adapt and recover will impact on the community at large. Therefore, people's perceptions of community wellbeing and resilience are likely to be decreased by recent exposure to an EWE.

AIMS AND HYPOTHESES

The aim of this study is to examine how climate change attitudes impact on the perceptions of EWEs, and how recent experience of EWEs influence perceptions of community wellbeing and community resilience. It is hypothesised that:

H_1 = Individuals who have stronger climate change attitudes will **a)** perceive EWEs as more severe, and **b)** have greater concerns about global warming
H_2 = Individuals from smaller rural centres will have lower scores on climate change attitudes when compared to individuals from larger regional centres
H_3 = Individuals from communities that have experienced an EWE in the past 3 years will **a)** have lower perceptions of community wellbeing, **b)** increased perceptions of community harm, and **c)** lower perceptions of community resilience.

METHOD

Participants

A random sample of 124 individuals was recruited from the Australian general public. Ten participants were excluded during data checks. The final sample consisted of 114 participants (87 females, 24 males, 1 other, 2 missing). Participants' age ranged between 18-73 years (M = 38.98, SD = 13.36). Respondents were individuals from rural (53%) or urban regions (47%) of Australia. Level of education varied among participants; less than Year 12 or equivalent (5%), Year 12 or equivalent (21%), Vocational Qualification (12%), Associate Diploma

(5%), Undergraduate Diploma (8%), Bachelor's Degree with Honours (36%), Master's Degree (9%), and Doctorate (4%). Majority of participants had been exposed to one or more EWE: cyclones (34%), floods (67%), drought (40%), bushfires (30%), and other (4%). Only 6 participants had not experienced an EWE (5%). Respondents experienced a mean of 2.70 EWEs (*SD* = .12). See Figure 1 for EWE frequencies.

Measures

Climate Attitudes. The Climate Change Attitude Scale (Christensen & Knezek, 2015) has 10 items (α =.87) that measure beliefs concerning climate change. Participants respond on a 5-point Likert scale (1 = *Strongly Disagree*; 5 = *Strongly Agree*), item 9 is reverse scored. Item scores were calculated as a mean total with higher scores indicating greater belief in climate change.

Community Wellbeing. The Community Wellbeing Scale (Walton, McCrea, & Leonard, 2014) has 32-items adapted from the CSIRO Survey of Community Wellbeing and Responding to Change Scale. Perceptions of community wellbeing are measured on eight factors: place attachment (4 items, α =.84), personal safety (4 items, α =.83), decision making and community voice (4 items, α =.82), community spirit (4 items, α =.89), community cohesion (3 items, α =.88), community trust (6 items, α =.84), overall community wellbeing (5 items, α =.85), future community wellbeing (2 items, α =.92; (Walton, McCrea, & Leonard, 2016). Participants respond on a 5-point Likert scale (1 = *Strongly Disagree*; 5 = *Strongly Agree*). Each sub-scale factors were computed into individual means scores. Higher scores indicating greater perceptions of community wellbeing.

Community Resilience. The Community Resilience Scale (Walton et al., 2014) has eight items (α =.92) on a 5-point Likert scale ranging from (1 = *Strongly Disagree*; 5 = *Strongly Agree*). Items measure perceptions of community resilience. A total mean score was calculated with higher scores indicating greater perceptions of community resilience.

Community Harm. A one item measure (α =.65) of perceived harm to community following an EWE pertaining to four domains: infrastructure, economy, public safety, and community wellbeing (Vaske, 2008; Zanocco et al., 2018). Item responses are a 4-point Likert scale (1 = *Not At All*; 4 = *A Great Deal*). Responses were collated as a mean score with higher scores indicating greater perceptions of community harm.

Perceived Severity. Perceived Attribution (Zanocco et al., 2018) consists of one item measuring an individuals' perceived severity of EWEs. Responses collected on a 5-point Likert scale (1 = *Much Less Severe*; 5 = *Much More Severe*). Zanocco et al. (2018) reported that this item was able to discriminate severity but no reliability coefficient was reported.

Concern. A one item self-report measure indicating attitude change toward concern about global warming after exposure to an EWE (Zanocco et al., 2018). Item measured on a 5-point Likert scale (1 = *Much Less Concerned*; 5 = *Much More Concerned*). If participants had not been exposed to an EWE they were asked to select 0 = *Never Experienced an Extreme Weather Event.* Although this item was able to discriminate concern no Cronbach alpha was reported.

All scale variables were computed as mean composite scores with the exception of community wellbeing, where mean scores were calculated separately for each of the eight sub-scales. Exposure to EWEs was categorised into six categories (1 = *cyclone*; 2 = *flood*; 3 = *drought*; 4 = *bushfire*; 5 = *other*; 6 = *no experience*). Gender was computed as 1 = *male*, 2 = *female*, 3 = *other*. Locality was systematically coded as 1 = *urban* and 2 = *rural* by following the recommendations of the Australian Government standards for Rural, Remote and Metropolitan Area (RRMA) classifications (Department of Health, 1994) and the regional postcode delivery guidelines (Department of Agriculture, 2017). Postcodes with populations less than 10,000 residents were considered rural.

PROCEDURE

Quantitative data was collected via an online Qualtrics survey dispersed to the Australian general public through social media, word-of-mouth and general snowballing techniques. James Cook University undergraduate students were offered research credit for participation. An information sheet was provided and informed consent obtained. Demographic information was acquired on gender, age, level of education, and postcode. A multi-response question enquired if participants had been exposed to one or more of the following EWEs in the last three years: cyclone, flood, drought, bushfire or other. If the latter was selected then participants were prompted to specify through free text comments. Respondents were then invited to complete all scale measures outlined above.

RESULTS

All results were analysed using IBM SPSS Software version 26.0 with an alpha level set at .05. Internal reliability analyses were conducted and Cronbach's alpha values are consistent with the original authors of the scales as well as additional literature. See Table 1.

