Climate Change Beliefs and the Connection to “Home”

A Survey of Colorado Residents

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Abstract

This environmental psychology study measured types of climate change beliefs among Colorado residents using online survey methods to determine if the psychological theories of positive place identity and rootedness to “home” influence either a belief in local climate change and/or the emotional response to beliefs of climate change experiences in Colorado.

The primary research question of this study was: How does the perceived threat of localized climate change affect a person’s emotional well-being and their willingness to accept the notion of local climate change? Three hypotheses were used to lend insight into this question. It was hypothesized that individuals with strong place attachment to a local area are less likely to believe they will be impacted by climate change in their local region. Additionally, individuals purporting a strong place attachment and belief in local climate change will feel pronounced emotional distress. Lastly, individuals with strong place attachment will express resistance to moving from their residential place due to local climate change threats if they have a positive place identity to their residential place.

There has been recent momentum to emphasize local climate change threats in climate science communication with the assumption people will be more motivated to protect their “backyard” as is often seen in “not in my back yard” NIMBY campaigns. I had reservations regarding this suggestion as other psychological phenomena suggests people have an “optimism bias” or express other forms of denial when confronted with
personal threats. This study contributes to the discussion of best practices for climate change communication.

Residents of Colorado (N=105) were asked to participate in an online survey with 46 Likert-scale questions asking (1) to what degree living in Colorado met their needs; (2) how likely they were to move out of Colorado; (3) what their beliefs are regarding climate change, including whether they believe climate change is occurring in Colorado; and (4) if they hold a belief in local climate change, does that belief foster emotional distress, and would the participant consider moving from Colorado because of their belief in local climate change.

Unexpectedly, regression analysis did not support the hypotheses of this research. Insightfully, however, analysis indicated a strong, statistically significant relationship between belief in local climate change and rootedness (how attached a person is to a particular place) wherein 1.0 measured unit of belief in local climate change correlated with an increased, 1.096 unit of rootedness to Colorado (p<.001). The results of this study suggest an important area of future research for climate change mitigation and adaptation among “rooted” residents who already believe in local climate change. As an example, further studies on rootedness and local climate change belief may elicit a repeatable, climate change communication framework for improving outcomes for pro-environmental behavior, stewardship, and climate change mitigation.
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Chapter I
Introduction

Climate change communicators are seeking more effective approaches for educating the public regarding an imminent threat of climate change in an effort to persuade others to engage in swift action towards mitigating climate change.

Initially, efforts beginning as early as the 1990s revolved around messages of global warming or global climate change (Schweizer, Davis, & Thompson, 2013). After not achieving a desired mobilization of mass action with this type of messaging, more recently climate change communicators began proposing a personalized approach to climate change messaging wherein the emphasis was on how climate change was affecting local communities (Scannell & Gifford, 2013). Citing the successful opposition and action communities have engaged in through “not in my back yard,” or NIMBY campaigns (Devine-Wright, 2009; Lee & Lee, 2017), a localized climate change message appears to be a logical extension to rally the public towards climate change mitigation and other pro-environmental behaviors on a local level. Climate change messages connected to an accurate assessment of risk of local climate change is suggested in some of the literature to predicate the effectiveness of a message. However, research has been inconclusive in establishing a reliable framework for addressing different risk perceptions among residents and those who are strongly attached to their local area (Bernardo, 2013).

One reason for this may stem from the seemingly illogical human reaction of denying the need for defending our homes and communities against a real or perceived
environmental threat (Graybill, 2011; Kick, Fraser, Fulkerson, & de Vries, 2011; Shepherd, 2014). Some research suggests people may either minimize or fail to fully appreciate risks when there is an abstract perceived threat (Arnet, 2000; De Dominicis, Fornara, Ganucci Cancellieri, Twigger-Ross, & Bonaiuto, 2015).

Research Significance and Objectives

Climate change not only impacts the Earth and our environment, it can render significant psychological impacts to people (Fritze, Blaski, Burke, & Wiseman, 2008; Cunsolo Willox & Harper, 2010; ecoAmerica, 2013; Linden, 2013, Clayton, Manning, & Hodge, 2014). I assumed that understanding the psychological mechanisms behind positive place identity (a person’s positive and strong attachment to a particular place), in conjunction with an individual’s perception of local climate change, are key to unlocking the climate change communication puzzle.

The research contributes to the small but growing body of knowledge of an individual’s acceptance or denial of local climate change and the related effects on an individual’s sense of well-being. It also contributes to the environmental psychology literature surrounding the concepts of “place attachment” and “positive place identity.”

My main objective was to determine what, if any, correlation can be shown between climate change risk perception, positive place identity, and denial mechanisms such as optimism bias. This study utilized an online survey of Colorado citizens in order to establish a “local” baseline for analysis. The measures included: (1) the strength of a Coloradan’s connection to living in Colorado in comparison to their beliefs of whether
climate change is occurring in Colorado, and (2) whether those beliefs have a positive or negative impact on the survey participants’ emotional well-being.

Background

At first glance, it may seem logical that individuals would be motivated to preserve and improve their local environment in order to enjoy a happier and healthier life. Yet there are numerous examples of how people intentionally, or through neglect, create environmental destruction within their communities. Can the field of environmental psychology provide insight or an explanation?

History of Climate Change Communication

Each year, tremendous amounts of resources—time, money, manpower, physical resources, and enthusiasm—are unnecessarily wasted by well-intentioned environmental advocacy groups, non-government organizations (NGOs), and climate scientists, working hard to combat climate change. These “climate change communicators” aim to inspire citizens, policy makers and politicians to make bold moves to halt or slow climate change and to foster pro-environmental behaviors for mitigating the negative effects of our CO₂-reliant lifestyle on our planet. Unfortunately, though discussions of climate change are increasing throughout the world, climate change is not considered one of the greatest global threats by a majority of the world’s population, particularly in the United States, Europe, Russia and Australia (Carle, 2015). Climate communicators are asking why more people are not more concerned about climate change.

Until approximately 2009, climate change messages and images consisted primarily of the devastating effects of rapid deforestation, the loss of animal habitats, for
example, images of polar bears floating on small blocks of ice in the quickly warming oceans (Swim & Bloodhart, 2015), or historic flooding of communities who are also floating on makeshift barges as they travel past their flooded homes (Schweizer, Davis, & Thompson, 2013). However, these messages are perceived as occurring primarily in lands distant from most of “us” (O’Neill & Nicholson-Cole, 2009) and therefore are likely not very effective at motivating people to have concern for and take action for climate change mitigation.

The term “global warming” became the most commonly term used to describe this type of environmental degradation. Fueling the global-warming public message campaign was the widely discussed 2006 documentary, *An Inconvenient Truth*, with widespread mainstream theater distribution, including over 100 days of screening in at least 20 theaters across the globe, resulting in worldwide sales over $52 million (Nash Information Services, 1997–2018). This film marked the peak of interest in solving global warming issues. Citizens were outraged over global warming threats and demanded their politicians and policy makers take action to mitigate them. Unfortunately, this movement’s velocity waned by the summer of 2009 when, a public release of climate science emails from University of East Anglia in the United Kingdom (now referred to as “Climategate”) disclosed scientists’ perceived inconsistencies in climate science and interpretations of the data (Armstrong, 2009). Global warming and climate change science opposition groups pounced on the emails, and proclaimed climate science was inconclusive in supporting “environmental crisis” predictions. Much of the public became persuaded by this reinvigorated skepticism, and internationally, the momentum of global warming mitigation policies and public concern stalled (Stoknes, 2015).
“Climategate” was not the only obstacle environmentalists and climate change communicators faced. A severe downturn in the global economy and rising threats from terror groups like ISIS shifted the public’s attention and lowered concern that global warming was as urgent or the most threatening problem (Carle, 2015) or worse, if the deniers were to be believed, was not a problem at all (Graybill, 2013).

In an attempt to renew the public’s interest, climate change communication experts advocated a shift in communication from messages warning about the impacts of climate change on a global level to a focus on current and future impacts on local communities. Other environmental movements found mobilization success when communities rallied around local issues, known as the NIMBY movement (Devine-Wright, 2009). Seeing the success of the “keep it local” campaign, climate change communicators may have reasoned that if citizens believe climate change can or will affect their community directly, versus “only in distant lands” or distant years (Bonaiuto, Breakwell, & Cano, 1996; Clayton, Manning, & Hodge, 2014), then individuals would re-engage in climate change mitigation advocacy.

Scannell and Grouzet (2009), leading proponents of local climate change messaging, noted “[C]limate change evokes different cognitive responses than do other environmental problems because of its magnitude, perceived distance, and abstractness” (p. 94). Thus, climate change message-makers reasoned presenting climate change as a local issue would reduce the physical distance from the problem, making it less abstract, and more urgent. Localizing the effects of climate change would theoretically restore pro-environmental citizen action and increase advocacy for government action and accountability on climate change.
Has this communication style increased the public’s concern for climate change and its willingness to take action towards climate change mitigation? Climate change perception is a psychological and socio-cultural phenomenon (Leiserowitz, 2006; Gifford, 2011; ecoAmerica, 2013; Nicolosi & Corbett, 2018). For example, is it possible there might be a positive correlation between local climate change threats and reports of negative well-being? Is it likely participants who express negative psychological feelings as it relates to local climate change might subsequently minimize the perceived impact on them personally, as demonstrated by participants in previous studies wherein researchers attributed these types of responses to optimism bias (Huńka, 2010)?

It is important to consider studies which have found contradictions or negative, unexpected reactions to local climate-change threat messaging, before the “make it local” approach becomes widely adopted among climate communicators (Frederick, 2014). Such studies call attention to how individuals form their beliefs; for instance, residents may recognize and accept the threats of environmental problems on a distant national or global level but may deny or minimize similar threats in their own communities despite solid evidence to the contrary.

This may seem counterintuitive. However, similar bias and denial have repeatedly been documented in health education research. Two of the mechanisms for individuals to emotionally process a threat is to deny it (Thompson & Schlehofer, 2008) or form a belief they are less likely to suffer from the threat than other people (Uzzell 2000; Pahl et al., 2005). This is what risk theory researchers call optimism bias. For example, researcher Arnett surveyed 200 adolescents (ages 12–17) and 200 adults (ages 30–50) in the United States to measure their knowledge about the health risks, including death, from smoking
tobacco. Most participants believed smoking could cause death but, interestingly, adolescent and adult smokers were more likely than nonsmokers to doubt they would die from smoking even if they smoked for 30 or 40 years” (Arnet, 2000). Arnett attributed these findings to optimism bias. In environmental psychology literature, Gifford et al. (2009) aggregated data from 18 countries, which revealed individuals believed environmental problems were more severe on a global versus a local scale (as cited in Dominicis et al., 2015).

Another way optimism bias denial may manifest is through positive place identity, a psychological concept central to the design of this study. Place identity, according to Proshansky (1978), “involves those dimensions of self which define the individual’s personal identity in relation to the physical environment by means of a complex pattern of conscious and unconscious ideas, beliefs, preferences, feelings, values, goals and behavioral tendencies and skills relevant to this environment” (as cited in Jorgensen & Stedman, 2001, p. 234). Positive place identity indicates a vital positive connection to a place and own’s own identity.

Positive place identity expands on the 40-year-old environmental psychology theory place identity. In describing the relationship and connection people have to their geographic environment(s), place identity incorporates a physical location (e.g., tree-lined, quiet streets or a favorite beach) with associated emotional social relationships and personal connections (e.g., childhood friends, teachers, loving parents, friendly neighbors, or feelings of safety). In other words, place identity commonly involves a collective personal perception simultaneously meeting one’s physical, social, spiritual, and psychological needs through a sense of (1) belonging, (2) significance, (3) security,
and (4) growth (Lewicka, 2010, Rollero & De Piccoli, 2010) When a “place” satisfies an individual’s multiple needs and it represents a person’s core values, this person is said to possess a positive place identity (Uzzell, Pol, & Badenas, 2002; Schnell & Mishal, 2008).

Hugh-Jones and Madill’s (2009) study in the United Kingdom captured the participants’ sentiments expressed in order to maintain a sense of positive place identity when they interviewed fourteen residents living near an active rock quarry. The researchers explored how residents of the neighborhood with negative living conditions could (1) “justify [their] continued residence in a challenging environment” and (2) how they could outwardly complain about their community’s faults while maintaining a positive concept of their neighborhood, or to maintain a “positive place identity” (p. 606).

The quarry’s business activities generated continual loud noises, dust-particulate air pollution, and, as a result of continual blasting, the walls of some nearby houses had cracked. Some of the residents had previously written complaint letters to local officials. The researchers inquired into the residents’ previously documented complaints about each of these annoyances. Surprisingly, when the researchers encouraged the residents to take action directly with the company, such as meet with the company executives to vocalize their complaints, nearly all interviewees suddenly recanted the degree of negativity of their complaints and a couple even dismissed the problem, going so far to state the company’s effects on the neighboring community was actually not that bad after all (Hugh-Jones & Madill, 2009).

Hugh-Jones and Madill concluded that simply interviewing these individuals about their problems with the quarry operation appeared to trigger a perceived personal threat to the interviewees and their personal connection to their neighborhood, thereby
affecting their positive place identity. What led these residents to this seemingly about-face position? Insight to this question may be found in other research studies. Bonaiuto, Breakwell, and Cano (1996), as an example, surveyed Italian students to discover the students perceived the water at their local beaches as less polluted than water at beaches farther away. How does our propensity towards optimism bias and the desire to maintain a positive place identity affect how climate change communicators and policy makers craft their messages?

The Development of Climate Change Messages as “Personally Relevant”

Lorenzone et al. (2007) and Gifford (2008) concur with other researchers that because climate change involves a degree of uncertainty and is presented as something happening “far in the future,” people do not consider it personally relevant or urgent and therefore it is relatively unactionable (as cited in Scannell & Gifford, 2013). In order to add the dimension of personal relevance to climate change communication, researchers from Canada’s University of Victoria and Yale University have suggested climate change messages should emphasize “day-to-day relevance” (Leiserowitz, 2007; Scannell & Gifford, 2013, p. 61); thereby making these communications more effective at eliciting increased public engagement in climate change issues and advocacy.

To test the salience of this suggestion, Scannell and Gifford (2013) surveyed 324 residents of Vancouver, Canada on their reactions towards two different types of climate change messages. One educational flyer featured global climate problems and the other emphasized environmental issues currently experienced by Vancouver residents. The locally focused flyer resulted in higher levels of climate change engagement than that of
the participants who received the generic, less personally relevant global climate change flyer (Scannell & Gifford, 2013).

It is important to note this study was not a longitudinal study. Reported engagement sentiments such as “I would take public transportation to work rather than drive so that I can reduce my carbon footprint” are not indicative of long-term or even moderate behavioral change (Stern, 2011; Swim, Clayton, & Howard, 2011). Perhaps participants’ responses for this Vancouver study were simply a short-term emotional and logical connection to the visual stimuli of the flyers presented to them during the study. Linking exposure to a climate-change message to changed behaviors is challenging because most environmental psychology studies are not longitudinal (Lewika, 2011; Nicolosi & Corbett, 2017).

Howell (2014) presents an exception through a longitudinal study measuring concern over environmental issues after moviegoers viewed the 2009 film Age of Stupid, a futuristic British drama-documentary of the effects of climate change set in 2055 (IMBd, 1999–2018). Participants completed a survey of their perceptions prior to seeing the movie. Questions gauged the perception of the seriousness or relevance of climate change to the movie-goers own lives. Then the moviegoers were surveyed 10 weeks after seeing the film, and again a year later. Howell recorded a dissipation in environmental concern one year after viewing the movie, wherein those reporting an increase in concern rose just 4.8% compared to 15.4% who reported decreased concern (Howell, 2014).

Similarly, Lowe et al. (2006) performed a pre- and post-event survey of viewers of the 2004 film, The Day After Tomorrow, an action drama depicting real-time climate change events including melting arctic ice sheets followed by drastic weather changes
and the beginning of a new ice age. In their study, they found that immediately following the movie, the 301 participants, self-reported an increased concern about climate change of nearly 62%.

Another pre- and-post-event study (Rudman, McLean, & Bunzl, 2013) measured climate change engagement of 269 survivors of the October 2012 Hurricane Sandy. This study is unique and valuable because the first survey was taken in 2010 (N=269), before Hurricane Sandy; therefore, they were able to record an authentic before and after response to an actual weather disaster. Prior to Hurricane Sandy, Rudman and colleagues asked New Jersey’s Rutgers University students whether they would vote for pro-environmental political candidates, identified in the study as “green politicians.” After the preliminary study, the weather disaster Hurricane Sandy occurred. The researchers decided it could be insightful to conduct the again. In the second cohort survey, taken in October 2012, Rudman, McLean, and Bunzl (2013) asked a different sample of Rutgers University students (N=318) whether they would more likely vote for traditional or green politicians. The results of the 2010 study had demonstrated students preferred traditional rather than green candidates.