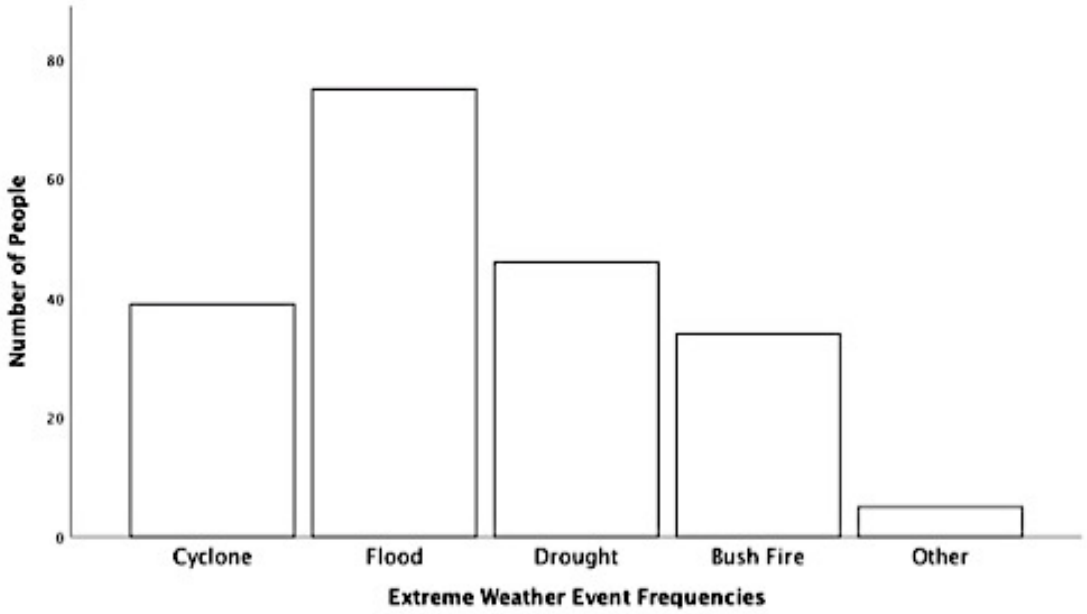

Figure 1

Frequency of extreme weather events

Table 1

Internal Reliability Coefficients for Scale Variables

Scale	Subscale	No. of Items	Cronbach's Alpha
Climate Attitudes		10	.94
Community Wellbeing	Place Attachment	4	.90
	Personal Safety	4	.89
	Decision Making	4	.91
	Community Spirit	4	.88
	Community Cohesion	3	.87
	Community Trust	6	.85
	Overall Community Wellbeing	5	.93
	Future Community Wellbeing	2	.92
Community Resilience		8	.91
Harm Perceptions		4	.85

Descriptive Statistics

Means, standard deviations, and range statistics for all scale variables can be seen in Table 2.

Table 2

Descriptive Statistics for Scale Variables

	N	*M*	*SD*
Climate Attitudes	106	4.08	.93
Place Attachment	100	4.02	.96
Personal Safety	100	3.72	1.08
Decision Making	100	3.11	1.04
Community Spirit	100	3.99	.78
Community Cohesion	96	3.59	1.00
Community Trust	96	3.42	.74
Overall Community Wellbeing	96	3.93	.88
Future Community Wellbeing	96	3.93	.97
Community Resilience	86	3.44	.75
Harm Perceptions	86	2.67	.86
Perceived Severity	85	4.14	.87
Concern	85	4.68	1.18

Relationship between variables

Pearson's correlations for all study variables are presented in Table 3. All statistically significant correlations are outlined below. Climate change attitudes had a weak positive correlation with gender, education level and EWE, while it was found that climate change attitudes had a weak negative correlation with age. Climate change attitudes had moderate positive correlations with perceived severity and concern, and weak negative correlations with age and gender. Locality was weakly positively correlated with age and showed a weak negative association with education level. EWEs demonstrated a weak positive relationship with climate change attitudes and place attachment. Perceived severity was weakly positively correlated with decision-making, and also moderately positively correlated with concern. Harm perceptions had weak positive associations with place attachment and community resilience, and a moderately positive correlation with community spirit. Community

resilience had a weak positive correlation with place attachment and personal safety. Community resilience had moderately positive correlations with decision-making, community spirit, community cohesion, community trust, overall community wellbeing, and future community wellbeing. Furthermore, all eight factors of the community wellbeing scale were positively weak to moderately correlated with one another and with community resilience. This indicates that higher scores on one variable are associated with higher scores on the other; however, correlations were not strong enough to be superfluous. Results did not statistically support H_3a, H_3b, or H_3c.

Table 3

Pearson Correlations for Study Variables

Variable	N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Gender	111	-																	
2. Age	110	-.24*	-																
3. Education	109	.17	-.09	-															
4. Locality	110	.01	.27**	-.25**	-														
5. EWE	111	.10	-.11	-.06	.03	-													
6. Climate	104	.38**	-.34**	.28**	-.18	.20*	-												
7. Place Attachment	98	.10	.28**	.05	-.01	.24*	-.03	-											
8. Personal Safety	98	-.12	.11	.13	.12	.18	.00	.51**	-										
9. Decision Making	98	.15	-.08	.30**	-.01	-.01	.13	.35**	.45**	-									
10. Community Spirit	98	.08	.10	.07	.02	-.01	-.04	.47**	.37**	.57**	-								
11. Cohesion	95	.03	-.06	.04	.08	-.07	-.01	.27**	.23*	.52**	.57**	-							
12. Community Trust	96	.08	-.03	.20	.11	-.01	.07	.28**	.36**	.78**	.57**	.68**	-						
13. Overall Wellbeing	95	.03	.09	.08	.10	.10	.14	.55**	.70**	.44**	.51**	.40**	.50**	-					
14. Future Wellbeing	95	-.01	.09	.10	.00	.12	.02	.70**	.60**	.46**	.61**	.50**	.48**	.81**	-				
15. Resilience	85	.19	-.05	.20	.05	.18	.16	.64**	.26*	.64**	.61**	.47**	.63**	.42**	.52**	-			
16. Harm Perceptions	85	-.06	.18	-.03	.13	.20	-.12	.22*	-.01	.14	.44**	.08	.16	.08	.18	.24*	-		
17. Severity	84	.18	-.06	.19	-.12	.20	.65**	.20	.12	.22*	.16	.03	.18	.19	.15	.16	.16	-	
18. Concern	84	.12	.08	.00	.08	.20	.41**	.02	.17	-.05	-.08	-.09	.02	.14	-.05	-.02	.13	.58**	-