In contrast, after the hurricane, preferences reversed significantly, wherein students preferred the green politicians over the traditional. Because they surveyed students who directly experienced (or experienced secondhand) an actual rather than hypothetical catastrophic weather disaster versus the climate disaster messages presented in the two movie surveys conducted by Howell (2014) and Lowe et al., (2013), the question arises: Is there a temporal decline in climate change engagement as one distances themselves from the exposure to the climate change message or experience? Is
the psychological theory referred to as psychological distance a contributing factor to the dissipation of concern recorded in these studies?

Climate Change Belief and Psychological Distance

McDonald, Chai, and Newell (2015) explored psychological distance in their analysis of the peer-reviewed literature pertaining personal experience with weather and climate change events. They concluded that “psychological proximity does not always lead to [an] increase in belief, concern, and action” (p. 114). Graybill (2011) found similar results through interviews with Russians living near the arctic circle. Those interviewed admitted their local community had drastic changes in the weather, but overwhelming, they were reluctant to attribute the weather changes to climate change.

As previously discussed in the United Kingdom Hugh-Jones and Madill (2009) survey, residents living near a rock quarry appeared threatened when the researcher repeated the residents’ own words that living near the quarry was a terrible experience. If people cannot or do not want to move away from “home,” the area where they have a place attachment, or perhaps they do not know how to resolve the threats, they may lack a solution-oriented sense of self-efficacy (Manzo & Perkins, 2006; Mah, 2009; Lowe & Rhodes, 2013). Under these circumstances, an individual’s cognitive thinking about local climate change may devolve to coping (Moser & Dilling, 2004). In coping with information, an individual is able to re-establish a level of psychological comfort where they distance themselves psychologically from the threat (O’Neill & Nicholson-Cole, 2009; McDonald, Chai, & Newell, 2015). This is a mechanism to re-establish a positive place identity and is a form of denial in circumstances where there is an actual threat (Frederick, 2014).
Occasionally environmental disasters and acts of nature suddenly and directly affect communities, such as with oil spills and nuclear power plant accidents and hurricanes and tsunamis. It is more likely, however, that people will recognize climate changes gradually. Until recently, few researchers evaluated the climate science impact on an individual’s psychology (Clayton, Manning, & Hodge, 2014), now commonly referred to as climate psychology.

A body of research over the last seven years, primarily derived through narratives and case studies, has focused on how people actually experiencing climate change are emotionally processing their experience. Some of the regions studied include the warming arctic of Canadian (Cunsolo Willox et al., 2012) and northern Russia (Graybill, 2013), survivors of the flooding caused by Hurricanes Isabel, Katrina, and Sandy in the United States (Horney et al., 2010; Manning, 2005; Rudman, McLean, & Bunzl, 2013; Lowe & Rhodes, 2013, respectively), Australian farmers subject to dust-bowl drought conditions (Rogan, O’Connor, & Horwitz, 2005; Ramkissoon, Smith, & Weiler, 2013), islanders in the Caribbean and South Pacific (Thomas & Benjamin, 2018), and mountain residents in the remote villages of China’s Three Gorges Reservoir area (Peng et al., 2016).

These extreme weather events or conditions affect people’s sense of place or, as discussed earlier, their place identity. Maintaining a positive place identity is a compelling psychological need wherein an individual strives to assume or invent a positive perception of their immediate environment(s) in order to cultivate or maintain a sense of well-being. Many people, if they are happy where they live, associate the notion
of their “home” with a positive place identity. It is suggested among the literature that everyone strives to establish a positive place identity across gender, social status, race and nationality (Lewicka, 2010). Yet, when faced with drastic weather events, especially if they are repeated, it may be very difficult to maintain a positive sense of place identity.

As we learned with the quarry residents, positive place identity is so compelling individuals may often (and even subconsciously) alter their beliefs about what is happening around them, perhaps even deny danger or dangerous conditions in order to achieve and maintain positive place identity (Hess, Malilay, & Parkinson, 2008). In another example, Ruiz and Hernandez (2014) measured perceptions of risks among those living on the side of a volcano on the Canary Islands of Spain. Those living higher on the volcano, and logically at greater risks for being affected by an eruption, were less concerned with the risks than those who lived farther down from the mouth of the volcano. In another example within the United States, until the year 2006, residents in the town of Pincher, Oklahoma refused to leave their hometown despite overwhelming evidence of lead toxicity in the air, soil, and water, which began mounting in the 1980s. As NBC reporter Dan Shepherd (2014) detailed, Pincher developed as a zinc and lead mining town and its mines provided the primary material for bullets made for both World Wars.

The mining industry was so embedded in the local culture parents thought nothing of children playing on mounds of discarded mining tailings or “chat.” In the 1970s, the local river turned reddish-orange due to toxic waste runoff from mining activities. As early as the 1980s, doctors noted that children from Pincher had higher incidences of respiratory illness than those of neighboring communities. Evidence of toxicity was
mounting along with the community’s numerous hills of mining chat. Finally, in 2006, the U.S. government offered a financial incentive to residents to relocate by purchasing homes and commercial real estate. Although not a forced migration, at this point most (though not all) residents relocated (Shepherd, 2014).

Why did it take so long for the residents to relocate, especially when there were observable indications of toxicity and its ill-effects on their own children? Is it possible the residents denied the problem in order to maintain their positive place identity? Presumably, responsible caregivers would be concerned for the safety of their children and take drastic measures to reduce their exposure to environmental hazards. But judging from the results of these studies and observations, something keeps people in their unsafe and/or risky environment. This raises the question of just how bad do circumstances have to get before we are willing move? Do we wait until after the first flood destroys our home, the second, the third? Do we wait for a cancer cluster to be identified in our neighborhood before we move? Examination of how we respond in order to maintain a positive place identity can help us understand seemingly incongruent human behavior.

“Rootedness” An Element of Place Identity

One psychological concept influencing positive place identity is place dependence or place permanence, also referred to in the literature as “rootedness.” Lewika (2013) defines rootedness as when people “[take] their residence place for granted, never [think] about moving, and never compare it with other places” (p. 44). One climate change migrant candidate and resident of Isle de Jean Charles in Louisiana summated the net effect of rootedness with his declaration: “I’ve lived my whole life here, and I’m going to die here” (Sutter, 2016).
This study measured rootedness and place permanence with questions such as: How long have you lived in Colorado? How long do you expect to live in Colorado? How many years would you have to suffer from drought conditions before you would consider moving?

The conclusion of a different study of 300 residents living in flood-prone communities in India as measured by Mishara and colleagues (2010), suggests the reason people continue living in dangerous areas is because there are more positives associated with the place than negatives. In essence people are rooted to their place even if they have adversity in the place.

In extreme circumstances, for those currently facing the possibility of becoming climate migrants, finding an alternative home or creating a new place attachment may seem too painful—more painful than living in the threatened place (Winstanley, Hepi, & Wood, 2015; Thomas & Benjamin, 2018). In their own words, current climate refugee candidates state: “and that’s so sad to think about it. It do make you angry, but what can you do? It makes you feel so helpless” (Cunsolo Willox & Harper, 2010, p. 543); “We are going to lose all our heritage, all our culture” (Davenport & Robertson, 2016); “I can’t handle any more change” (Graybill, 2012, p. 828); and “[I]f I had to be taken away from the bush and forced to live in the city, I would feel like I was at some great loss and it would affect my health, physically and mentally, it would affect me” (Rogan, O’Connor & Horwitz, 2005, p. 152).

These individuals echo what some researchers are warning about just as governments and NGOs admit to the need to develop plans to relocate communities of people we are now labeling “climate migrants” (although climate refugee is also another
term used, “refugee” is wholly distinct in that refugee is also often affiliated with political prosecution and therefore, as it pertains to relocation due to climate change, the term climate migrant is deemed more appropriate (Thomas & Benjamin, 2018, p. 90).

“Disruption of place attachment and identity are traumatic for the individual and collective psyche” (Hess, Malilay, & Parkinson, 2008, p. 475) creates culture loss (Kirsch, 2001), and some individuals even receive diagnosis of post-traumatic stress disorder (PTSD) as a result of becoming a climate migrant (Kolossa, 2010; Lowe, Manove, & Rhodes, 2013). It is no wonder it took the residents of Pincher, Oklahoma, so long to leave their hometown, choosing instead to dismiss or tolerate the problems and maintain their positive place identity.

History of Place Identity Research

Place identity is of particular interest to environmental psychologists, geographers, and natural disaster risk managers. Many studies have focused on what different types of places people tend develop strong, emotional connections with (e.g., Korpela et al., 2009; Brehm, Eisenhauer, & Stedman, 2012). Emotional connections to a particular place is not based on size of the place but rather the place’s meaning to the individual. As humanistic geographer Yi-Fu Tuan (1975) articulated, “connection can extend to an attachment to one’s country, or even to a place as small as a bedroom” (as cited in Gifford, 2007, p. 123). Further, the place an individual identifies with need not be a principle residence or hometown; for example, tourist areas and second homes can evoke significant place attachment (Jorgensen & Stedman, 2001).

At the core of place identity is the concept of “place attachment,” which was first introduced in the 1992 book by Altman and Low, *Place Attachment: Environment and*
Behavior. They defined place attachment is a “people-place bonding” and it integrates “emotions, knowledge and beliefs, and behaviors and actions in reference to a place (as cited in Rollero & De Piccoli, 2010, p. 198).

Gaps in Place Identity Research

Place identity research is gaining momentum. More than 60 percent of the articles on place identity have been published in the last 10 years (Lewicka, 2010) and continue to be published. As an example, De Dominicis et al. (2015) conducted a place attachment based meta-analysis of 138 peer-reviewed articles. Yet, despite the interest, have we made much progress in the field? Lewicka asks: “Do we know more now about reasons leading to people forming attachments to places?” (p. 208). Several place identity researchers concede they have not made much progress. In fact, some researchers conclude their own studies were limited by the lack of “robust measures of place attachment” (Halpenny, 2010, p. 418; Scannell & Gifford, 2013).

The gap between theory and empirical evidence in place identity research may be due in part to the variation of vocabulary terms employed when conducting surveys and interviews. Some examples include “a sense of place,” “place dependence,” and “community identity” (Rollero & De Piccoli, 2010, p. 198). Lack of a systematized professional lexicon makes it difficult to compare results of studies, to build on theories, or to validate results by repeating the methodology (Sanchez, 2014). Lewicka (2010) further reports, during her literature review of more than 400 articles produced over the last 40 years, that place identity studies often failed to test specific theories or hypotheses.

Further, survey participants likely have their own interpretations of the specific words used in the research (Gustafson, 2014). For example, the definition for “place
attachment” may seem obvious to the researcher, say as a specific place you are attached to; however, the individualized and emotional interpretation of place attachment is subjective, and self-reported intensity of emotions to terms with many different potential interpretations makes it difficult to compare results between studies. This could be why some studies using the same methods present conflicting conclusions.

Threat and Risk Perception on Positive Place Identity

The lexicon conundrum is not unique to place identity research. Risk theory has faced similar challenges. Risk perception is not concrete, even when it is supported by statistics and facts purporting probable outcomes. Risk perception is fluid, reflecting an individual’s feelings at a given time under certain circumstances. As psychologist Paul Slovic (1992) clarifies, “Risk does not exist ‘out there,’ independent of our minds and cultures, waiting to be measured” (p. 119). Natural disaster resilience research has contributed significantly to risk perception theories.

Hidalgo and Hernandez (2001) assert a vital element of place identity is to feel safe within the environment a person identifies with (as cited in Rollero & De Piccoli, 2010, p. 198). Yet, how is a person to feel safe when they are constantly inundated with fear-based climate change messages predicting imminent doom? Will such climate change messages negatively affect an individual’s sense of well-being and positive place identity? As such, will the recipient of the threat-based messages tend towards denial-type coping mechanisms such as fact dismissal, in order to restore their positive place identity? It is logical to conclude when a person learns of a potential threat to their place attachment, they will act to mitigate the threat. Brody, Grover, and Vedlitz (2012) state
“when individuals perceive a threat to the things they value, they are likely to take action to eliminate or moderate the negative consequences” (p. 4).

Unfortunately, risk theory researchers have had difficulty designing studies which can reliably predict a person’s risk assessment and related behaviors (Bourque et al., 2012). Risk perception studies related to climate change has been limited (Brody, Grover, & Vedlitz, 2012; Linden, 2015) though some researchers have focused on specific neighborhood threats (Mishara, Mazumdar, & Suar, 2010; De Dominicis et al., 2015). It may be possible to extrapolate from these findings in order to design future research. For example, Devine-Wright (2009) recorded a rise in community resistance to the construction of a wind farm which some deemed would negatively threaten the aesthetics of the community.

Mishara and colleagues’ Indian study demonstrated homeowners versus renters were more likely to engage in flood preparedness (Mishara, Mazumdar, & Suar, 2010). Another study of two Italian cities prone to flooding was conducted by Dominicis et al. (2015) found surprising results in that while higher levels of risk perception of flooding correlated with willingness to mitigate the threat, individuals with a strong place attachment who also lived in areas with the highest risk were less willing to engage in flood preparedness. They conducted two studies to confirm this counterintuitive conclusion.

The first was a survey of 444 homeowners in two cities. In the questionnaire, researchers asked participants to gauge their “flood risk perception, neighborhood attachment, attitude towards preventative behaviors, and intention to enact preventative behaviors” (Dominicis et al., 2015, p. 70). They correctly hypothesized participants with
strong place attachment would be less engaged in preventative behaviors; and they attributed this seemingly contradictory sentiment to optimistic bias. Their second study was designed to confirm and expand the first study. Using the same methods and same cities, they surveyed 466 new participants and statistically confirmed their original hypothesis.

Why does optimism bias prevail over “logic and facts”? Bias is the thought, feeling or attitude which is not based on evidence, facts or logical argument (Arnett, 2000; Bränström & Brandberg 2010). An individual with optimistic bias tends to see imminent threats or outcomes as having little adverse impact on them (Arnett, 2000).

Mentally Processing Physical Experiences: The Place Identity Denial and Apathy Cycle

Neuroscience researcher Joseph E. LeDoux (1996) tells us we continuously mentally process information in our environment to access potential threats. The observed information either reinforces or erodes our perception of safety, security, connection, and emotional well-being. At times our need to believe the area where we live meets our needs may directly conflict with the circumstances surrounding us as already discussed. When that is the case, how do we reconcile this information? In a 2014 article, I proposed a theory with a series of steps to explain a possible cognitive mechanism for reconciling information conflicting with our sense of positive place identity (Frederick, 2014). This theory, called “The Place Identity Denial and Apathy Cycle,” suggests a progression of behaviors and emotions we may experience when exposed to information that may threaten our place identity (Figure 1). The stages are:

1. Exposure to a message;
2. Initial consideration of message;
3. Momentary acceptance;
4. Message is perceived as an insurmountable threat to the positive place identity;
5. A negative place identity evolves;
6. Negative emotions arise leading to non-rational resistance;
7. No desire to move to a new location or otherwise change (rootedness);
8. Negative emotions build;
9. Perception of a lack of control develops;
10. Denial, dismissal, or apathy develops through conclusions drawn such as “I don’t believe the threat is real” or the threat is rationalized and reflected in such statements as “It’s not likely to happen,” “It won’t be that bad,” “We’ll get through it. We always have,” “That which doesn’t break us, makes us stronger,” or “It’s God’s will.”
11. Positive place identity is restored and a sense of emotional well-being increases (Frederick, 2014).

Figure 1. The Place Identity Denial and Apathy Cycle. A cycle of psychological stages people may experience when “place identity” is threatened. (Frederick, 2014).
The following case studies by other researchers document some of the various stages of the Place Identity Denial and Apathy Cycle.

Case study 1: Rootedness, emotional well-being and climate change in Canada. How do people feel when it is obvious climate change is affecting their community? Nestled between Quebec and Newfoundland, the residents the Canadian town of Rigolet are the most southern Canadian Inuit community. Their way of life is being threatened by climate change. Looking out over the vast expanse of what was once a continual sheet of ice, a Canadian Inuit woman could not ignore the fact she was experiencing climate change in her local community when she commented “everything that you know is taken away from you. . . . You’re in no place to control that yourself, so if you can’t affect your own life or circumstances, you’re going to feel very helpless” (Cunsolo Willox et al., 2012, p. 543). These are voices from a community compromised by climate change. For them, climate change’s proximity is not a debatable, abstract concept. It is destroying their land and way of life.

Despite modern living enveloping their community, residents value traditional learning from their elders and continue to rely on hunting, fishing, and foraging for food whenever possible. Unfortunately, climate change is making these activities more challenging and unpredictable. Climate change is decreasing the amount of snowfall and quality of ice, which in turn affects the local flora and fauna, thereby limiting the community’s ability to provide food for their families. The stress from living under these conditions manifests throughout the community in the form of poor health. Inuit communities throughout Canada have above-average suicide and drug or alcohol
addiction rates and they have more chronic diseases than non-Inuit Canadians (Cunsolo Willox et al., 2013). When a community has traditionally used the land for sustenance and the land is no longer predictably providing, how does that situation affect a culture, a community and its members? Will they choose to relocate or make some other cultural shift to regain control over their external circumstances? Or will they elect to remain trapped in a threatening environment because they are deeply connected to the place?

Researchers from the University of Guelph in Canada discovered a connection between an attachment to a place and the subsequent lack of desire to relocate (Cunsolo Willox et al., 2012) (Figure 2). Their multiyear study combined surveys and 60-minute face-to-face interviews with 72 adults of the 269 of the community’s members, representing 25% of the community. The data contrasts the members’ deep attachment to their community (Figure 2) to their emotional well-being derived from the sense of rootedness (Figure 3). The researchers discovered the residents were experiencing pervasive negative emotions in response to changes to their community, as measured through how they felt about “changes in weather patterns, snow, ice, wildlife, and vegetation” (p. 544). Their attachment to this location appears to outweigh their willingness to relocate.

The Inuit narrative and survey present a poignant dilemma many people face when climate change threatens their positive place identity. As Cunsolo Willox and colleagues (2010) document, the stimuli from their environment conflicts with the reasons why the community have reported a (1) “sense of identity connected to [the] place”; (2) “comfort and peace from [this] place”; and (3) “deep connection to place/land” (p. 542).
Figure 2. Land attachment and sense of place in Rigolet, Nunatsiavut, Canada. Overview of responses to selected place-based questions from the Environmental Distress Survey conducted in 2010 (Cunsolo Willox et al., 2012).

Further, their responses (Figure 3) suggests their place identity was negatively affected. This is represented by the self-reported accounts of “frustration, sadness, fear, helplessness, and distress” (p. 544).

Case study 2: Environmental destruction, personal responsibility and depression among Australian farmers. An Australian study by Rogan, O’Connor and Horwitz (2005) highlights the role humans play in creating environmental degradation, how they come to terms with this devastation when coupled with climate change, and how it affects their place identity and attachment.
Figure 3. Emotional responses to place-based climate change Rigolet, Nunatsiavut, Canada. Measurement of reported negative emotions ranging from frustration through distress based on questions from the Environmental Distress Survey conducted in 2010 (Cunsolo Willox et al., 2012).

Rogan and colleagues present an excellent narrative of Perth farmers’ climate change experience when they reviewed interviews conducted for a documentary (a project independent of their study). The researchers randomly selected 10 out of the 31 interviews with farmers ranging in age from forty to ninety.

The farmers’ viewpoints were relevant in consideration of the ongoing environmental challenges in the area. Years of their poor natural resource management of the land and water pursuant to increasing farm yields had created a dry wasteland susceptible to wind storms and wildfires (Rogan, O’Connor, & Horwitz, 2005). More recently, they had experienced a 102-day drought, just shy of the region’s all-time record
122-day drought (Perth Now, 2014). Though these farmers had a history of living in
drought conditions (Australia Bureau of Statistics, 1998) it did not mean they emotionally
adapted to the situation.

While it may be difficult for some to come to terms with their contribution to
declining local environmental conditions (Rogan, O’Connor, & Horwitz, 2005), it is not
uncommon for people to accept responsibility, especially during the “acceptance” phase
of the Positive Place Identity Denial & Apathy Cycle (Frederick, 2014). Bob, a farmer,
admitted “this is what farmers do, they clear the land. . . I was one of the spoilers”
(Rogan, O’Connor, & Horwitz, 2005, p. 151). Bob came face-to-face with the extent of
the negative impact he and other Perth farmers created when he was flying over his
community and observing the landscape through the airplane’s window. “It was just so
graphic that is was mind boggling, but very, very challenging as to what are you going to
do about it. Is there anything you can do about it?” (Rogan, O’Connor, & Horwitz, 2005,
p. 151). Brigette, another local farmer, concurred, “[W]e saw great clouds of dust, it was
just like a big bush fire out to the east . . . where the soil was being lifted and taken day
after day, so we knew we had done wrong” (Rogan, O’Connor, & Horwitz, 2005, p. 151).
While some of these farmers indicated they had adopted more environmentally friendly
farming methods, Nathan, also a farmer, indicated there was a significant perceived risk
in making such a change—especially when funds were tight (Rogan, O’Connor, &
Horwitz, 2005, p. 153). Uncertainty of outcome when behavior is changed and the
potential risks entailed in this change often serve to maintain inertia (Bandura, 1977).

The preference for the status quo also helps to support a state of denial
(MacKenzie, 2010). It is during this stage people tend to shut down their senses so they
do not have to be exposed to information conflicting with their positive place identity (Hugh-Jones & Siobhan, 2009). As Brigette stated, “You want to shut your windows and pull the blinds and just forget about everything outside. It’s a disaster, it’s a disaster and it is depressing. . . . I don’t want to experience that” (Rogan, O’Connor, & Horwitz, 2005, p. 156). When another couple found a new home with a river running through the property as well as lush vegetation, they exclaimed, “[I]t makes us feel happy. . . . [I]sn’t that wonderful that we have something like this here? . . . [W]e don’t have to close our eyes and look the other way” (Rogan, O’Connor, & Horwitz, 2005, p. 156). The pain and struggle are palpable in these comments. There is a sense of helplessness over the enormity of it all. Residents do not know what to do next and they are afraid to take any major financial risks on what they may consider “unproven farming methods.”

Perhaps it makes sense that populations deriving economic sustenance from the land would have a particularly strong place attachment, but they are not the only ones. Place identity and attachment know no borders, have no social or economic class distinctions (Mishara, Mazumdar, & Suar, 2010), and affect both men and women and the old and young alike (Lewika, 2010). It is a universality fashioned by our experience with the external world and reinforced by our beliefs and culture. It is so vital to our identity it drives our decision making. As with any survival-based assessment, our brains process the information automatically and draw conclusions (LeDoux, 1996) from which we are reluctant to depart.

The above discussions present peer-reviewed studies supporting my premise. Further, studies in the fields of risk theory’s optimism bias and avoidance behaviors towards threats strongly suggest people are more apt to ignore problems, particularly
abstract problems, then they are to be proactive to prevent them. I expect to produce compelling support against using localizing climate change as a pro-environmental behavior adoption tool.

Research Questions, Hypotheses and Specific Aims

The primary research question of this study was: How does the perceived threat of localized climate change affect a person’s emotional well-being and their willingness to accept the notion of local climate change? The following three questions narrow the primary research question into manageable researchable premises: (1) Will the responses from Coloradans surveyed in this research indicate that a localized threat of climate change diminishes the participants' overall acceptance or belief in local climate change? (2) Will thoughts of local climate change spawn negative, non-productive emotions such as denial, helplessness, or anxiety? (3) Will the notion of local climate change threaten their positive place identity, or attachment to their home and local community?

This study tested three hypotheses:

H1: Individuals with strong place attachment to a local area are less likely to believe they will be impacted by climate change in their local region.

H2: If individuals with strong place attachment do believe climate change will or currently does impact their local community, they will feel pronounced emotional distress.

H3: Individuals with strong place attachment will express resistance to moving from their residential place due to local climate change threats if they have a positive place identity to their residential place.
Specific Aims

The specific aims for addressing these research questions and hypotheses were to:

1. survey 105 Colorado residents;
2. collate data via an online survey hosted by SurveyMonkey;
3. analyze data through a series of regression analysis tests to test each hypothesis; and
4. compare results with those of studies in prior peer-review studies to look for validations or contradictions in my data with current climate communication trends and documented climate change beliefs.
Chapter II

Methods

An online survey questionnaire of Colorado residents (N=105) was selected as the mechanism to measure expressed opinions, beliefs, and associated emotions towards potential local and global climate change. Most questions were designed with a Likert scale style of measurement, where participants were asked questions and then were asked whether they agree, disagree, etc., or to what extent they agreed or disagreed (e.g., Krosnick & Presser, 2010).

Survey Audience

The survey was conducted in two main time frames. I collected 72 responses from September 2015 through December 2016 from the following groups and platforms: Facebook, LinkedIn, and a Denver-based women’s writers group. I also encouraged participants to share the survey with their own family, friends, and online social network with the objective of increasing the sample size. The second sample group of 33 participants, reached via the online site Craigslist Colorado, was collected between November 2016 and April 2017. Each of these target groups were directed to a SurveyMonkey weblink hosting the survey questions.

Craigslist provided a valuable outreach venue for the survey, as this sample group was assumed to be more diverse than the first sample group because the original source of the survey solicitation was not from my personal social network. Additionally, using Craigslist allowed the posting of the same ad in multiple regions based on the geographic areas Craigslist uses to target their ads. This mechanism increased access to survey takers.
all over Colorado. From these regions, I randomly selected one city zip code for each region because Craigslist requires a zip code in order to place an ad. Craigslist uses the following geographical areas: Boulder (80301), Colorado Springs (80910), Denver (80202), eastern CO (Bennett 80102), Fort Collins/Northern Colorado (80521), High Rockies (Breckenridge 80424); Pueblo (81003), and Western Slope (Grand Junction 81501).

Materials and Survey Design

The survey was administered through SurveyMonkey’s online software. The survey questions were accessed by participants via the link https://www.surveymonkey.com/r/X65WJJS and are now presented in Ancillary Appendix 1. The 46 questions were a combination of bivariate and multivariate inquiries and included requests for demographic information such as age, educational level, gender, and income.

The survey questions were predominately derived from four well-respected university studies and combined in the present study to present a wide-ranging survey on local climate change perceptions and the possible emotional consequences of such perceptions.

Source 1: Yale University’s Project on Climate Change Communication

Through the Yale Project on Climate Change Communication, Yale University researchers conducted a telephone interview of 800 Colorado residents (Leiserowitz et al., 2013). They administered similar surveys in California, Ohio, and Texas in order to diversify their results by surveying populations with different American demographics. I
decided to use this study for a couple of reasons. One, the study was conducted in several states, giving the researchers opportunity to vet the questions on the value of the data the questions can provide. Two, Yale University’s Project on Climate Change Communication research is well-respected within the environmental behavior research community. At the time of this writing, Google Scholar (2018) notes Yale University’s director of the project, Dr. Anthony Leiserowitz, is cited in 13,588 publications. Of the 46 questions presented in the current survey, 22 are nearly identical to those of the Yale University survey. The purpose of using these well-vetted questions in this study was to expand on the Yale University’s study by including emotional, place identity, and rootedness concepts, which were lacking in the Yale University study. Conversely, questions from the Yale University survey not included in this study encompass several behavioral and politically focused assessments such as “How many light bulbs in your home are energy-efficient compact florescent lights?” (Leiserowitz et al., 2013, p. 17) and “Over the past twelve months, how many times have you . . . written letters, emailed, or phoned government officials about global warming?” (Leiserowitz et al., 2013, p. 33). Those types of questions were outside the scope of the hypotheses of this study.

Further, the Yale University study and this study had a potentially significant semantic difference. Yale University researchers used the term “global warming” in most questions, whereas my study mostly used “climate change.” It was possible this semantic difference could produce drastically different results between the two studies.

The initial terminology used in the climate change-global warming conversation since approximately 1990s was “global warming” (Shabecoff, 1988, as cited in Leiserowitz et al., 2014, p. 7). As an example, Al Gore’s 2006 documentary, An
*Inconvenient Truth*, used the term “global warming.” Yet shortly after the movie’s release, the term “global warming” fell out of favor among climate communicators, primarily because it seemed easy to refute. As Norwegian professor and cofounder of the Center for Climate Strategy, Per Espen Stoknes, asserts, the notion of global warming infers each year temperatures will continue to rise (Stoknes, 2015). But during periods when local weather patterns include record cold spells and snowfalls, it is easier for global warming skeptics to promptly deny global warming. In fact, not only do skeptics deny global warming exists, several studies have reported the public’s belief in global warming is often based on current weather trends (Speller & Twigger-Ross, 2009).

In spite of the above-mentioned challenges with using the term global warming, Yale University’s 2013 survey intentionally used “global warming” versus “climate change.” They explained their semantic use in the May 2014 report, *What’s in a Name: Global Warming vs. Climate Change* (Leiserowitz et al., 2014). Based on three prior Yale University studies on the semantics of climate communication, Yale University researchers concluded people do not attribute a synonymous meaning to both terms. In fact, they found “global warming” to be a “more widely used and a more engaging term” (Leiserowitz et al., 2014, p. 4).

To test this assertion, I informally asked several Coloradan friends and family which term resonated with them the most and why. The people I spoke with preferred the term “climate change”, and in most cases, cited the fact that Colorado was presently experiencing some particularly cold winters which provided another example of people literally associating global warming with temperature fluctuations in which they are familiar with (Li, Johnson, & Zaval, 2010). My study did ask a few questions about belief
in “global warming” and I compared the participants’ beliefs in global warming versus climate change to determine if the participants of this study made a distinction between the terms.

Source 2: University of Guelph’s Survey of Emotional Response to Climate Change

I obtained the questions of Source 2 directly from this Canadian university’s lead researcher, Dr. Cunsolo Willox. Their research questions conformed with Health Canada’s Research Ethics Board and the Nunatsiavut Research Ethics Protocol (Cunsolo Willox & Harper, 2010). Cunsolo, Willox and Harper modified their questionnaire based on the 2006 Environmental Distress Survey by Higginbotham and colleagues (Higginbotham et al., 2007). I selected questions from Cunsolo Willox and colleagues’ research because of their documented evocative psychological responses to local climate change. Their research provides several valuable questions for measuring emotional response, place identity, and place permanence (a.k.a. rootedness).

Their studies measured poignant, emotional reactions of residents already experiencing climate change in the arctic Canadian region. Likewise, my survey intended to measure whether Coloradans reported similar emotional distress to personally experienced climate change as was reported by the Canadian residents surveyed (Cunsolo Willox et al., 2012). The Canadian results were discussed in Chapter I.

My study design differed from Cunsolo Willox and Harper in that their survey was interview and narrative-style; in addition, questions specific to Canadian arctic landscapes and indigenous lifestyle, which are irrelevant to Colorado residents, were removed for my study.
This third study’s questions are valuable to include in my study because they assessed survey participants’ sense of overall emotional well-being, irrespective of their feelings about any particular issue, including climate change. The four-question survey is an attempt to create a subjective measurement of happiness (Lyubomirsky & Lepper, 1999). Lyubomirsky and Lepper surveyed high school and college students in the United States and Russia, as well as adults in both countries, for a total of 2,732 participants and 14 studies to hone the validity of the Happiness Scale.

Lyubomirsky and Lepper were interested in including an overall self-reported assessment of happiness to see if happiness data conflicts with the emotional reactions to local climate change threats. For example, is there a trend in which people who report themselves to be overwhelmingly depressed also believe strongly in local climate change?

These measurements may also suggest a level of the participant’s self-efficacy as well as their overall sense of personal control over and satisfaction with life. For example, information revealing a person considers themselves to be generally happy but very sad about climate changes in their local environment may suggest a person can still feel optimistic about finding solutions for climate change mitigation. All four questions of the Happiness Scale are included in this study without modification and serve as the baseline for reported levels of well-being among the participants. I recognize that the Happiness Scale is a limited definition of a complex state of mind like well-being; however, given the complexity of all the other concepts measured in this study, I elected to keep the notion of “well-being” simple.
Source 4: Harth, Leach, and Kessler’s “Survey of Guilt, Anger, and Responsibility for Climate Change”

What is interesting about the Harth, Leach and Kessler (2013) study is that their climate change–related questions uncovered a relationship between the different types of feelings among the 67 German university student participants, such as personal guilt, anger, or pride, in comparison to climate change-related statements with different tones.

Message-type and emotional reaction correlations emerged; as an example, participants who were angered by the climate change message they read were more likely to opt for more punitive measures for polluters, including increased fines for firms convicted of polluting the environment, whereas those who felt guilty after reading an environmental message were more likely to want to become personally involved in resolving the problem (Harth, Leach, & Kessler, 2013).