*$p < .05$, ** $p < .01$

Comparing urban and rural communities

An independent samples t-test was run to determine if there were differences in climate change attitude scores between urban and rural communities. A Welch t-test is reported due to the assumption of homogeneity of variances being violated, as assessed by Levene's test for equality of variances (p = .002). See Figure 2. There were 48 urban and 54 rural participants. Six outliers were found as assessed by inspection of boxplots (4 urban, 2 rural). Three of the 4 outliers scored <1.4 out of 5 on climate change attitudes in the urban group were extreme scores (± 3 *SD* of mean) and excluded from analysis. All other outliers were retained as they fell within an acceptable range and did not significantly skew variability of the data set. Scores were not normally distributed as assessed by Shapiro-Wilk's test (p < .05). Climate change attitudes were higher in the urban group (M = 4.43, SD = .58) than the rural group (M = 3.91, SD = .12), with a statistically significant difference, M =.52, 95% CI [.23 to 82], $t(91.62) = 3.53$, p = .001, d = .68. This results supports H_2.

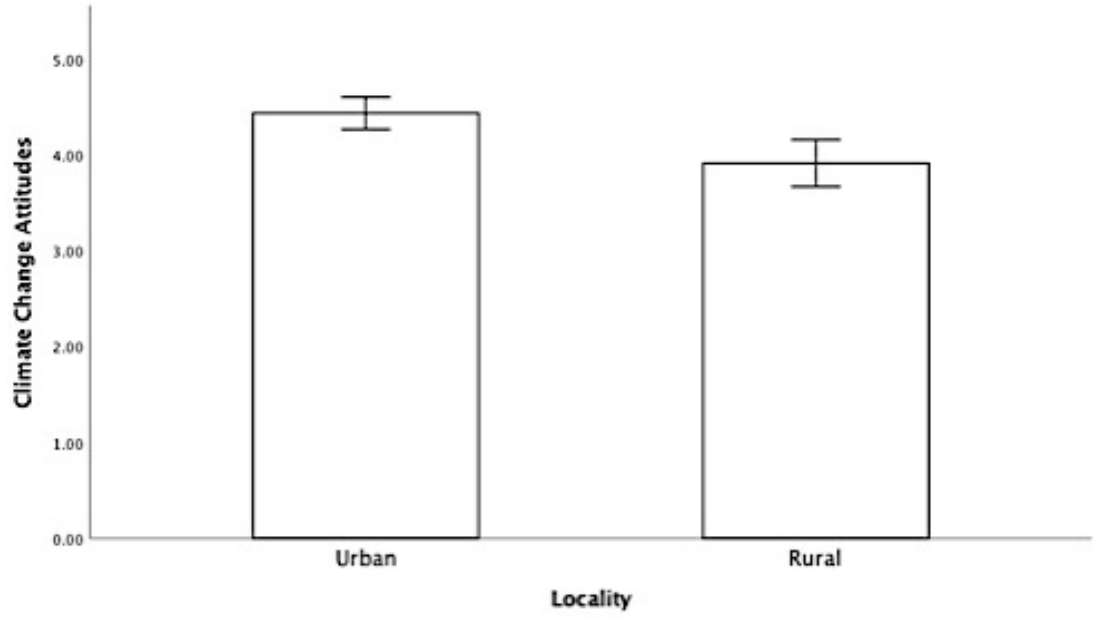

Figure 2
Mean climate change attitudes of urban and rural groups

Predicting climate change attitudes

A hierarchical multiple regression analysis was conducted to further investigate any unique predictors of climate change attitudes while holding demographic variables constant. The assumptions of linearity, normality, and homoscedasticity were all met as assessed by scatterplots. Durbin-Watson analysis indicated independence of residuals and tolerances values indicated the assumption of multicollinearity was met. No outliers were detected. See Table 4 for standardised (β) and unstandardised (B) regression coefficients, 95% CI's, and squared semi-partial correlations (sr^2).

Step1: gender, age, and education level accounted for 26% of the variability in climate change attitudes, R^2 = 26.2, $F(3,80) = 9.45$, $p < .001$. Gender $\beta = .30$, $t(80) = 2.99$, $p = .004$, and age $\beta = -.25$, $t(80) = -2.51$, $p = .014$, and education level $\beta = .20$, $t(80) = 2.04$, $p = .045$ significantly predicted climate change attitude scores. Specifically, females and those who identified as "other" had stronger climate change attitudes, while older individuals had relatively lower climate change beliefs. Moreover, people with higher levels of education also had stronger climate change attitudes.

Step 2: locality, EWE exposure, place attachment, overall community wellbeing, future community wellbeing, community resilience, harm perceptions, perceived severity, and concern accounted for an additional 35% proportion of variability in climate change attitudes, $\Delta R^2 = .35$, $F_{chg}(9,71) = 7.21$, $p < .001$. There was no significant independent association found between EWE, locality, place attachment, overall community wellbeing, future community wellbeing, community resilience, harm perceptions, and concern with climate change attitudes. However, perceived severity, $\beta = .56$, $t(73) = 5.56$, $p < .001$, significantly predicted climate change attitudes. Thus indicating people who perceived EWEs as more severe had stronger climate change attitudes. In summation, 61% of variance in climate change attitudes was accounted for by independent variables in these models. These results support H_1a and H_1b.