Emotional distress can be difficult to measure in a manner which is comparable between psychological studies. For that reason, my study defined and measured emotional distress through personal assessment to some questions taken from the Cunsoilo Willox and Harper 2010 emotional distress survey, and the Harth, Leach, and Kessler (2013) survey of guilt, anger, and responsibility for climate change were incorporated into this research. Further, the combination of the questions from each of the four sources described above was intended to empirically demonstrate a connection between place identity, climate change events and beliefs and emotional well-being not previously presented in the literature and to test the hypotheses of my study.
Consent to Participate and Ethics Statement

In the introduction to my survey, participants were warned some questions were designed to illicit a strong emotional response and if the participant felt too upset about the survey, they were encouraged to abandon the survey at any time. I provided contact information so if a participant wanted to discuss the survey and their experience with myself afterwards, they would have an avenue for discussion and closure. I believed these measures would help mitigate any potential risks which occasionally occur during social and behavioral research as was taught during the Human Subjects Certification training I completed to gain approval from the Harvard Internal Review Board for using a survey method with human subjects.

The methodology and survey questions were previously reviewed by my thesis director, Ramon Sanchez, Sc.D., of the Center for Health and the Global Environment at Harvard T. H. Chan School of Public Health. The questions were approved by Harvard University’s Committee on Human Subjects.

Data Preparation and Interpretation Techniques

Hypotheses testing required the combination of multiple questions to test abstract notions of positive place identity, rootedness, happiness and well-being, and a belief in climate change. Correlating the responses of multiple questions became very complicated very quickly. The first step was to assign a numeric rank to each response for each question. This was time consuming because not every question was written with a consistent progressive scale. The scales for some questions were reversed so all questions with multivariable responses were identically scaled.
There were a number of challenges in designing this survey and interpreting the results due to the complexity of the concepts inventoried. Place attachment researchers Smith and Weiler (2013) of Monash University in South Africa echo sentiments of other scholars in the field when they declare “place attachment has been defined differently by researchers and scholars, and the general consensus is that it is a multidimensional construct” (citing Halpenny, 2010, Hidalgo & Hernade, 2001; and Scannell & Gifford, 2010) (p. 435).

Compounding the linguistic complexity of place attachment, this survey also measured beliefs in global and local climate change. For these reasons, several hypotheses were developed to break down different elements of the research question into results which could be measured against each other to look for any statistically significant relationships between concepts.

SSPS software was used to analyze data. One reason I selected SSPS software is because it is commonly used in psychological studies where questions have numerous responses and the software can identify large numbers of variables most strongly correlated. Another reason I chose this software is it readily accounts for missing data. In some research, if data is missing, the surveys are omitted from analysis. “Missing data can reduce the statistical power of a study and can produce biased estimates, leading to invalid conclusions” (Kang, 2013). Several grossly incomplete surveys in the current research were not considered.

The survey was conducted online, and I didn’t monitor any participants. Some participants answered the first few questions but then didn’t answer any of the rest of the questions. Including the partial responses, the survey had 147 responses submitted. The
incompleteness issue was more common with participants originating from Craigslist. Kang referred to this type of data “missing completely at random” or MCAR (Kang, 2013, p. 402). In contrast, missing data due to a drop out variable, as I assumed was the circumstance surrounding missing data when nearly all of the questions were answered and only a few were skipped, may not lead to false conclusions if they are properly accounted for during analysis.

It is important to note this study was designed to allow for missing data from individual surveys. In compliance with the Human Subjects Certification training and standards, a participant must be given the option of “Prefer not to answer” to mitigate any potential distress a particular survey question may cause. This option works well with Likert scales because a sliding scale of agreement or disagreement with statements, for example, offers participants to express their neutrality or state they are undecided on the statement in question (LaMarca, 2011); yet, if they are overall distressed about the question, then even selecting a seemingly neutral answer may not be satisfactory for the participant; therefore, they may prefer not to answer at all.

As an example, question 35 asked: “In consideration of the environmentally related questions asked in this survey, please indicate how much you agree or disagree with the following. NOTE: If you are not comfortable answering this question, please skip it.”

a. Changes in the environment in my area are decreasing my ability to enjoy my life.

b. I feel positive about some local environmental changes.

c. I feel anxiety about some local environmental changes.

d. I feel sadness because of the changes in environment in Colorado.
e. I feel stressed because of the changes in environment in Colorado.

f. I feel frustrated because of the changes in environment in Colorado.

g. I feel scared because of the changes in environment in Colorado.

h. I feel distress about the changes in environment in Colorado.

i. I feel helpless about changes in the environment in Colorado.

j. I feel angry about changes in the environment in Colorado.

Once MCAR data was eliminated, a series of reliability tests were conducted to
determine if assigning single factor scores to the different responses was appropriate. It
was expected the reliability tests would be positive since most survey questions were
taken from already vetted and published research projects and only a few questions were
modified or added for Colorado-specific scenarios.

Statistical Tests

Semantics plays a critical role in influencing a bias in climate change (Leiserowitz
et al., 2014) and place identity research (Lewicka, 2010). Therefore, to test the data
validity of esoteric concepts such as rootedness, a measure of a potential relationship
between rootedness beliefs in global and local climate change questions was tested using
T-tests. Regression analysis was used to predict whether rootedness and global/local
climate change beliefs had an effect on well-being. To test the accuracy of separating the
groups into beliefs or non-beliefs in climate change, the Mann-Whitney U was used.

Testing Climate Change Beliefs

The next step was to test for reliability of the algorithms. Reliability and validity
of the algorithms used to test each of the hypotheses is critical (Verplanken & Roy,
2013). Algorithms for testing each hypothesis are outlined in Ancillary Appendix 2. For example, with regard to climate change belief, the Cronbach’s alpha measure [coefficient alpha] associated with this set of items (questions 12–18, 21, and 38) was found to be very high, indicating high internal consistency reliability. Specifically, 15 items were included in this scale, with a Cronbach’s alpha of 0.908 (almost 91% consistency) (Indiana University, 2017).

To begin answering the research question, the first step was to determine whether participants believed in climate change. The groups were segmented via responses to the questions (Table 1). Once the surveys were thus segmented into climate change believers and non-believers, each sample group was tested against questions supporting each hypothesis.

Then the following question was examined: For those who believe in climate change, do they believe in mostly global, mostly local, or a combination of both? To begin answering, questions 11, 19, 20, 24, and 40 were analyzed. These sets of questions were examined separately using non-parametric Mann-Whitney U to test distinctiveness among the groups. The Mann-Whitney U is often relied on in psychological research to test belief and behavior (Statistic Solutions, 2017).

Group 1 included those who believed only in global climate change, Group 2 included those who believed only in local climate change, and Group 3 included those who believed in both global and local climate change. These groups were then tested against each hypothesis to look for statistical trends.
Table 1. Grouping of climate change beliefs: identify if survey participant believes in climate change at all (questions 12–18, 21, and 38).

<table>
<thead>
<tr>
<th>Q12</th>
<th>Do you think that global pollution is leading to environmental problems?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q13</td>
<td>Do you think that climate change is leading to environmental problems?</td>
</tr>
<tr>
<td>Q14</td>
<td>Do you think that global cooling is leading to environmental problems?</td>
</tr>
<tr>
<td>Q15</td>
<td>Do you think that global warming is leading to environmental problems?</td>
</tr>
<tr>
<td>Q16</td>
<td>Recently you may have noticed that climate change has been getting some attention in the news. Do you think that climate change is happening, or not?</td>
</tr>
<tr>
<td>Q17</td>
<td>In your opinion . . .</td>
</tr>
<tr>
<td></td>
<td>a. recent climate change is a part of the normal, geologic cycle.</td>
</tr>
<tr>
<td></td>
<td>b. recent climate change is a result of environmental degradation, most likely from human activity.</td>
</tr>
<tr>
<td></td>
<td>c. recent climate change is BOTH a part of the normal, geologic cycle AND a result of environmental degradation, most likely from human activity.</td>
</tr>
<tr>
<td></td>
<td>d. climate change is a hoax.</td>
</tr>
<tr>
<td>Q18</td>
<td>Do you think climate change is having an influence on the following?</td>
</tr>
<tr>
<td></td>
<td>a. Wildfires</td>
</tr>
<tr>
<td></td>
<td>b. Flooding of rivers or lakes</td>
</tr>
<tr>
<td></td>
<td>c. Drought</td>
</tr>
<tr>
<td></td>
<td>d. Heat waves</td>
</tr>
<tr>
<td></td>
<td>e. Reduced snowpack in the mountains</td>
</tr>
<tr>
<td></td>
<td>f. Air pollution</td>
</tr>
<tr>
<td></td>
<td>g. Increase in environmental-related health problems</td>
</tr>
<tr>
<td>Q21</td>
<td>On some issues, people feel that they have all the information they need in order to form a firm opinion, while on other issues they would like more information before making up their mind. For climate change, would you say you . . .</td>
</tr>
<tr>
<td></td>
<td>a. Need a lot more information</td>
</tr>
<tr>
<td></td>
<td>b. Need some more information</td>
</tr>
<tr>
<td></td>
<td>c. Need a little more information</td>
</tr>
<tr>
<td></td>
<td>d. Do not need any more information</td>
</tr>
<tr>
<td>Q38</td>
<td>On a scale of 1 (not very important) to 7 (very important), if you accept the idea of climate change, how much of a problem is it in comparison to other problems like: poverty, the economy, and political injustice?</td>
</tr>
</tbody>
</table>

Further, the group who did not believe in either global or local climate change (N=52) was also tested against each hypothesis as they represented nearly 50% of the sample wherein belief in climate change had a population size of 53 (N=53) and to
further test hypothesis 1 for potential local climate change denial bias. A complete algorithm of how questions were combined to form sample groups and to tests the hypotheses is located in Ancillary Appendix 2.
Chapter III

Results

While 147 Colorado residents began the study, only 105 completed the 46 Likert-scale online survey.

Participant Demographics

Participants of this online survey do not reflect the population demographics of Colorado. In this study, 59 participants were female (57.3%), 44 (42.7%) were male and two elected not to respond. In Colorado, with a population of 5,029,196 people, females represent 49.9% and males represent 50.1% (U.S. Census Bureau, cited on Suburbanstats.org., 2016).

Race data from this research also deviated from Colorado demographics. Asian and Pacific Islanders were more heavily represented in the study with N=6 (5.7%) whereas in Colorado, they represent 2%. Hispanic or Latino were considerably underrepresented at with N=3 (2.9%) versus 20%. Conversely, American Indian or Alaskan Native were slightly overrepresented in the study at N=2 (1.9%) versus 1% in the Colorado population. No participants identified themselves as black or African American; therefore, not capturing the climate change beliefs of the 4% Colorado demographic. N=92 (87.6%) of the participants identified as White or Caucasian which approximates 73% in Colorado (U.S. Census Bureau, cited on Suburbanstats.org., 2016). Two (1.9%) of the participants elected not to respond.

The age of participants’ data also diverged from Colorado statistics. The age groups over-represented include those who identify themselves as 70 or older at N=10,
(9.5%) versus a Colorado representation of 2.1%, the 51–59 age bracket at N=29 (27.6%) versus 6.9% and the 21–30 age bracket, wherein N=11 (10.5%) versus 7.1%. Three age groups in the study comprised 18 (17.1%) participants: ages 31–40 (Colorado statistic at 7.2%); ages 41–50 (Colorado statistic at 7.1%), and ages 61–70 (Colorado statistic at 4.4%) (U.S. Census Bureau, cited on Suburbanstats.org., 2016).

Of further representational disparity was the educational level of the participants. While N=3 participants (2.9%) elected not to answer, N=2 (0.95%) attended but did not finish high school, N=5 (4.8%), N=7 (6.7%) finished high school, N=5 (4.8%) finished one year of college, N=16 finished two to three years of college (15.2%), N=32 (30.5%) graduated from college and N=33 (31.4%) graduated from graduate school. I could not find reliable Colorado demographic information to compare with this study’s survey results. While this survey was intended to only take ten to fifteen minutes to complete, there was considerable reading involved as the response options for some questions were long. This may have influenced the number of participants with higher levels of education to complete the survey.

Overview of Different Levels of Local Climate Change Belief Among Participants

Some of the survey questions measured the level of belief of typical climate change related phenomenon, including: extremes in weather conditions, natural disaster frequency, and severity of air pollution. There were also questions intended to measure the participant’s perceived proximity to climate change, e.g. “it is affecting them right now” versus in “future generations.” Finally, a question included for this analysis was originally presented in the Yale University (2013) survey of Coloradan’s beliefs in
climate change and pertained to a potential causation of climate change, the method of oil and gas extraction, fracking.

The climate change beliefs of the two opposing groups, the “No” group and the “Yes” group (Table 2) were compared to each other for each response. The numbers (N) change because not all participants answered each question. The Mann Whitney \(U\) test was used to allow for smaller sample sizes comparisons to assess whether there was actually a difference in belief between the two groups so the hypotheses could be tested. Most responses regarding a belief versus a non-belief in local climate change led to pronounced, statistically significant results (with p values frequently <.001) (Table 2). The exception was “Severity of drought” and “Opinion fracking.”

Analysis of Hypothesis 1

Hypothesis 1 asserts: Individuals with strong place attachment to a local area are less likely to believe they will be impacted by climate change in their local region.

First, a new measure was calculated focusing upon rootedness, which was based upon participants responding strongly to questions 5, 6, 26–28, 37, and 43. In total, this set of questions incorporated 26 items, with a Cronbach’s alpha of 0.700, indicating an acceptable level of reliability. As was done previously, these individual items were first recoded so the minimum and maximum values aligned and wherein each of the climate change groups tested in relation to rootedness. An additional new variable was also calculated, consisting of a measure of global versus local, which incorporated the same set of questions as mentioned previously: 11, 19, 20, 24, and 40.
Table 2. Mann-Whitney U tests with belief of climate change.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Belief</th>
<th>P value</th>
<th>z</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>Rank</td>
<td>Exp.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sum</td>
<td></td>
</tr>
<tr>
<td>Severity Wildfires</td>
<td>52</td>
<td>2061</td>
<td>2600</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-3.945***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severity Flooding</td>
<td>52</td>
<td>2181</td>
<td>2652</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-3.369***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severity Drought</td>
<td>52</td>
<td>2401</td>
<td>2678</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-1.947</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severity Heat Waves</td>
<td>49</td>
<td>1936</td>
<td>2376.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-3.451***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severity Snowpack</td>
<td>50</td>
<td>2074</td>
<td>2475</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-2.978**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severity Air Pollution</td>
<td>52</td>
<td>2271</td>
<td>2574</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-2.233*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Envir. Health Problem</td>
<td>43</td>
<td>1313</td>
<td>1870.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-5.021***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climate Ch. Personally</td>
<td>37</td>
<td>1165.5</td>
<td>1591</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-3.976***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climate Ch. Family</td>
<td>36</td>
<td>1083.5</td>
<td>1566</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-4.428***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climate Ch. P. Community</td>
<td>39</td>
<td>1318</td>
<td>1716</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-3.562***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climate Ch. P. Colorado</td>
<td>40</td>
<td>1428</td>
<td>1820</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-3.377***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climate Ch. P. US</td>
<td>38</td>
<td>1287.5</td>
<td>1710</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-3.940***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climate Ch. P. Developing</td>
<td>38</td>
<td>1341.5</td>
<td>1691</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-3.769***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climate Ch. P. Modern</td>
<td>39</td>
<td>1277.5</td>
<td>1755</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-4.300***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climate Ch. Next Gen.</td>
<td>41</td>
<td>1390.5</td>
<td>1865.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-4.821***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climate Ch. Pl./An.</td>
<td>40</td>
<td>1217.5</td>
<td>1820</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-5.490***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climate Ch. Pl./An. 2</td>
<td>41</td>
<td>1470.5</td>
<td>1886</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-4.579***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>When CC Start Harm</td>
<td>42</td>
<td>1433</td>
<td>1869</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-4.103***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opinion Fracking</td>
<td>26</td>
<td>661.5</td>
<td>572</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.352*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. *p<.05, **p<.01, ***p<.001
Focusing upon the entire sample, a positive, weak, and statistically significant correlation \( (r(103) = .256, p < .01) \) was found between rootedness the new measure of global/local. Then an independent-samples \( t \)-test of the data was used to determine if there was a significant difference in mean rootedness on the basis of a dichotomized measure, again using a median split, of global/local. Levene’s test for the equality of variances was conducted on these data. The result of this analysis indicated the assumption of the equality of variances was not violated \( (W(1, 103) = 0.443, p = .507) \). The independent-samples \( t \)-test approached statistical significance at the .05 level \( (t(103) = -1.870, p = .064) \). Unexpectedly, a higher mean rootedness was measured among those who believed in climate change as compared with those who did not (Table 3).

Table 3. T-test for rootedness.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Std. Err.</th>
<th>Std. Dev.</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower</td>
</tr>
<tr>
<td>No</td>
<td>52</td>
<td>5.232</td>
<td>.147</td>
<td>1.060</td>
<td>4.937</td>
</tr>
<tr>
<td>Yes</td>
<td>53</td>
<td>5.621</td>
<td>.148</td>
<td>1.074</td>
<td>5.325</td>
</tr>
</tbody>
</table>

Next, testing was conducted separately on the basis of belief in global climate change. First, among individuals who do not believe in global climate change, no correlation was found between global/local and rootedness \( (r(51) = .011, p = .935) \). Then, an independent-samples \( t \)-test was run to determine whether there was a significant mean difference in rootedness on the basis of dichotomized global/local, with this analysis again only focusing on individuals who did not believe in global climate change. As with rootedness, a Levene’s test for the equality of variances was conducted on these data,
indicating equality \( W(1, 51) = .060, p = .807 \). The independent-samples \( t \)-test did not indicate a significant mean difference \( t(51) = .718, p = .476 \) (Table 4).

Table 4. T-test for rootedness, global climate change non-believers.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Std. Err.</th>
<th>Std. Dev.</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>37</td>
<td>5.155</td>
<td>.161</td>
<td>.979</td>
<td>4.828 - 5.481</td>
</tr>
<tr>
<td>1</td>
<td>16</td>
<td>4.946</td>
<td>.239</td>
<td>.957</td>
<td>4.436 - 5.456</td>
</tr>
</tbody>
</table>

The same process was conducted on each of the other groups. The correlation conducted between global/local and rootedness was weak and approached statistical significance at the 0.05 alpha level \( r(50) = .259, p = .064 \). With regard to the independent-samples \( t \)-test, first, Levene’s test did not indicate the assumption of the equality of variances was violated \( W(1, 50) = 1.708, p = .197 \). The \( t \)-test failed to indicate a significant mean difference \( t(50) = -1.494, p = .141 \) (Table 5).

Table 5. T-test for rootedness, global (not local) climate change believers.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Std. Err.</th>
<th>Std. Dev.</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>15</td>
<td>5.422</td>
<td>.324</td>
<td>1.253</td>
<td>4.728 - 6.116</td>
</tr>
<tr>
<td>1</td>
<td>37</td>
<td>5.914</td>
<td>.164</td>
<td>.997</td>
<td>5.581 - 6.246</td>
</tr>
</tbody>
</table>
Analysis of Hypothesis 2

H2: If individuals with strong place attachment do believe climate change will or currently does impact their local community, they will feel pronounced emotional distress.

Positive place identity was measured through questions 7, 8, 9, and 10. For the purposes of this study, well-being was measured using the classic Happiness Scale (Lyubomirsky & Lepper, 1999). The four questions taken directly from the happiness scale were presented as questions 31, 32, 33, and 34.

Regression analysis was run, wherein happiness was the dependent variable and rootedness, global/local, and the interaction between these two measures were the predictors. Rootedness and global/local were standardized, and these calculation results were used in the model. With regard to positive place identity, a one unit increase in this measure was associated with a 0.377 unit increase in happiness for the entire sample. This result was expected as assumptions wherein having a positive place identity naturally leads to an increase in happiness. The relationship between positive place identity and happiness also demonstrated statistical significance (p<.001) (Table 6). This regression model was statistically significant, with the adjusted $R$-squared indicating that 8.0% of the variation in happiness was explained on the basis of all predictors included within this model.

The same analysis was repeated, this time focusing upon individuals who did not believe in climate change. Results were found to be similar to those presented in Table 6, wherein the effect of positive place identity on happiness was significant among participants who do not believe in climate change (Table 7).
Table 6. Regression with positive place identity and happiness: entire sample.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Coefficient</th>
<th>SE</th>
<th>t</th>
<th>p</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PP Identity (z)</td>
<td>.377</td>
<td>.114</td>
<td>3.31</td>
<td>.001</td>
<td>.151 to .604</td>
</tr>
<tr>
<td>Global/Local (z)</td>
<td>-.008</td>
<td>.113</td>
<td>-.08</td>
<td>.940</td>
<td>-.232 to .215</td>
</tr>
<tr>
<td>Interaction</td>
<td>-.042</td>
<td>.119</td>
<td>-.35</td>
<td>.727</td>
<td>-.277 to .194</td>
</tr>
<tr>
<td>Constant</td>
<td>6.981</td>
<td>.112</td>
<td>62.32</td>
<td>.000</td>
<td>6.758 to 7.203</td>
</tr>
</tbody>
</table>

Note. N = 104; F(3, 100) = 3.98, p = .010; R² = .107, Adjusted R² = .080

Table 7. Regression with positive place identity and happiness: global climate change non-believers.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Coefficient</th>
<th>SE</th>
<th>t</th>
<th>p</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PP Identity (z)</td>
<td>.348</td>
<td>.151</td>
<td>2.30</td>
<td>.026</td>
<td>.044 to .652</td>
</tr>
<tr>
<td>Global/Local (z)</td>
<td>-.120</td>
<td>.143</td>
<td>-0.84</td>
<td>.402</td>
<td>-.407 to .166</td>
</tr>
<tr>
<td>Interaction</td>
<td>-.020</td>
<td>.131</td>
<td>-0.15</td>
<td>.882</td>
<td>-.284 to .245</td>
</tr>
<tr>
<td>Constant</td>
<td>6.877</td>
<td>.163</td>
<td>42.17</td>
<td>.000</td>
<td>6.549 to 7.205</td>
</tr>
</tbody>
</table>

Note. N = 53; F(3, 49) = 2.55, p = .067; R² = .135, Adjusted R² = .082

Regression analysis among those who believe in climate change found that while neither the effect of global/local or the interaction achieved statistical significance in this
analysis, a one unit increase in positive place identity was associated with a 0.487 unit increase in happiness. This regression model did not achieve statistical significance as the adjusted $R$-squared indicated these predictors collectively explained only 5.5% of the variation in happiness (Table 8).

Table 8. Regression with happiness and positive place identity: global climate change believers.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Coefficient</th>
<th>SE</th>
<th>t</th>
<th>p</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower       Upper</td>
</tr>
<tr>
<td>PP Identity (z)</td>
<td>.487</td>
<td>.220</td>
<td>2.21</td>
<td>.032</td>
<td>.044 .929</td>
</tr>
<tr>
<td>Global/Local (z)</td>
<td>.146</td>
<td>.301</td>
<td>.48</td>
<td>.630</td>
<td>-.459 .750</td>
</tr>
<tr>
<td>Interaction</td>
<td>-.244</td>
<td>.363</td>
<td>-.67</td>
<td>.505</td>
<td>-.973 .486</td>
</tr>
<tr>
<td>Constant</td>
<td>6.957</td>
<td>.246</td>
<td>28.32</td>
<td>.000</td>
<td>6.462 7.451</td>
</tr>
</tbody>
</table>

Note. N = 51; $F(3, 47) = 1.98, p = .130; R^2 = .112, Adjusted $R^2 = .055$

Snapshots of individual questions pertaining to emotional responses revealed at least some Coloradans participants of this survey who believed in local climate change also expressed distress regarding local climate change threats (Table 9); however, none of the measured feelings regarding thoughts of climate change threats yielded significant results (emotional responses were measured using questions 22, 23, 25, 29, 35, 36, and 39). Question 35 (N=104) of the survey (Ancillary Appendix 1) asked: “In consideration of the environmental-related questions asked in this survey, please indicate how much you agree or disagree with the following. NOTE: If you are not comfortable answering this question, please skip it.” The majority disagreed with the statement “Changes in the environment in my area are decreasing my ability to enjoy my life,” with 50.4%
disagreeing and 16.5% indicating that they neither agree or disagree. In contrast, 33% agreed with this statement (Table 10). The 33% may raise a concern for some psychological researchers and public health officials suggesting climate change is already having an increased negative psychological impact on Colorado residents.

Table 9. Emotions experienced by those feeling negative emotions regarding changes in Colorado’s environment.

<table>
<thead>
<tr>
<th>Emotion</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sadness</td>
<td>51%</td>
</tr>
<tr>
<td>Frustrated</td>
<td>48%</td>
</tr>
<tr>
<td>Anxiety</td>
<td>38.83%</td>
</tr>
<tr>
<td>Distress</td>
<td>34.69%</td>
</tr>
<tr>
<td>Stressed</td>
<td>34.65%</td>
</tr>
<tr>
<td>Angry</td>
<td>31.32%</td>
</tr>
<tr>
<td>Scared</td>
<td>29.70%</td>
</tr>
<tr>
<td>Helpless</td>
<td>25%</td>
</tr>
</tbody>
</table>

As the data scales in question 40 did not overlap, a separate test was run for the nominal order (Market Research Guy, N.D.). Those who believed in climate change were most likely to believe climate change is a big problem for Colorado or for both Colorado and other regions, N=55 (52.88%) (See Figure 4). A reduced, but still high percentage of participants believed in climate change but felt this was a bigger problem for other areas N=18 (17.31%). Those who did not believe in climate change indicated they felt climate change to not be a real threat N=20 (19.23%). Cross tabulation of Question 40 (N=104)
revealed the association between and belief in climate change had statistical significance \( (\chi^2(3) = 8.018, p < .001) \).

Table 10. Survey results for question 35 as they pertain to reactions to environmental changes (Ancillary Appendix 1).

<table>
<thead>
<tr>
<th></th>
<th>STRONGLY AGREE</th>
<th>AGREE</th>
<th>SOMEWHAT AGREE</th>
<th>NEITHER AGREE NOR DISAGREE</th>
<th>SOMEWHAT DISAGREE</th>
<th>DISAGREE</th>
<th>STRONGLY DISAGREE</th>
<th>TOTAL</th>
<th>WEIGHTED AVERAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changes in the environment in my area are decreasing my ability to enjoy my life.</td>
<td>2.91%</td>
<td>9.71%</td>
<td>20.39%</td>
<td>16.50%</td>
<td>16.50%</td>
<td>26.21%</td>
<td>7.77%</td>
<td>103</td>
<td>4.44</td>
</tr>
<tr>
<td>I feel positive about some local environmental changes.</td>
<td>3.92%</td>
<td>31.37%</td>
<td>21.57%</td>
<td>26.47%</td>
<td>8.82%</td>
<td>5.88%</td>
<td>1.96%</td>
<td>102</td>
<td>3.30</td>
</tr>
<tr>
<td>I feel anxiety about some local environmental changes.</td>
<td>4.85%</td>
<td>10.68%</td>
<td>23.30%</td>
<td>25.24%</td>
<td>15.53%</td>
<td>17.48%</td>
<td>2.91%</td>
<td>103</td>
<td>4.00</td>
</tr>
<tr>
<td>I feel sadness because of the changes in environment in Colorado.</td>
<td>11.00%</td>
<td>15.00%</td>
<td>25.00%</td>
<td>22.00%</td>
<td>11.00%</td>
<td>15.00%</td>
<td>1.00%</td>
<td>100</td>
<td>3.56</td>
</tr>
<tr>
<td>I feel stressed because of the changes in environment in Colorado.</td>
<td>4.95%</td>
<td>10.99%</td>
<td>18.81%</td>
<td>25.74%</td>
<td>14.85%</td>
<td>19.80%</td>
<td>4.95%</td>
<td>101</td>
<td>4.14</td>
</tr>
<tr>
<td>I feel frustrated because of the changes in environment in Colorado.</td>
<td>7.00%</td>
<td>18.00%</td>
<td>23.00%</td>
<td>19.00%</td>
<td>13.00%</td>
<td>16.00%</td>
<td>4.00%</td>
<td>100</td>
<td>3.77</td>
</tr>
<tr>
<td>I feel scared because of the changes in environment in Colorado.</td>
<td>3.96%</td>
<td>7.92%</td>
<td>17.82%</td>
<td>25.74%</td>
<td>17.82%</td>
<td>16.81%</td>
<td>7.92%</td>
<td>101</td>
<td>4.34</td>
</tr>
<tr>
<td>I feel distress about the changes in environment in Colorado.</td>
<td>4.08%</td>
<td>7.14%</td>
<td>23.47%</td>
<td>22.45%</td>
<td>17.38%</td>
<td>10.39%</td>
<td>6.12%</td>
<td>95</td>
<td>4.24</td>
</tr>
<tr>
<td>I feel helpless about changes in the environment in Colorado.</td>
<td>5.00%</td>
<td>7.00%</td>
<td>13.00%</td>
<td>26.00%</td>
<td>23.00%</td>
<td>21.00%</td>
<td>6.00%</td>
<td>100</td>
<td>4.41</td>
</tr>
<tr>
<td>I feel angry about changes in the environment in Colorado.</td>
<td>7.07%</td>
<td>12.12%</td>
<td>19.19%</td>
<td>26.20%</td>
<td>12.12%</td>
<td>15.15%</td>
<td>6.06%</td>
<td>99</td>
<td>3.96</td>
</tr>
</tbody>
</table>
In summary, which of the following statements most represents your opinion?

<table>
<thead>
<tr>
<th>ANSWER CHOICES</th>
<th>RESPONSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>I do not feel climate change is a real threat.</td>
<td>19.23%</td>
</tr>
<tr>
<td>I feel climate change is a big problem for Colorado.</td>
<td>2.88%</td>
</tr>
<tr>
<td>I feel climate change is a bigger problem for people living in other areas around the world.</td>
<td>17.31%</td>
</tr>
<tr>
<td>I feel climate change is a big problem for BOTH Colorado as well as others around the world.</td>
<td>52.88%</td>
</tr>
<tr>
<td>Prefer not to answer this question.</td>
<td>7.69%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>104</td>
</tr>
</tbody>
</table>

Figure 4. Results from question 40 of the survey. Measurements of local and/or global climate change perception.

Analysis of Hypothesis 3

Hypothesis 3 suggests: Individuals with strong place attachment will express resistance to moving from their residential place due to local climate change threats if they have a positive place identity to their residential place. To test this hypothesis, answers to questions pertaining to a person’s “rootedness” to Colorado were combined with positive place identity questions. Examples of rootedness included how long a person lived in Colorado and how willing they were to relocate from Colorado given various opportunities or adversities. Positive place identity questions included questions
about how connected a person feels to Colorado and whether they felt living in Colorado meets their emotional needs.

In order to test this hypothesis, three linear regression analyses were conducted in which rootedness was regressed upon local climate change threats, positive place identity, and the interaction between these two measures. Results for the entire sample of participants indicated that both local climate change threats and positive place identity were significant predictions of rootedness (Table 11). In contrast, the interaction between these two measures did not reach statistical significance. Most notably, a one unit increase in local climate change threats increased rootedness by 0.644 units, while a one unit increase in positive place identity increased rootedness by 0.176 units.
Table 11. Regression with rootedness.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Coefficient</th>
<th>SE</th>
<th>t</th>
<th>p</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower</td>
</tr>
<tr>
<td>Local CC Threats (z)</td>
<td>.644</td>
<td>.083</td>
<td>7.76</td>
<td>&lt;.001</td>
<td>.480</td>
</tr>
<tr>
<td>PP Identity (z)</td>
<td>.176</td>
<td>.084</td>
<td>2.08</td>
<td>.040</td>
<td>.008</td>
</tr>
<tr>
<td>Interaction</td>
<td>-.050</td>
<td>.081</td>
<td>-0.61</td>
<td>.544</td>
<td>-.211</td>
</tr>
<tr>
<td>Constant</td>
<td>5.434</td>
<td>.082</td>
<td>66.19</td>
<td>&lt;.001</td>
<td>5.271</td>
</tr>
</tbody>
</table>

Note. N = 105; F(3, 101) = 24.20, p < .001; R² = .418, Adjusted R² = .401

The same analysis was conducted only on individuals who did not believe in climate change. Local climate change threats achieved significance, and the interaction was also significant (Table 12). This result is not particularly meaningful due to the fact that positive place identity did not achieve statistical significance. With regard to local climate change threats, a one unit increase in this measure was found to be associated with a 0.311 unit increase in rootedness. This regression model also achieved statistical significance, with the adjusted $R^2$-squared indicating 20.4% of the variation in rootedness was explained on the basis of all predictors included within this model.
Table 12. Regression with rootedness among climate change non-believers.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Coefficient</th>
<th>SE</th>
<th>t</th>
<th>p</th>
<th>95% Confidence Interval</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local CC Threats (z)</td>
<td>.311</td>
<td>.153</td>
<td>2.03</td>
<td>.048</td>
<td>.003</td>
<td>.003</td>
<td>.619</td>
</tr>
<tr>
<td>PP Identity (z)</td>
<td>.042</td>
<td>.133</td>
<td>0.32</td>
<td>.752</td>
<td>-.225</td>
<td>-.225</td>
<td>.309</td>
</tr>
<tr>
<td>Interaction</td>
<td>-.225</td>
<td>.111</td>
<td>-2.03</td>
<td>.048</td>
<td>-.447</td>
<td>-.447</td>
<td>-.003</td>
</tr>
<tr>
<td>Constant</td>
<td>5.230</td>
<td>.149</td>
<td>35.47</td>
<td>&lt;.001</td>
<td>4.999</td>
<td>4.999</td>
<td>5.600</td>
</tr>
</tbody>
</table>

Note. N = 53; F(3, 49) = 5.44, p < .01; R^2 = .250, Adjusted R^2 = .204

With respect to individuals who did believe in climate change, only local climate change threats were found to achieve statistical significance in this analysis. Most unexpectedly, a 1.0 measured unit increase in this measure was found to be associated with a 1.096 unit increase in the outcome, rootedness (Table 13). This regression model was also found to achieve statistical significance, with the adjusted R-squared indicating 60.7% of the variation in rootedness was explained on the basis of all predictors included within this model.