Table 4

Results of Hierarchical Multiple Regression Analysis Predicting Climate Change Attitudes

Variables	*N*	*B*	*SE*	95% CI (B) Lower	95% CI (B) Upper	*β*	sr^2
Step 1							
Gender	111	.67	.23	.23	1.12	.30*	.29
Age	112	-.02	.01	-.03	-.00	-.25*	-.24
Education	111	.37	.18	.01	.74	.20*	.20
Step 2							
Gender	111	.43	.19	.06	.81	.19*	.17
Age	112	-.01	.01	-.03	-.00	-.20*	-.17
Education	111	.11	.15	-.19	.41	.06	.05
Locality	112	-.12	.15	-.42	.19	-.06	-.06
EWE	113	.06	.06	-.06	.18	.08	.07
Place Attachment	100	-.03	.12	-.27	.20	-.04	-.02
Overall WB	96	.21	.15	-.08	.50	.20	.11
Future Wellbeing	96	-.20	.16	-.52	.12	-.21	-.09
Community Resilience	86	.09	.12	-.15	.32	.07	.06
Harm Perceptions	86	-.15	.09	-.33	-.04	-.14	-.12
Perceived Severity	85	.58	.11	.37	.79	.55**	.42
Concern	85	.04	.08	-.12	.19	.04	.03

Note: R^2 at Step 1 = .26 (ΔR^2 = .23), R^2 at Step 2 = .61 (ΔR^2 = .55).
*p < .05, **p < .001

DISCUSSION

Climate Change Attitudes and Perceptions of Severity

Results from the Pearson's correlations analysis revealed statistically significant associations between climate change attitudes, perceived severity and concern. Therefore, stronger climate change attitudes were associated with greater perceived severity of EWEs. Likewise, stronger climate change attitudes were also associated with increased concerns about global warming as a result of exposure to an EWE. Thus supporting H_1a and H_1b.

The results also found statistically significant weak positive associations between climate change attitudes and gender, education level and EWE. These findings demonstrated that people who were female, had a higher level of education, and experience with EWEs had stronger climate change attitudes. By contrast, a significantly weak negative correlation was found between age and climate change attitudes. Therefore, older people had lower climate change beliefs. Hierarchical regression analyses revealed that age, gender, education and perceived severity accounted for 61% of the variability in climate change attitudes. Perceived

severity of EWEs was a significant predictor of the explained variance in climate change attitudes over and above demographics such as age, gender, and education alone.

It stands to reason then that people's attitudes towards climate change are significantly influenced by the perceived threat that is elicited in response to exposure of EWEs. These findings are congruent with previous research that has delineated a clear link between exposure to extreme weather and increased risk perceptions in the face of climate change (Akompab et al., 2013). These findings are also in accordance with theoretical models of PMT (Rogers, 1975) and HBM (Rosenstock et al., 1988). Specifically, people's tendency to form attitudes and behaviours based on a coping and threat appraisal of perceived risk. It is logical to conclude that people who have lived experience with EWEs are likely to have stronger climate change attitudes, and therefore perceive extreme weather conditions as more severe. Moreover, individuals with strong beliefs about climate change are also likely to have greater concerns about global warming.

Locality and Climate Change Attitudes

An independent samples t-test comparing climate change attitudes between urban and rural populations yielded a significant difference. Individuals living in rural communities reported having lower climate change attitudes in comparison to people from urban regions of Australia. Thus, supporting H_2. These findings are consistent with previous research, which has found that rural folk are less likely to believe in climate change and more likely to attribute EWEs to normal weather variability (Buys, Miller, & van Megen, 2012). While climate change attitudes are stronger in individuals from urban areas (Reser et al., 2012). This could be a result of limited accessibility to education and resources in rural parts of Australia.

Locality also had a significantly weak positive correlation with age and weak negative association with education level. Thus, the sample population indicated that people in rural areas tended to be older in age and reportedly had less education, whereas the urban sample had younger people with higher education levels. Past research has found that age and education are strong predictors of climate change attitudes. In particular, older people and individuals with lower education levels are likely to have lower climate change attitudes (Olofsson & Öhman, 2006). Therefore, this provides further explanation to the discrepancy in climate change attitudes between rural and urban populations.

Furthermore, EWEs demonstrated a weak positive relationship with climate change attitudes and place attachment. Therefore, increased exposure to EWEs was associated with an increase in climate change attitudes and increased place attachment. These findings support existing theoretical models such as CLT (Trope & Liberman, 2010) suggesting that those who have greater exposure to EWEs (i.e., less psychological distance) are more likely to have stronger climate change attitudes (i.e., concrete thinking). It also supports PMT (Rogers, 1975) as the appraisal of perceived threat is likely to increase with added exposure to extreme

weather conditions, thereby influencing stronger climate change attitudes. Perceived risk to place identity and attachment to home or region are likely to be threatened as well, thereby also increasing climate change attitudes (Scannell & Gifford, 2013). These findings are congruent with past research which found exposure to EWEs influences climate change attitudes, perceptions of place attachment and place identity (Lemée et al., 2019). Future implications for these findings suggest that locality plays a role in the formation of climate change attitudes and the perceptions of EWEs. Age and education level also influence this relationship. Therefore, place specific strategies for educating Australians about the impact of climate change relevant to a person's local area is more likely to yield a better informed community, as well as resources designed to target populations of different age and education level.