Table 13. Regression with rootedness among climate change believers.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Coefficient</th>
<th>SE</th>
<th>t</th>
<th>p</th>
<th>95% Confidence Interval</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local CC Threats (z)</td>
<td>1.096</td>
<td>.133</td>
<td>8.22</td>
<td>&lt;.001</td>
<td>.828</td>
<td>1.364</td>
<td></td>
</tr>
<tr>
<td>PP Identity (z)</td>
<td>.009</td>
<td>.132</td>
<td>0.07</td>
<td>.948</td>
<td>-.258</td>
<td>.275</td>
<td></td>
</tr>
<tr>
<td>Interaction</td>
<td>.323</td>
<td>.218</td>
<td>1.48</td>
<td>.144</td>
<td>-.115</td>
<td>.761</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>5.043</td>
<td>.130</td>
<td>38.86</td>
<td>&lt;.001</td>
<td>4.782</td>
<td>5.304</td>
<td></td>
</tr>
</tbody>
</table>

Note. N = 52; F(3, 48) = 27.24, p < .001; R^2 = .630, Adjusted R^2 = .607.
Term Usage of Global Warming or Climate Change: Did it Matter?

To test the interchangeability for the use of “climate change” and “global warming” in this study, the survey presented two questions. Question 13: “Do you think climate change is leading to environmental problems?” Alternatively, Question 15 asked: “Do you think global warming is leading to environmental problems?” The results demonstrated the terms were indistinguishable among the participants (Table 14).

Table 14. Use of terms “climate change” versus “global warming.”

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>I don’t know</th>
<th>Prefer not to answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q13: Climate Change</td>
<td>N=78 (71.56%)</td>
<td>N=19 (17.43%)</td>
<td>N=10 (9.17%)</td>
<td>N=2 (1.83%)</td>
</tr>
<tr>
<td>Q15: Global Warming</td>
<td>N=74 (67.89%)</td>
<td>N=19 (17.43%)</td>
<td>N=13 (11.93%)</td>
<td>N=3 (2.75%)</td>
</tr>
</tbody>
</table>
Chapter IV
Discussion

The most significant factor for belief in climate change was correlated to how “rooted” a person was to Colorado. Regression analysis indicated a strong, statistically significant relationship between belief in local climate change and rootedness, wherein a 1.0 measured unit of belief in local climate change correlated with an increased, 1.096 (p<.001) unit of rootedness to Colorado (Table 13).

Overview of the Study

Positive place identity measured separately from rootedness did not have an impact on belief in local climate change wherein 1.0 measured unit of belief in local climate change only correlated with an increase of 0.009 of positive place identity (p-value of 0.948).

These findings demonstrated no significant relationship to the first hypothesis: individuals with strong place attachment to a local area are less likely to believe they will be impacted by climate change in their local region. After analyzing the results, I conducted another literature review to see if other researchers had experienced similar results. Anton and Lawrence (2016) explored the relationship between people who lived in threatened areas where they found place attachment was greater among those living in threatened areas. Proshanky, Fabian, and Kaminoff (1983) suggested this could be because the “threat of losing a place reminds people of their attachment to it” (as cited in Anon & Lawrence, 2016, p. 145).
Anton and Lawrence measured 130 Australian participant reactions towards proposed legislative changes which would lead to a “place change” in two cities. There are several differences between their study and my study. One, they measured how likely residents were to protest against the proposed change they deemed threatening. Similarly, Devine-Wright (2009) notes that when one citizen bands together with other citizens who deem a change to be a threat, then this emboldened community may indeed trigger a stronger attachment to their favorite place.

This present survey did not include questions directed toward people actively taking action to counteract climate change, as did, for example, the 2013 Scannell and Gifford survey of Vancouver residents previously discussed which demonstrated a positive correlation between place identity, localized climate change belief, and an intention to take action towards climate change mitigation. In contrast, the questions in this survey focused on whether the participant was likely to stay or move away from particular local threats. Further research can be conducted to measure whether personal or community-based efficacy moderates a belief in localized climate change among people who have high levels of place attachment.

When I began this thesis, I considered rootedness to be an element of positive place identity, as is commonly presented in the literature. However, during data analysis, I separated the rootedness measure from positive place identity. Positive place identity proved to be a reliable predictor of rootedness in relation to local climate change threats; however, in contrast to the hypotheses of this thesis, the interaction between these two measures was not found to achieve statistical significance. This contrasts with the study findings of Jorgensen and Stedman (2001) and Peng et al. (2016), wherein both studies
reported strong correlations between the concepts of place identity and place dependence (rootedness). The current survey’s data; however, suggest that the terms “positive place identity” and “rootedness” hold independent weight and that in future place attachment research, they should be tested as separate measures.

In general, rootedness was the most determining factor for most responses. As an example, when compared with non-believers in climate change, non-believers had a slightly lower mean of rootedness to Colorado, at 5.2 than climate change believers, whose mean was 5.6 (Table 3). Additionally, rootedness was also a significant indicator among those who believe in climate change and those who do not. Even those who do not believe in climate change still found the threat of climate change to be of significance where one unit of climate change threat increased the unit of rootedness by 0.311. However, the inclusion of positive place identity in these analyses did not result in significant results, so positive place identity measures were not found to be supportive of this study’s hypotheses.

Hypothesis 3 tested the influence of rootedness on climate change belief. Hypothesis 3 proposed: Individuals with strong place attachment will express resistance to moving from their residential place due to local climate change threats if they have a positive place identity to their residential place.

Again, rootedness, as opposed to positive place identity, demonstrated results with a greater statistical significance. Specifically, a one unit increase in climate change threats was found to increase rootedness by 0.644 (p<.001) units, while a one unit increase in positive place identity was found to increase rootedness by 0.176 units (p<.04) (Table 11). The survey questions for rootedness are identified earlier in the
Results section and Ancillary Appendix 2. The measure was found reliable, with a Cronbach's alpha of 0.700.

Another interesting result was that the people who believed in the different effects of climate change and those who didn’t were nearly equal. In responding to potential problems attributed to climate change such as an increase in wildfires, changing levels of snowpack as an effect of climate change, responses to questions ranged from yes = 47, no = 52 and yes = 48, no = 50, etc. (Table 2 with N=108).

In general, running the data through the algorithms demonstrated statistically good reliability scores. Although the results did not support the hypotheses, individual survey questions still provide insight regarding emotional responses to climate change. A lack of statically significant results correlating local climate change beliefs and negative well-being was not established, though participants still indicated emotional distress at the thought of local climate change. For example, 33% of the participants (N=104) agreed with the survey statement “[C]hanges in the environment in my area are decreasing my ability to enjoy life” (Figure 4 and Table 9).

Limitations of the Research

In a physical sense, many global and local climate issues are inextricably bound (Bonaiuto, Breakwell, & Cano, 1996). This observation seems to bear true for this study. The correlation focusing only on global climate change belief and rootedness was weak but approached statistical significance at the 0.05 alpha level ($r(50) = .259, p = .064$); however, the $t$-test failed to indicate a significant mean difference ($t(50) = -1.494, p = .141$) (Table 4). This limits some of the testing objectives of this study as I was
particularly interested in testing emotional well-being of those who thought only of
global climate change versus local climate change and yet data analysis of the responses
didn’t establish a segregation into those two groups.

Gosling (2004) concludes web-based surveys are a valid tool for psychological research (as cited in Verplanken & Roy, 2013, p. 5). This study used SurveyMonkey as the research platform. As I was designing the survey I coordinated with SurveyMonkey’s technical team as to how to design this survey with only 50 questions so the survey could qualify for free access to SurveyMonkey’s pool of people who volunteer to take surveys. I expected the SurveyMonkey volunteer pool would be an excellent way to reach an entirely different Colorado demographic. There were challenges in designing the survey to be in compliance with their standards and for some time, the technical team was unable to identify the outstanding issue. Finally, a senior technician intervened, noting the survey has significantly more questions than 50 because each question with multiple parts counts as one question. The only option to use the survey in its current form with the extensive questions designed to discern the nuance of each participant’s responses towards complex issues and still reach this more independent demographic comprised of SurveyMonkey survey takers was to pay $1,500 as an access fee. This was not an option considered for this current research.

Another challenge was the survey was not shared among people on Facebook and LinkedIn as much as anticipated. One reason for the smaller number of participants through social media platforms could be because of targeting the survey to Colorado residents only. As the results demonstrated, it is unclear whether participants distinguished between local and global when answering all the questions; at least there
was no statistical significance in how they reported their beliefs in the two phenomena. It is not possible to be in the mind of a participant to know how this general lack of distinction among the participants was reflected in their individual responses to each question. Data from this survey suggests a good future test is to provide the same survey but not limit it to Colorado or other local areas.

Lastly, this research does not reflect the demographics of Colorado as discussed at the beginning of the results section. There was a particular disparity between race, age and levels of education. While not intentional, surveying a narrow demographic is not uncommon in the literature. A 2017 meta-analysis of 66 articles researching climate change and place attachment (referred to as a “sense of place” by the authors) found the dominate populations surveyed in the field were in the Global North versus Global South regions of the world, in developed countries, and were conducted among rural populations (Nicolosi & Corbett, 2017).

Changes in Research Design

If hindsight is 20/20, then I would have designed this research project differently. Several positive place identity studies relied on to formulate these hypotheses tended towards interview research and/or small group studies (Rogan, O’Connor, & Horwitz, 2005; Hugh-Jones & Madhill, 2009; Cunsolo Willox et al., 2012). The Yale University survey modified for some of this study’s survey questions utilizes Lickert-scale questions but, in contrast, the delivery of the Yale University survey was via telephone, not online (Leiserowitz et al., 2013). Considering the complexity of the topics surveyed and the volume of data the results provided, I realized it may have been better to test the same hypotheses but with target focus groups. This approach may provide more in-depth
distinctions climate change believers have with the vocabulary associated with place attachment.

Repeatedly testing the same focus groups may significantly contribute to the field of place attachment because within the field, studies readily contradict each other's major findings. In a 2016 review of 136 peer-reviewed literature on place attachment and risk perception of localized natural disasters, Bonaiuto et al. found inconsistent results among the studies.

Additionally, implementing a telephone survey or public interview approach where the questions are read aloud to the participant may increase the likelihood of those responding to not be so disproportionately represented with graduate-level education, which in the present study represented 31.4% percent, as some of the questions require quite a bit of reading.

Although the research design for this thesis relied on four previously published studies, combining those questions may have created confusion to the survey taker and may explain why the survey had N=147 begin the survey with only N=105 included after accounting for MCAR data. Searle and Gow (2016) note potential bias existing in psychological studies can be attributed to the order of the questions in the survey or interview. As an example, the beginning of this survey asks how the person feels about living in Colorado and how likely it is they will move. These types of questions serve to establish a measure for positive place identity and some of the rootedness measures.

Then, without any leading statement, the survey questions related to climate change in general and followed by local climate change specifically. Following the climate change questions, the survey asks participants to rate their general levels of
happiness. There are no transitional statements or meaningful segues between the sets of questions. These omissions were intentional, in an effort to not unduly influence participants towards the assumptions of the hypotheses as drawing connections between question groups might lead participants to understand the premise of the research. The abrupt presentation of the questions may account for some survey attrition as the survey could have seemed confusing and random.

Preparing for Future Research

Perhaps the most insightful result from this research leads to the proposal to treat rootedness as a separate measure in future place identity research. Most place attachment researchers have regarded rootedness as an element of place attachment. As an example, in their Colorado study researching the psychosocial responses to the 2010 Colorado Four-Mile Canyon fire, researchers Nawrotzki et al. (2014) define place attachment as “The strength of place attachment is, in part, a function of length of residence, with a longer duration strengthening attachment” (p. 217). At least in this study, data did not suggest strong correlations between place attachment (or as termed in this study, positive place identity) and rootedness.

Also, future research focused reaching a demographic who attests to rootedness and a belief in climate change can test whether these two measures cross over to some of the areas researchers and people in the field struggle with, including increasing pro-environmental behavior and natural disaster preparedness.
Improving Climate Change Communication

The driving force behind this thesis was to contribute to the research field for improving climate change communication, leading to the specific purpose of encouraging pro-environmental behaviors. Perhaps the most promising measure revealed through this research pertains to rootedness and a belief in local climate change. This suggests campaigns such as NIMBY, though I initially challenged them, might be very productive. As our attention begins to shift from preventing climate change to trying to mitigate it and live with it, rootedness presents a potentially fruitful area of research (Bonaiuto et al., 2016).

Lastly, the 2017 meta-analysis study by Nicolosi and Corbett that surveyed 66 studies of place attachment research also examined climate change beliefs and responses to environmental general issues. It is important to note that the summary statistical analysis Nicolosi and Corbett conducted did not discern between local and global climate change. Their study presented several valuable findings for closing the gap between engagement and non-engagement in pro-environmental behavior by focusing on people with strong place attachment. Remarkably, 49 out of 66 studies (74.2%) indicated a positive correlation between place attachment and the environment and/or climate change (Nicolosi & Corbett, 2017). As this meta-analysis was published after this my own study ended, I was not aware of the preponderance of the correlation identified by Nicolosi and Corbett.

There were interesting distinctions as it relates to actual engagement in the Nicolosi and Corbett analysis. The researchers summarized: “[P]apers in this literature conceptualised engagement as (1) expressing concern or holding positive attitudes about
climate change or the environment, (2) taking action (such as pro-environmental behaviour or behavioural intention . . . and (3) as both concern and action. About 40% (N=26) measured concern, 40% (N=27) measured action, and almost 20% (N=13) measured both concern and action” (Nicolosi & Corbett, 2017, p. 81). The meta-analysis suggests we still have a wide gap converting climate change concern into action. Furthermore, they found that taking action had the strongest indication of place attachment, at 81.5%, as it pertains to environmental concerns but not specifically climate change concerns (Nicolosi & Corbett, 2017). This finding supports the idea of people being proactive to protect their “backyard” from potential threats (Devine-Wright, 2013).

Conclusions

In spite of the data being non-supportive for the hypotheses of this thesis, several interesting correlations emerged. Most notably, the strength of rootedness held more persuasive power in the concepts tested than positive place identity. Historically, place attachment researchers consider rootedness merely an element of positive place identity or place attachment. However, in this research, rootedness repeatedly demonstrated itself as a separate construct.

Particularly, this research demonstrated a strong correlation of rootedness with belief (not non-belief as proposed) of local climate change at the rate of one unit to an increase of rootedness by 0.644 (p<.001). Based on the participants in this study, the longer Coloradans live in Colorado and the more reluctant they are to move, the more they believe in local climate change. If further research confirms this finding, then climate change messaging can target those with strong rootedness to inspire an increase in pro-environmental behaviors and even disaster preparedness.
Before analyzing the data, I expected to see pronounced emotional distress among those who believed in local climate change and also had reported levels of positive place identity. Adding the emotional measures as they pertain to climate change taken from the German study by Harth, Leach, and Kessler (2013) and the Canadian study by Cunsolo Willox and Harper (2010) did not yield significant results in this survey.

For every unit measure of positive place identity, happiness did increase 0.377 (p<.001) among the entire sample and 0.487 (p<0.32) among climate change believers. But climate change threats did not adjust the emotions associated with positive place identity or well-being in a significant way. That being said, some participants still reported feeling many negative emotions, including sadness and frustration when thinking of climate change.

I also expected to find a relationship between denial of climate change when a person exhibited positive place identity. Among the non-believers of climate change, there was a statistical increase at the thought of local climate change as it related to rootedness but there was no correlation once positive place identity was incorporated. Although those who deny climate change is happening were represented in this survey at nearly 50% (N=52 of 105), the data did not suggest the participants denied local climate change threats on the basis of maintaining their positive place identity.

This study was not able to test each hypothesis against those who believe only in global versus those who believe in both global and local climate change, as data analysis did not support a strong separation between these two groups; therefore, this online survey did not support my intention to demonstrate the pitfalls of global as opposed to local climate change messaging.
References


Ancillary Appendix 1

Survey Questions

The following is a copy of the survey questions approved by Harvard’s Internal Review Board for the Committee on Human Subjects on August 19, 2015.

1. Survey & Age Consent: This survey is designed for people 18 years or older. If you are younger than 18, please do not take this survey. Please confirm you are 18 years or older.
   - [ ] I agree to participate in this study, and I am 18 years of age or older.
2. This survey is designed to assess attitudes and opinions among Colorado residents. If you are a Colorado resident, we welcome you to participate in this survey. Please indicate your residency below.

- Yes, I am a Colorado resident
- No, I am not a Colorado resident

3. Which Colorado town or city do you live in?

4. How did you hear about this survey?

- SurveyMonkey
- A friend/family member
- Facebook/LinkedIn
- A club or organization I belong to or work for
- My college or university
- Craig's List
### Colorado and Environmental Changes

5. How long have you lived in Colorado?

- [ ] I am a native
- [ ] 0-5 years
- [ ] 5-10 years
- [ ] 10-20 years
- [ ] 20+ years

6. How long do you expect to stay in Colorado?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree/Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Prefer not to answer</th>
<th>Not applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>I will stay here until a job or another opportunity in another state or country presents itself</td>
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<tr>
<td>I want to raise my children in Colorado</td>
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<tr>
<td>I want to retire in Colorado</td>
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<tr>
<td>I can't imagine ever moving away from Colorado</td>
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<td></td>
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<tr>
<td>I would rather live somewhere different from Colorado</td>
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</tr>
</tbody>
</table>
7. Please indicate how much you agree or disagree with the following statements.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Prefer not to answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am proud of the cultural history of Colorado.</td>
<td></td>
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</tr>
<tr>
<td>I love the landscape in Colorado.</td>
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<tr>
<td>My sense of who i am is vitally linked to living in Colorado.</td>
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<tr>
<td>I feel that living in Colorado has shaped my personality and experience but I do not feel it is an integral part of who i am.</td>
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</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Prefer not to answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>I get comfort peace of mind from living in Colorado.</td>
<td></td>
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<tr>
<td>I feel i know every neighborhood, nook and cranny near where i live.</td>
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<tr>
<td>I feel a deep connection to Colorado.</td>
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</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Prefer not to answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living in Colorado sufficiently meets my ECONOMIC needs and goals.</td>
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</tr>
<tr>
<td>Living in Colorado sufficiently meets my SOCIAL needs and goals.</td>
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<tr>
<td>Living in Colorado sufficiently meets my SPIRITUAL needs and goals.</td>
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</tr>
</tbody>
</table>
10. As it relates to your involvement in your community and with issues in Colorado, please indicate your agreement or disagreement with the following statements.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Prefer not to answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>I feel a sense of responsibility to the PEOPLE of Colorado.</td>
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<tr>
<td>I feel I have a sense of responsibility to the LAND in Colorado.</td>
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<tr>
<td>I feel a sense of responsibility to the WILDLIFE in Colorado.</td>
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</tbody>
</table>

11. In your view, do you think each of the following has become much less severe, somewhat less severe, stayed about the same, become somewhat more severe, or much more severe in Colorado over the past five years?

<table>
<thead>
<tr>
<th>Wildfires</th>
<th>Much less severe</th>
<th>Somewhat less severe</th>
<th>Same</th>
<th>Somewhat more severe</th>
<th>Much more severe</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flooding of rivers or lakes</td>
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<td></td>
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<tr>
<td>Drought</td>
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<tr>
<td>Heat waves</td>
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</tr>
<tr>
<td>Reduction in annual snowpack levels in the mountains</td>
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<tr>
<td>Air pollution</td>
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<td></td>
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<tr>
<td>Increase in environmentally-related health problems</td>
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</tr>
</tbody>
</table>

12. Do you think global pollution is leading to environmental problems?

- Yes
- No
- Not sure
- Prefer not to answer
13. Do you think climate change is leading to environmental problems?

- Yes
- No
- Not sure
- Prefer not to answer

14. Do you think global cooling is leading to environmental problems?

- Yes
- No
- Not sure
- Prefer not to answer

15. Do you think that global warming is leading to environmental problems?

- Yes
- No
- Not sure
- Prefer not to answer

16. Recently you may have noticed that climate change has been getting some attention in the news. Do you think climate change is happening, or not?

- Yes
- No
- Not sure
- Prefer not to answer

17. In your opinion...

- Recent climate change is a part of the normal, geologic cycle, not resulting from human activity.
- Recent climate change is a result of environmental degradation, most likely from human activity.
- Recent climate change is BOTH a part of the normal, geologic cycle AND a result of environmental degradation, most likely from human activity.
- Climate change is a hoax.
- Prefer not to answer.
- Don't know.
18. Do you think climate change is having an influence on the following?

<table>
<thead>
<tr>
<th></th>
<th>Climate change is not relevant to this question</th>
<th>Very likely</th>
<th>Somewhat likely</th>
<th>Somewhat unlikely</th>
<th>Very unlikely</th>
<th>Don't know</th>
<th>Prefer not to answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wildfires</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
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<tr>
<td>Flooding of rivers or lakes</td>
<td>○</td>
<td>○</td>
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<td>○</td>
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<td>○</td>
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<tr>
<td>Drought</td>
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<tr>
<td>Heat waves</td>
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<tr>
<td>Reduced snowpack in the mountains</td>
<td>○</td>
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<td>○</td>
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<tr>
<td>Air pollution</td>
<td>○</td>
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<tr>
<td>Increase in environmental-related health problems</td>
<td>○</td>
<td>○</td>
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</tr>
</tbody>
</table>

19. Please indicate whether you think climate change will harm each of the following and to what extent you think this may or may not happen.

<table>
<thead>
<tr>
<th></th>
<th>Climate change is not relevant to this question</th>
<th>A great deal</th>
<th>A moderate amount</th>
<th>Only a little</th>
<th>Not at all</th>
<th>Not sure</th>
<th>Prefer not to answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>You personally</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
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</tr>
<tr>
<td>Your family</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>People in your community</td>
<td>○</td>
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<td>○</td>
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</tr>
<tr>
<td>People in the State of Colorado</td>
<td>○</td>
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</tr>
<tr>
<td>People in the United States</td>
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<tr>
<td>People in developing countries</td>
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<td>○</td>
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</tr>
<tr>
<td>People in modern industrialized countries</td>
<td>○</td>
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<td>○</td>
<td>○</td>
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<td>○</td>
<td>○</td>
</tr>
<tr>
<td>The next generation of people</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Plant and animal species within 10 years</td>
<td>○</td>
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<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Plant and animal species 10 or more years from now</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
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<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
20. When do you think climate change will start to harm people in Colorado? Would you say...
- They are being harmed right now
- In 10 years, or
- In 25 years, or
- In 50 years, or
- In 100 years, or
- Never
- Don’t know
- Prefer not to answer

21. On some issues, individuals often feel they have all the information they need in order to form a firm opinion, while on other issues they would like more information before making up their mind. For climate change, would you say you...
- Need a lot more information
- Need some more information
- Need a little more information
- Do not need any more information
- Don’t know
- Prefer not to answer

22. Please tell me whether you strongly agree, somewhat agree, somewhat disagree, or strongly disagree with each of the following statements.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Don’t know</th>
<th>Prefer not to answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>I could likely change my mind about climate change.</td>
<td></td>
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</tr>
<tr>
<td>The actions of a single individual won’t make any difference in climate change</td>
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</tr>
<tr>
<td>New technologies can solve climate change without individuals having to make big changes in their lives.</td>
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</tbody>
</table>
23. Which one of the following statements comes closest to your view?

- I have personally experienced the effects of climate change
- Climate change isn’t happening
- Humans can’t reduce climate change, even if it is happening
- Humans could reduce climate change, but people aren’t willing to change their behavior, so we’re not going to
- Humans could reduce climate change, but it’s unclear at this point whether we will do what’s needed
- Humans can reduce climate change, and we are going to do so successfully
- Don’t know
- Prefer not to answer

24. “Fracking” is a way to extract natural gas from shale rock deep underground. Based on anything you may have heard or read about fracking, do you...

- Strongly support fracking
- Somewhat support fracking
- As long as fracking doesn’t take place in my town, I support fracking
- I’m undecided
- Somewhat oppose fracking
- Strongly oppose fracking
- Don’t know
- Prefer not to answer

25. If Colorado were to switch from fossil fuels like coal and oil to cleaner energy sources like solar and wind, do you think it would...

- Increase economic growth and the number of jobs in Colorado
- Have no effect on the economic growth and number of jobs in Colorado
- Decrease economic growth and the number of jobs in Colorado
- Don’t know
- Prefer not to answer
26. If state officials were to declare a state of emergency for Colorado because of the following problems, please indicate your likely willingness to move away from the threat.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Very likely</th>
<th>Somewhat likely</th>
<th>Somewhat unlikely</th>
<th>Very unlikely</th>
<th>Don’t know</th>
<th>Prefer not to answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repeated wildfires and smoke-filled local air</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Identification of a cancer cluster in your town or city</td>
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</tr>
<tr>
<td>Repeated flooding of rivers or lakes in your town or city</td>
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<tr>
<td>Drought conditions lasting several years</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Repeated heat waves and subsequent power outages</td>
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</tr>
<tr>
<td>Devastation of forest trees due to pests, drought, and wildfire</td>
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</tr>
<tr>
<td>Increase incidence of asthma attacks in people in your community due to air pollution</td>
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<td></td>
</tr>
<tr>
<td>Report of toxic chemicals in the soil and/or water in your community</td>
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<tr>
<td>Shutting down of local coal plant and/or related mining resulting in job loss</td>
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</tr>
</tbody>
</table>

27. If any of the above threats occurred, please indicate how long such a threat would need to exist for you to commit to trying to move away.

- 0-1 year
- 1-3 years
- 4-6 years
- 6 years or more
- I would not choose to move
- I would only move if my house or neighborhood were condemned
28. If you were faced with an environmental disaster and it was recommended that you evacuate your home, which would you choose to do?

- Evacuate as soon as it is recommended by authorities
- Wait to evacuate until the authorities issued a command to evacuate
- Refuse to evacuate

29. If a recent study reported Colorado is the most polluting and environmentally-damaging state in the Union and if this were true, please indicate how much you agree or disagree with the following statements.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Don't know</th>
<th>Prefer not to answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>We Coloradans are responsible for the fact that people have to suffer from climate change.</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>I feel angry about Colorado’s contribution to climate change.</td>
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<tr>
<td>I feel guilty about Colorado’s contribution to climate change.</td>
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<tr>
<td>I feel fearful about Colorado’s contribution to climate change.</td>
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<tr>
<td>I do not believe the results of the study, in fact, I feel pride about Colorado’s environmental behavior.</td>
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</tr>
</tbody>
</table>
30. If a recent scientific study reported that Colorado is the most polluting and environmentally-damaging state in the Union and given this statement to be true, please indicate how much you agree or disagree with the following statements.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Don't Know</th>
<th>Prefer not to answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>I think that within Colorado, environmental-damaging violators should be punished.</td>
<td></td>
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<tr>
<td>I intend to urge support companies operating in Colorado that publicly support efforts to clean up Colorado's environment.</td>
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<tr>
<td>It is our duty to take care of the environmental problems that we caused.</td>
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<tr>
<td>We should compensate those living in Colorado who have to suffer from our environmental damage.</td>
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<tr>
<td>We should compensate those living in the United States who have to suffer from our environmental damage.</td>
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</tbody>
</table>

31. Generally speaking, on a scale of 1 (not a very happy person) to 7 (a very happy person), I would consider myself a:

- [ ] 1 (generally not a very happy person)
- [ ] 2
- [ ] 3
- [ ] 4
- [ ] 5
- [ ] 6
- [ ] 7 (generally a very happy person)
- [ ] Prefer not to answer
32. On a scale from 1 (generally less happy) to 7 (generally more happy) compared with most of my peers, I consider myself:

○ 1 (generally less happy)
○ 2
○ 3
○ 4
○ 5
○ 6
○ 7 (generally more happy)
○ Prefer not to answer

33. Some people are generally very happy. They enjoy life regardless of what is going on, getting the most out of everything. On a scale of 1 (generally not at all) to 7 (generally a great deal) to what extent does this characterization describe you?

○ 1 (generally not at all)
○ 2
○ 3
○ 4
○ 5
○ 6
○ 7 (generally a great deal)
○ Prefer not to answer
34. Some people are generally not very happy. Although they are not depressed, they never seem as happy as others around them. On a scale of 1 (generally not at all) to 7 (generally a great deal), to what extent does this characterization describe you?

- [ ] 1 (generally not at all)
- [ ] 2
- [ ] 3
- [ ] 4
- [ ] 5
- [ ] 6
- [ ] 7 (generally a great deal)
- [ ] Prefer not to answer
35. In consideration of the environmental-related questions asked in this survey, please indicate how much you agree or disagree with the following. NOTE: If you are not comfortable answering this question, please skip it.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Neither Agree</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changes in the environment in my area are decreasing my ability to enjoy my life.</td>
<td></td>
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<tr>
<td>I feel positive about some local environmental changes.</td>
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<tr>
<td>I feel anxiety about some local environmental changes.</td>
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<tr>
<td>I feel sadness because of the changes in environment in Colorado.</td>
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<tr>
<td>I feel stressed because of the changes in environment in Colorado.</td>
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<tr>
<td>I feel frustrated because of the changes in environment in Colorado.</td>
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<tr>
<td>I feel scared because of the changes in environment in Colorado.</td>
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<tr>
<td>I feel distress about the changes in environment in Colorado.</td>
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<tr>
<td>I feel helpless about changes in the environment in Colorado.</td>
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<tr>
<td>I feel angry about changes in the environment in Colorado.</td>
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<td></td>
</tr>
</tbody>
</table>
36. In consideration of the environmental-related questions asked in this survey, please indicate how much you agree or disagree with the following.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree</th>
<th>Strongly Disagree</th>
<th>Don’t Know</th>
<th>Prefer not to answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am concerned environmental problems will cause illness to myself or my family.</td>
<td></td>
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<tr>
<td>My sense of well-being has been negatively affected by the changes in the environment.</td>
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<tr>
<td>My sense of belonging to Colorado has been negatively affected by environmental change.</td>
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</tbody>
</table>

37. Imagine an independent study reported a significant increase of reported cancer rates in your community, and the data demonstrated cancer clusters were growing at a rate of 26% per year. Based on this information, please indicate whether you would be likely to take any of the actions listed below.

<table>
<thead>
<tr>
<th>Very Likely</th>
<th>Somewhat Likely</th>
<th>Somewhat Unlikely</th>
<th>Very Unlikely</th>
<th>Don’t Know</th>
<th>Prefer not to answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>I would ask my doctor’s opinion on the report.</td>
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<tr>
<td>I would conduct my own research and attend public meetings to learn more.</td>
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<tr>
<td>I would wait to see if the cancer cluster gets bigger.</td>
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<tr>
<td>I would wait to take action until I knew some of my neighbors developed cancer.</td>
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<tr>
<td>I would wait to take action until an immediate family member was diagnosed with cancer.</td>
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<td>I would consider moving away.</td>
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<tr>
<td>I would absolutely move away.</td>
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<tr>
<td>I would ignore the report because there is no use worrying about what you can’t control.</td>
<td></td>
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</tbody>
</table>
38. On a scale of 1 (not very important) to 7 (very important), if you accept the idea of climate change, how much of a problem is it in comparison to other problems like: poverty, the economy, and political injustice?

- 1 (not very important)
- 2
- 3
- 4
- 5
- 6
- 7 (very important)
- Prefer not to answer

39. If you accept the idea of climate change, how would you rate your feelings when you think about climate change or hear about climate change?

<table>
<thead>
<tr>
<th>Emotion</th>
<th>0 (do not feel this emotion)</th>
<th>1 (rarely feel this emotion)</th>
<th>2 (occasionally feel this emotion)</th>
<th>3 (often feel this emotion)</th>
<th>4 (feel this emotion all the time)</th>
<th>Prefer not to answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skeptical</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Fearful</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Confused</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Sad</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Happy</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Optimistic</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Angry</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Guilty</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Frustrated</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

40. In summary, which of the following statements most represents your opinion?

- I do not feel climate change is a real threat.
- I feel climate change is a big problem for Colorado.
- I feel climate change is a bigger problem for people living in other areas around the world.
- I feel climate change is a big problem for BOTH Colorado as well as others around the world.
- Prefer not to answer this question.
Demographic Information: Have you ever wondered why surveys ask you personal information? It is so that researchers can determine if their study was an accurate reflection of the general population or if the survey was targeted to certain groups of people. The most trustworthy surveys are those that are a good sample of the general population. Therefore, your truthful answers to these questions are very valuable.