Perceptions of Community

No significant relationship was found between exposure to EWEs and perceptions of community wellbeing, community harm or community resilience. Therefore, H_3a, H_3b, and H_{3c}were not supported. This is inconsistent with previous studies reporting lowered perceptions of community wellbeing (Morrissey & Reser, 2007) and community resilience (Anderies & Janssen, 2011), and increased perceptions of community harm following EWEs (Walton et al., 2016). While not statistically significant, data trends in the current study suggest a positive correlation. It could be inferred that following an EWE individuals are more likely to have greater perceptions of community wellbeing and resilience due to greater community cohesion and connectedness during disaster recovery (Lemée et al., 2019; The Climate Institute, 2011). This may suggest that greater social support and community connectedness buffers the perceived threat of EWEs and consequently enhances perceptions of community wellbeing and community resilience. Increased local community action during disaster response provides people with opportunities to help and resources to act on health behaviours that will benefit themselves and the community at large (Brink & Wamsler, 2019). It was expected that resources, both physical and psychological, would be impacted in the wake of EWEs causing lower perceptions of community wellbeing and resilience. However, this study in combination with past research suggests that even when physical threats (i.e., EWEs) are apparent, psychological resources (e.g., community connectedness) are enhanced within communities in order to recover quickly from disaster.

Harm perceptions had significant weak associations with place attachment and community resilience, and a moderate positive correlation with community spirit. This suggests that greater perceptions of harm done to community as a result of EWEs were associated with greater perceptions of community resilience and place attachment. Community resilience also had a significant, weak positive correlation with place attachment and personal safety. Attachment to place clearly plays a role in the perceptions of risk and the perceptions of community resilience in the face of EWEs. The emotional and social links to a living place can provide individuals with a personal identity and sense of belonging (Williams & Vaske,

2003). When external forces threaten this identity a greater perception of risk is likely to be experienced. Consequently, the way in which people respond and cope to this perceived risk is likely to differ. The results from this study suggest that place attachment can aid in the recovery and help foster resilient coping strategies among the collective community (Lemée et al., 2019). Community resilience also had statistically significant moderate correlation with decision-making, community spirit, community cohesion, community trust, overall community wellbeing, and future community wellbeing. Perceptions of community resilience were moderately correlated with all eight factors of community wellbeing. Most important to note is the moderate correlation between overall community wellbeing and future community wellbeing with community resilience. This specifically demonstrates the perceived relationship of the wellbeing of communities and a community's resilience.

The more sceptical an individual is the less likely they are to perceive climate change as a potential threat (Brugger et al., 2016). The current study supports this contention as participants also exhibited a low trust in local community officials and state governments as examined by Pearson correlations in the Community Wellbeing Scale. It might be hypothesised that strong beliefs regarding climate change are related to lack of confidence in governing bodies and researchers rather than the effects of climate change itself (Hmielowski, Feldman, Myers, Leiserowitz, & Maibach, 2014). It has also been reported that age and rural location are predictors of scepticism, which in turn may mediate the relationship between climate change attitudes (Whitmarsh, 2011). This may be the case with older Australians living remotely and clearly indicative that further investigation is warranted.

Limitations

Firstly, responses to climate change attitudes may have been influenced by geographical bias as the large majority of the sample population consisted of participants from Far North Queensland where EWEs are more prevalent. In particular, long-term drought followed by the unprecedented 2019 Townsville floods may have produced a response bias after recent exposure to an EWE. Nonetheless, this makes the findings current and extremely relevant to the effect climate change has on the wellbeing of Australian communities. Secondly, an in-depth comparison analysis between participants who have and have not experienced an EWE was not possible in the sample population due to majority (95%) reportedly having personal experience with one or more EWE in the last 3 years. Nonetheless, this is a strong indication that very few Australians have not been exposed to an EWE and further signifies the importance of this research and the effect climate change is having on the mental health and wellbeing of the Australian population. Thirdly, the study had low statistical power given the small sample size whereby reducing the likelihood of detecting a true effect.. Lastly, the scales used in this study demonstrated good reliability in the original research as well as in the current study; however, these measures have not been widely tested to assess reliability and validity. Alternatively, different measures for predicting climate change attitudes and

more robust measures of community wellbeing could be used in future research. Despite these limitations, the findings from the current study add value to the existing body of research.

Strengths

Firstly, this study was conducted six months after the 2019 Townsville floods thus making the data from this research extremely current and relevant concerning climate change attitudes and the perceptions of EWE's on community wellbeing and resilience in Australia. Secondly, a relatively equal number of respondents in urban and rural areas allowed for a comparison analysis of climate change attitudes. Thereby making conclusions more accurately reflective of the general population. Thirdly, studies rely on convenience samples from university students to obtain data by offering research credit in exchange for participation. While this was offered to James Cook University students, no students actually participated. Thereby this sample is a true reflection of the general population within Australia and more generalisable. Lastly, the use of the Community Wellbeing Scale (Walton et al., 2014) provided a more expansive understanding of wellbeing by measuring the construct across eight domains at a community level.

Future Recommendations

Perceptions of community wellbeing and resilience could be directly affected by a person's level of engagement with their community and place attachment. Therefore, further research into social and community connectedness as a mediator of climate change attitudes and perceptions of community in the context of EWEs is recommended. Furthermore, a longitudinal approach using pre and post measures of climate change attitudes and their influence on perceptions of community wellbeing following an EWE would yield interesting results. Wellbeing is often measured subjectively; future research should continue to investigate wellbeing at the community level. Additionally, comparing climate change attitudes between collectivist and individualistic cultures would provide further insight.

Examination of gender and personality differences in climate change attitudes and how this impacts community wellbeing is warranted as it is not currently on the research agenda. Additionally, trends in the current study show scepticism and distrust towards governing bodies may influence climate change attitudes. Investigating this relationship further particularly regarding attitude formation is recommended.

CONCLUSION

This study is one of the first to provide insight into the discrepancies of climate change beliefs among the Australian public, and to gauge the perceptions of EWEs and their impact on community wellbeing and resilience (Kais & Islam, 2016; Nurse, Basher, Bone, & Bird,

2010). Overall, the results from this study suggest that there is a strong relationship with risk perceptions and climate change attitudes, as well as concerns about global warming. Furthermore, the significant discrepancies in climate change attitudes between rural and urban groups showed that Australians living rurally have lower climate change beliefs. While the hypotheses about EWEs predicting perceptions in community wellbeing and community resilience were not supported, future research with more robust measures may be more productive.

Results from this study may prove useful for local and state officials, emergency responders, health allied professionals, and educators facing increasingly extreme weather in Australia. It can inform recovery initiatives for communities hit by natural disasters to include wellbeing and resilience as a part of the recovery stage, and guide public awareness campaigns to improve climate literacy and mental health outcomes in different regions of Australia. Specifically designed climate education and EWE resources could be used for target populations based on the demographic and geographical predictors found in this study.

AUTHOR DECLARATION

I declare that the research presented and reported in this thesis was conducted ethically in accordance with the National Health and Medical Research Council (NHMRC) and with the approval from the James Cook University Human Research Ethics Committee. Ethics approval number H7844.

ACKNOWLEDGEMENTS

I am thankful to my family and friends who completely sustained me while simultaneously facing cancer and trying to complete my thesis research. Thank you to my parents who modeled a strong passion for education and learning. And to my supervisor, Dr Sarah Lutkin, whose passion for this project aligned with my own. It was a pleasure to see the research come to life with her support and guidance. Finally, an acknowledgement to the people of Townsville who captured my heart completely and demonstrated strength, community, and resilience following the 2019 floods. It is what inspired this research topic.

REFERENCES

Akompab, D., Bi, P., Williams, S., Grant, J., Walker, I., & Augoustinos, M. (2013). Heat waves and climate change: Applying the health belief model to identify predictors of risk perception and adaptive behaviours in Adelaide, Australia. *International Journal of Environmental Research and Public Health, 10*(6), 2164-2184. doi:10.3390/ijerph10062164

Amundsen, H. (2012). Illusions of resilience? An analysis of community responses to change in northern Norway. *Ecology and Society, 17*(4), 46. doi:10.5751/ES-05142-170446

Anderies, J. M., & Janssen, M. A. (2011). The fragility of robust social-ecological systems. *Global Environmental Change, 4*(21), 1153-1156. doi:10.1016/j.gloenvcha.2011.07.004

Australian Medical Association. (2019). *AMA formally recognises climate change as a health emergency*. Retrieved from https://ama.com.au/sites/default/files/documents/030919%20-%20AMA%20Calls%20Climate%20Change%20A%20Health%20Emergency_1.pdf

Brink, E., & Wamsler, C. (2019). Citizen engagement in climate adaptation surveyed: The role of values, worldviews, gender and place. *Journal of Cleaner Production, 209*, 1342-1353. doi:10.1016/j.jclepro.2018.10.164

Brugger, A., Morton, T. A., & Dessai, S. (2016). "Proximising" climate change reconsidered: A construal level theory perspective. *Journal of Environmental Psychology, 46*, 125-142. doi:10.1016/j.jenvp.2016.04.004

Bureau of Meteorology. (2018). Australia's changing climate. Retrieved from http://www.bom.gov.au/state-of-the-climate/australias-changing-climate.shtml

Buys, L., Miller, E., & van Megen, K. (2012). Conceptualising climate change in rural Australia: Community perceptions, attitudes and (in)actions. *Regional Environmental Change, 12*(1), 237-248. doi:10.1007/s10113-011-0253-6

Carlton, J. S., Mase, A. S., Knutson, C. L., Lemos, M. C., Haigh, T., Todey, D. P., & Prokopy, L. S. (2016). The effects of extreme drought on climate change beliefs, risk perceptions, and adaptation attitudes. *Climatic Change, 135*(2), 211-226. doi:10.1007/s10584-015-1561-5

Caruana, C. (2010). Picking up the pieces: Family functioning in the aftermath of natural disaster. *Family Matters*(84), 79-88.

Christensen, R., & Knezek, G. (2015). The Climate Change Attitude Survey: Measuring Middle School Student Beliefs and Intentions to Enact Positive Environmental Change. *International Journal of Environmental and Science Education, 10*(5), 773-788.

Climate Council. (2018). *Weather gone wild: climate change-fuelled extreme weather in 2018*. Retrieved from https://www.climatecouncil.org.au/wp-content/uploads/2019/02/Climate-council-extreme-weather-report.pdf

Demski, C., Capstick, S., Pidgeon, N., Sposato, R. G., & Spence, A. (2017). Experience of extreme weather affects climate change mitigation and adaptation responses. *Climatic Change, 140*(2), 149-164. doi:10.1007/s10584-016-1837-4

Department of Agriculture. (2017). Regional postcode delivery classifications. Retrieved from https://www.agriculture.gov.au/import/online-services/delivery-postcode/summary

Department of Health. (1994). Rural, remote and metropolitan area classification. Retrieved from https://www.health.gov.au/health-workforce/health-workforce-classifications/rural-remote-and-metropolitan-area

Ebi, K. L., & Bowen, K. (2016). Extreme events as sources of health vulnerability: Drought as an example. *Weather and Climate Extremes, 11*(C), 95-102. doi:10.1016/j.wace.2015.10.001

Epstein, S. (1990). Cognitive-experiential self-theory. In L. A. Pervin (Ed.), *Handbook of personality: Theory and research* (pp. 165-192). New York: Guilford Press.

Foley, J. A., DeFries, R., Asner, G. P., Barford, C., Bonan, G., Carpenter, S. R., . . . Gibbs, H. K. (2005). Global consequences of land use. *Science, 309*(5734), 570-574. doi:10.1126/science.1111772

Geiger, N., Swim, J. K., & Fraser, J. (2017). Creating a climate for change: Interventions, efficacy and public discussion about climate change. *Journal of Environmental Psychology, 51*, 104-116. doi:10.1016/j.jenvp.2017.03.010

Hamilton-Webb, A., Manning, L., Naylor, R., & Conway, J. (2017). The relationship between risk experience and risk response: A study of farmers and climate change. *Journal of Risk Research, 20*(11), 1379-1393. doi:10.1080/13669877.2016.1153506

Hansen, J., Sato, M., & Ruedy, R. (2012). Perception of climate change. *Proceedings of the National Academy of Sciences, 109*(37), E2415-E2423. doi:10.1073/pnas.1205276109

Hart, P. S., & Nisbet, E. C. (2012). Boomerang effects in science communication: How motivated reasoning and identity cues amplify opinion polarization about climate mitigation policies. *Communication Research, 39*(6), 701-723. doi:10.1177/0093650211416646

Hmielowski, J. D., Feldman, L., Myers, T. A., Leiserowitz, A., & Maibach, E. (2014). An attack on science? Media use, trust in scientists, and perceptions of global warming. *Public Understanding of Science, 23*(7), 866-883. doi:10.1177/0963662513480091

Howe, P. D., & Leiserowitz, A. (2013). Who remembers a hot summer or a cold winter? The asymmetric effect of beliefs about global warming on perceptions of local climate conditions in the US. *Global Environmental Change, 23*(6), 1488-1500. doi:10.1016/j.gloenvcha.2013.09.014

Kais, S. M., & Islam, M. S. (2016). Community capitals as community resilience to climate change: conceptual connections. *International Journal of Environmental Research and Public Health, 13*(12), 1211. doi:10.3390/ijerph13121211

Kunda, Z. (1990). The case for motivated reasoning. *Psychological Bulletin, 108*(3), 480-498. doi:10.1037//0033-2909.108.3.480

Laerd Statistics. (2015). Statistical tutorials and software guides. Retrieved from https://statistics.laerd.com/

Lee, T. M., Markowitz, E. M., Howe, P. D., Ko, C.-Y., & Leiserowitz, A. A. (2015). Predictors of public climate change awareness and risk perception around the world. *Nature Climate Change, 5*(11), 1014-1020. doi:10.1038/nclimate2728

Lemée, C., Fleury-Bahi, G., & Navarro, O. (2019). Impact of place identity, self-efficacy and anxiety state on the relationship between coastal flooding risk perception and the willingness to cope. *Frontiers in Psychology, 10*. doi:10.3389/fpsyg.2019.00499

Leviston, Z., Greenhill, M., & Walker, I. (2015). Fourth annual survey of Australian attitudes to climate change: Interim report. Retrieved from http://images.smh.com.au/file/2014/02/07/5139061/CSIROCC4.pdf

Lewis, G. B., Palm, R., & Feng, B. (2019). Cross-national variation in determinants of climate change concern. *Environmental Politics, 28*(5), 793-821. doi:10.1080/09644016.2018.1512261

Linden, S. (2014). On the relationship between personal experience, affect and risk perception: The case of climate change. *European journal of social psychology, 44*(5), 430-440. doi:10.1002/ejsp.2008

Lorenzoni, I., Leiserowitz, A., De Franca Doria, M., Poortinga, W., & Pidgeon, N. F. (2006). Cross-National comparisons of image associations with "global warming" and "climate change" among laypeople in the United States of America and Great Britain. *Journal of Risk Research, 9*(03), 265-281. doi:10.1080/13669870600613658

Marx, S. M., Weber, E. U., Orlove, B. S., Leiserowitz, A., Krantz, D. H., Roncoli, C., & Phillips, J. (2007). Communication and mental processes: Experiential and analytic processing of uncertain climate information. *Global Environmental Change, 17*(1), 47-58. doi:10.1016/j.gloenvcha.2006.10.004

Mase, A. S., Gramig, B. M., & Prokopy, L. S. (2017). Climate change beliefs, risk perceptions, and adaptation behavior among Midwestern US crop farmers. *Climate Risk Management, 15*(C), 8-17. doi:10.1016/j.crm.2016.11.004

Mason, L. R., & Rigg, J. (2019). *People and climate change: vulnerability, adaptation, and social justice*. New York, NY: Oxford University Press.

McPhillips, L. E., Chang, H., Chester, M. V., Depietri, Y., Friedman, E., Grimm, N. B., . . . Shafiei Shiva, J. (2018). Defining Extreme Events: A Cross-Disciplinary Review. *Earth's Future, 6*(3), 441-455. doi:10.1002/2017EF000686

Menapace, L., Colson, G., & Raffaelli, R. (2015). Climate change beliefs and perceptions of agricultural risks: An application of the exchangeability method. *Global Environmental Change, 35*, 70-81. doi:10.1016/j.gloenvcha.2015.07.005

Morrissey, S. A., & Reser, J. P. (2007). Natural disasters, climate change and mental health considerations for rural Australia. *Australian Journal of Rural Health, 15*(2), 120-125. doi:10.1111/j.1440-1584.2007.00865.x

Munich RE. (2018). *NatCatSERVICE: Relevant natural loss events worldwide 1980-2018*. Retrieved from https://natcatservice.munichre.com/events/1?filter=eyJ5ZWFyRnJvbSI6MTk4MCwieWVhclRvIjoyMDE4fQ%3D%3D&type=1

Myers, T. A., Maibach, E. W., Roser-Renouf, C., Akerlof, K., & Leiserowitz, A. A. (2013). The relationship between personal experience and belief in the reality of global warming. *Nature Climate Change, 3*(4), 343-347. doi:10.1038/nclimate1754

Nicholls, N., Nicholls, N., Butler, C. D., Butler, C. D., Hanigan, I., & Hanigan, I. (2006). Inter-annual rainfall variations and suicide in New South Wales, Australia, 1964–2001. *International Journal of Biometeorology, 50*(3), 139-143. doi:10.1007/s00484-005-0002-y

Nurse, J., Basher, D., Bone, A., & Bird, W. (2010). An ecological approach to promoting population mental health and well-being—a response to the challenge of climate change. *Perspectives in public health, 130*(1), 27-33.

Olofsson, A., & Öhman, S. (2006). General beliefs and environmental concern: Transatlantic comparisons. *Environment and Behavior, 38*(6), 768-790. doi:10.1177/0013916506287388

Ren, F.-M., Trewin, B., Brunet, M., Dushmanta, P., Walter, A., Baddour, O., & Korber, M. (2018). A research progress review on regional extreme events. *Advances in Climate Change Research, 9*(3), 161-169. doi:10.1016/j.accre.2018.08.001

Reser, J. P., Bradley, G. L., Glendon, A. I., Ellul, M. C., & Callaghan, R. (2012). Public risk perceptions, understandings and responses to climate change in Australia and Great Britain. Retrieved from https://www.nccarf.edu.au/sites/default/files/attached_files_publications/Reser_2012_Public_risk_perceptions_Final.pdf

Rogers, R. W. (1975). A protection motivation theory of fear appeals and attitude change1. *The Journal of Psychology, 91*(1), 93-114. doi:10.1080/00223980.1975.9915803

Rosenstock, I. M., Strecher, V. J., & Becker, M. H. (1988). Social learning theory and the health belief model. *Health Education Quarterly, 15*(2), 175-183. doi:10.1177/109019818801500203

Scannell, L., & Gifford, R. (2013). Personally Relevant Climate Change: The Role of Place Attachment and Local Versus Global Message Framing in Engagement. *Environment and Behavior, 45*(1), 60-85. doi:10.1177/0013916511421196

Simpson, D. M., Weissbecker, I., & Sephton, S. E. (2011). Extreme weather-related events: implications for mental health and well-being. In I. Weissbecker (Ed.), *Climate change and human well-being: Global challenges and opportunities* (pp. 57-78). New York, NY: Springer.

Tang, B., Liu, X., Liu, Y., Xue, C., & Zhang, L. (2014). A meta-analysis of risk factors for depression in adults and children after natural disasters. *BMC Public Health, 14*(1), 623. doi:10.1186/1471-2458-14-623

The Climate Institute. (2011). *A Climate of Suffering: The Real Costs of Living with Inaction on Climate Change: Mental Health and Community Wellbeing in the Wake of Extreme Weather*. Melbourne & Sydney: The Climate Institute.

Trope, Y., & Liberman, N. (2010). Construal-level theory of psychological distance. *Psychological Review, 117*(2), 440-463. doi:10.1037/a0018963

Vaske, J. J. (2008). *Survey research and analysis: applications in parks, recreation and human dimensions*. State College, PA: Venture Publishing.

Walton, A., McCrea, R., & Leonard, R. (2014). *CSIRO survey of community wellbeing and responding to change: Western Downs region in Queensland*. Retrieved from http://gisera.org.au/publications/tech_reports_papers/socioeco-proj-3-community-wellbeing-report.pdf

Walton, A., McCrea, R., & Leonard, R. (2016). The 2016 CSIRO community wellbeing and responding to change survey: Western Downs regions, Queensland - changes between 2014 and 2016 in the context of coal seam gas development. CSIRO: Brisbane. Retrieved from www.gisera.org.au

Whitmarsh, L. (2008). Are flood victims more concerned about climate change than other people? The role of direct experience in risk perception and behavioural response. *Journal of Risk Research, 11*(3), 351-374. doi:10.1080/13669870701552235

Whitmarsh, L. (2011). Scepticism and uncertainty about climate change: Dimensions, determinants and change over time. *Global Environmental Change, 21*(2), 690-700. doi:10.1016/j.gloenvcha.2011.01.016

Williams, D. R., & Vaske, J. J. (2003). The measurement of place attachment: Validity and generalizability of a psychometric approach. *Forest science, 49*(6), 830-840. doi:10.1093/forestscience/49.6.830

Willox, C. A., Harper, S. L., Ford, J. D., Landman, K., Houle, K., & Edge, V. L. (2012). "From this place and of this place:" Climate change, sense of place, and health in Nunatsiavut, Canada. *Social Science & Medicine, 75*(3), 538-547. doi:10.1016/j.socscimed.2012.03.043

Wiseman, J., & Edwards, T. (2009). Community health and wellbeing in a changing climate: Challenges and priorities for the health sector in Victoria. *Health Issues,* (99), 10-15. Retrieved from https://search-informit-org.elibrary.jcu.edu.au/fullText;dn=160883741647454;res=IELHEA

World Health Organisation. (2015). Climate change and human health. Retrieved from https://www.who.int/globalchange/global-campaign/cop21/en/

Xiao, C., & McCright, A. M. (2015). Gender differences in environmental concern: Revisiting the institutional trust hypothesis in the USA. *Environment and Behavior, 47*(1), 17-37. doi:10.1177/0013916513491571

Zamir, R., Alpert, P., & Rilov, G. (2018). Increase in weather patterns generating extreme desiccation events: Implications for Mediterranean Rocky Shore ecosystems. *Estuaries and Coasts, 41*(7), 1868-1884. doi:10.1007/s12237-018-0408-5

Zanocco, C., Boudet, H., Nilson, R., Satein, H., Whitley, H., & Flora, J. (2018). Place, proximity, and perceived harm: extreme weather events and views about climate change. *Climatic Change, 149*(3-4), 349-365. doi:10.1007/s10584-018-2251-x