41. Are you male or female?
   - Male
   - Female
   - Prefer not to answer

42. What age group are you in?
   - 18-20 years
   - 21-30 years
   - 31-40 years
   - 41-50 years
   - 51-60 years
   - 61-70 years
   - Over 70 years
   - Prefer not to answer

43. Do you have children?
   - Yes
   - No
   - Prefer not to answer

44. What is the highest level of education you have completed?
   [Box to write answer]
45. What is your ethnicity? (Please select all that apply.)

☐ American Indian or Alaska Native
☐ Asian or Pacific Islander
☐ Black or African American
☐ Hispanic or Latino
☐ White / Caucasian
☐ Prefer not to answer

Other (please specify)

46. What is your approximate average household income?

☐ $0-$24,999
☐ $25,000-$49,999
☐ $50,000-$74,999
☐ $75,000-$99,999
☐ $100,000-$124,999
☐ $125,000-$149,999
☐ $150,000-$174,999
☐ $175,000-$199,999
☐ $200,000 and up
Thank you very much for taking the time to answer this survey.

The aim of this survey is to determine if there is a relationship between how connected a person feels to their local community and how potential environmental threats affect their sense of well-being. Your contributions are greatly appreciated.

The survey questions about "a state of emergency, Colorado being the most polluting and environmentally damaging state, and community cancer clusters" were fictionalized scenarios about studies relating to Colorado. Responses to these questions will help us understand how people feel about various environmental issues.

If you would like to receive notification when the results of this study are released, please contact the survey designer and researcher, Allison Frederic at Editor@PositivePsychology.org. While contacting me obviously reveals that you took the survey, your contact information will not be matched up with survey results.

If you are interested in the psychological connection between environmental threats and personal well-being, you are welcome to follow Allison on Twitter at https://twitter.com/AllisonF_Author.

Copyright Information
The questions in this survey were slightly adapted or in many instances taken in entirety from the following peer-reviewed research studies.


Ancillary Appendix 2

Algorithms to Test Hypotheses

The following three illustrations provide overviews of the algorithms to test the three hypotheses in this study’s research. Subsequent illustrations present algorithmic testing including the specific survey questions.

H1: Individuals with strong place attachment to a local area are less likely to believe they will be impacted by climate change in their local region.

Identify likely indicators of strong positive place identity.

First, identify degrees of rootedness.

Second, measure positive place identity.

Third, measure place permanence.
H2: If individuals with strong place attachment do believe climate change will or currently does impact their local community, they will feel pronounced emotional distress.

Identify beliefs in local climate change and compare to emotional measurements.

First, identify beliefs in global warming climate change.

Second, identify beliefs in local climate change.

Third, measure general sense of happiness.

Fourth, measure emotional responses to local climate change perception.
H3: Individuals with strong place attachment will express resistance to moving from their residential place due to local climate change threats if they have a positive place identity to their residential place.

Measure solution-oriented and optimistic-type responses to questions about local climate change in comparison to emotional responses to local climate change perception.

First measure solution-oriented and optimistic-type responses to questions about local climate change.

Second compare the results from the solution-oriented and optimistic-type responses to questions about emotional reactions to local climate change identified in H2.

The following illustrations combine the hypothesis testing algorithms with specific survey questions.
H1: Individuals with strong place attachment to a local area are less likely to believe they will be impacted by climate change in their local region.

Identify likely indicators of strong positive place identity.

First, this is done by identifying rootedness.

Participant responds strongly to questions 5, 6, and 43.

Q5. How long have you lived in Colorado?

Q 6. How long do you expect to stay in Colorado? With response selections of:

a. I will stay here until a job or another opportunity in another state or country presents itself
b. I want to raise my children in Colorado
c. I want to retire in Colorado
d. I can’t imagine ever moving away from Colorado
e. I would rather live somewhere different. Colorado is not the place for me.

Q43. Do you have children?
H1: Individuals with strong place attachment to a local area are less likely to believe they will be impacted by climate change in their local region.

Identify likely indicators of strong positive place identity.

Second, this is done by measuring positive place identity.

Participant responds strongly to questions suggesting positive place identity Q 7, 8, 9, and 10

Q7. Please indicate how much you agree or disagree with the following statements.
   a. I am proud of the cultural history of Colorado.
   b. I love the landscape in Colorado.
   c. My sense of who I am is vitally linked to living in Colorado.
   d. I feel that living in Colorado has shaped my personality and experience but I do not feel it is an integral part of who I am.

Q8. Please indicate how much you agree or disagree with the following statements.
   a. I get comfort or peace of mind from living in Colorado.
   b. I feel I know every neighborhood, nook and cranny near where I live.
   c. I feel a deep connection to Colorado.

Q9. Please indicate how much you agree or disagree with the following statements.
   a. Living in Colorado sufficiently meets my ECONOMIC needs and goals.
   b. Living in Colorado sufficiently meets my SOCIAL needs and goals.
   c. Living in Colorado sufficiently meets my SPIRITUAL needs and goals.
H1: Individuals with strong place attachment to a local area are less likely to believe they will be impacted by climate change in their local region.

Identify likely indicators of strong positive place identity.

Second, this is done by measuring positive place identity.

Participant responds strongly to questions suggesting positive place identity: Q 7, 8, 9, and 10

Q10. As it relates to your involvement in your community and with issues in Colorado, please indicate your agreement or disagreement with the following statements.

a. I feel a sense of responsibility to the PEOPLE of Colorado.
b. I feel I have a sense of responsibility to the LAND in Colorado.
c. I feel a sense of responsibility to the WILDLIFE in Colorado.
**H1: Individuals with strong place attachment to a local area are less likely to believe they will be impacted by climate change in their local region.**

Identify likely indicators of strong positive place identity.

Third, this is done by measuring place permanence.

Participant responds strongly to questions suggesting place permanence. Q 26, 27, 28, 29, and 37

**Q26. If state officials were to declare a state of emergency for Colorado because of the following problems, please indicate your likely willingness to move away from the threat.**

a. Repeated wildfires and smoke-filled local air  
b. Identification of a cancer cluster in your town or city  
c. Repeated flooding of rivers or lakes in your town or city  
d. Drought conditions lasting several years  
e. Repeated heat waves and subsequent power outages  
f. Devastation of forest trees due to pests, drought, and wildfires  
g. Increase incidence of asthma attacks in people in your community due to air pollution  
h. Report of toxic chemicals in the soil and/or water in your community  
i. Shutting down of local coal plant and/or related mining resulting in job loss

**Q27. If any of the above threats occurred, please indicate how long such a threat would need to exist for you to commit to trying to move away.**

a. 0-1 year  
b. 1-3 years  
c. 4-6 years  
d. 6 years or more  
e. I would not choose to move  
f. I would only move if my house or neighborhood were condemned
**H1:** Individuals with strong place attachment to a local area are less likely to believe they will be impacted by climate change in their local region.

Identify likely indicators of strong positive place identity.

Third, this is done by measuring place permanence.

Participant responds strongly to questions suggesting place permanence. Q 26, 27, 28, 29, and 37

**Q28.** If you were faced with an environmental disaster and it was recommended that you evacuate your home, which would you choose to do?

- a. Evacuate as soon as it is recommended by authorities
- b. Wait to evacuate until the authorities issued a command to evacuate
- c. Refuse to evacuate

**Q29.** If a recent scientific study reported that Colorado is the most polluting and environmentally damaging state in the Union and given this statement to be true, please indicate how much you agree or disagree with the following statements.

- a. We Coloradans are responsible for the fact that people have to suffer from climate change.
- b. I feel angry about Colorado’s contribution to climate change.
- c. I feel guilty about Colorado’s contribution to climate change.
- d. I feel fearful about Colorado’s contribution to climate change.
- e. I do not believe the results of the study, in fact, I feel pride about Colorado’s environmental behavior.
**H1**: Individuals with strong place attachment to a local area are less likely to believe they will be impacted by climate change in their local region.

---

Identify likely indicators of strong positive place identity.

---

Third, this is done by measuring place permanence.

---

Participant responds strongly to questions suggesting place permanence. Q 26, 27, 28, 29, and 37

Q37. If an independent study reported a significant increase of reported cancer rates in your community. The data demonstrated that the cancer cluster is growing at a rate of 25% per year. Based on this information, please indicate whether you are likely to take any of the actions listed below.

- a. I would ask my doctor's opinion on this report.
- b. I would conduct my own research and attend public meetings to learn more.
- c. I would wait to see if the cancer cluster gets bigger.
- d. I would wait to take action until I knew some of my neighbors developed cancer.
- e. I would wait to take action until an immediate family member was diagnosed with cancer.
- f. I would consider moving away.
- g. I would absolutely move away.
- h. I would ignore the report because there is no use worrying about what you can't control.
H2: If individuals with strong place attachment do believe climate change will or currently does impact their local community, they will feel pronounced emotional distress.

Identify believes in local climate change and compare to emotional measurements.

First identify beliefs in global warming climate change.

Participant responds positively to questions belief in climate change. Q 12, 13, 14, 15, 16, 17, 21, 24, and 38.

Q12. Do you think that global pollution is leading to environmental problems?
Q13. Do you think that climate change is leading to environmental problems?
Q14. Do you think that global cooling is leading to environmental problems?
Q15. Do you think that global warming is leading to environmental problems?
Q16. Recently you may have noticed that climate change has been getting some attention in the news. Do you think that climate change is happening, or not?
H2: If individuals with strong place attachment do believe climate change will or currently does impact their local community, they will feel pronounced emotional distress.

Identify beliefs in local climate change and compare to emotional measurements.

First, identify beliefs in global warming climate change.

Participant responds positively to questions belief in climate change. Q 12, 13, 14, 15, 16, 17, 21, 24, and 38

Q17. In your opinion...

a. recent climate change is a part of the normal, geologic cycle.
b. recent climate change is a result of environmental degradation, most likely from human activity.
c. recent climate change is both a part of the normal, geologic cycle AND a result of environmental degradation, most likely from human activity.
d. climate change is a hoax.

Q21. On some issues, people feel that they have all the information they need in order to form a firm opinion, while on other issues they would like more information before making up their mind. For climate change, would you say you...

a. need a lot more information
b. need some more information
c. need a little more information
d. do not need any more information
H2: If individuals with strong place attachment do believe climate change will or currently does impact their local community, they will feel pronounced emotional distress.

Identify believes in local climate change and compare to emotional measurements.

First, identify beliefs in global warming climate change.

Participant responds positively to questions belief in climate change. Q 12, 13, 14, 15, 16, 17, 21, 24, and 38

Q24. “Fracking” is a way to extract natural gas from shale rock deep underground. Based on anything you may have heard or read about fracking, do you...

a. Strongly support fracking
b. Somewhat support fracking
c. As long as fracking doesn’t take place in my town, I support fracking
d. I’m undecided
e. Somewhat oppose fracking
f. Strongly oppose fracking
g. Don’t know

Q38. On a scale of 1 (not very important) to 7 (very important), if you accept the idea of climate change, how much of a problem is it in comparison to other problems like: poverty, the economy, and political injustice?
H2: If individuals with strong place attachment do believe climate change will or currently does impact their local community, they will feel pronounced emotional distress.

Identify beliefs in local climate change and compare to emotional measurements.

Second, identify beliefs in local climate change.

Participant responds positively to questions belief in local climate change. Q 11, 18, and 20

Q11. In your view, do you think each of the following has become much less severe, somewhat less severe, stayed about the same, become somewhat more severe, or much more severe in Colorado over the past five years?

a. Wildfires
b. Flooding of rivers or lakes
c. Drought
d. Heat waves
e. Reduced snowpack in the mountains
f. Air pollution
g. Increase in environmental related health problems
H2: If individuals with strong place attachment do believe climate change will or currently does impact their local community, they will feel pronounced emotional distress.

Identify believes in local climate change and compare to emotional measurements.

Second, identify beliefs in local climate change.

Participant responds positively to questions belief in local climate change. Q 11, 18, and 20

Q18. Do you think climate change is having an influence on the following?
   a. Wildfires
   b. Flooding of rivers or lakes
   c. Drought
   d. Heat waves
   e. Reduced snowpack in the mountains
   f. Air pollution
   g. Increase in environmental related health problems

Q20. When do you think climate change will start to harm people in Colorado? Would you say...
   a. They are being harmed right now
   b. In 10 years, or
   c. In 25 years, or
   d. In 50 years, or
   e. In 100 years, or
   f. Never
   g. Don't know
H2: If individuals with strong place attachment do believe climate change will or currently does impact their local community, they will feel pronounced emotional distress.

Identify believes in local climate change and compare to emotional measurements.

Third, measure general sense of happiness.

Participant responds positively to questions measures on the Happiness Scale. Q 31, 32, 33, and 34

Q31. Generally speaking, on a scale of 1 (not a very happy person) to 7 (a very happy person), I would consider myself a:

Q32. On a scale from 1 (generally less happy) to 7 (generally more happy) compared with most of my peers, I consider myself:

Q33. Some people are generally very happy. They enjoy life regardless of what is going on, getting the most out of everything. On a scale of 1 (generally not at all) to 7 (generally a great deal) to what extent does this characterization describe you?

Q34. Some people are generally not very happy. Although they are not depressed, they never seem as happy as they might be. On a scale of 1 (generally not at all) to 7 (generally a great deal), to what extent does this characterization describe you?
H2: If individuals with strong place attachment do believe climate change will or currently does impact their local community, they will feel pronounced emotional distress.

Identify believers in local climate change and compare to emotional measurements.

Fourth, measure emotional responses to local climate change.

Participant responds negatively to questions measuring their emotional responses to local climate change. Q 35, 36, 39, and 40

Q35. In consideration of the environmentally-related questions asked in this survey, please indicate how much you agree or disagree with the following. NOTE: If you are not comfortable answering this question, please skip it.

a. Changes in the environment in my area are decreasing my ability to enjoy my life.
b. I feel positive about some local environmental changes.
c. I feel anxiety about some local environmental changes.
d. I feel sadness because of the changes in environment in Colorado.
e. I feel stressed because of the changes in environment in Colorado.
f. I feel frustrated because of the changes in environment in Colorado.
g. I feel scared because of the changes in environment in Colorado.
h. I feel distress about the changes in environment in Colorado.
i. I feel helpless about changes in the environment in Colorado.
j. I feel angry about changes in the environment in Colorado.
H2: If individuals with strong place attachment do believe climate change will or currently does impact their local community, they will feel pronounced emotional distress.

Identify believes in local climate change and compare to emotional measurements.

Fourth, measure emotional responses to local climate change.

Participant responds negatively to questions measuring their emotional responses to local climate change. Q 35, 36, 39, and 40

Q36. In consideration of the environmentally-related questions asked in this survey, please indicate how much you agree or disagree with the following.

a. I am concerned environmental problems will cause illness to myself or my family.
b. My sense of wellbeing has been negatively affected by the changes in the environment.
c. My sense of belonging to Colorado has been negatively affected by environmental change.
H2: If individuals with strong place attachment do believe climate change will or currently does impact their local community, they will feel pronounced emotional distress.

Identify believes in local climate change and compare to emotional measurements.

Fourth, measure emotional responses to local climate change.

Participant responds negatively to questions measuring their emotional responses to local climate change. Q 35, 36, 39, and 40

Q39. If you accept the idea of climate change, how would you rate your feelings when you think about climate change or hear about climate change?

a. Skeptical
b. Fearful
c. Confused
d. Sad
e. Happy
f. Optimistic
g. Angry
h. Guilty
i. Frustrated

Q40. In summary, which of the following statements most represents your opinion?

a. I do not feel that climate change is a real threat.
b. I feel that climate change is a big problem for Colorado.
c. I feel that climate change is a bigger problem for people living in other areas around the world.
d. I feel that climate change is a big problem for BOTH Colorado as well as others around the world.
**H3:** Individuals with strong place attachment will express resistance to moving from their residential place due to local climate change threats if they have a positive place identity to their residential place.

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Measure solution-oriented and optimistic-type responses to questions about local climate change.

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First, measure solution-oriented and optimistic-type responses to questions about local climate change.

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Participant responds positively to the following questions. Q 19, 22, 23, 25, and 29

**Q19.** Please indicate whether you think climate change will harm each of the following and to what extent you think this may or may not happen.

- a. You personally
- b. Your family
- c. People in your community
- d. People in Colorado
- e. People in the United States
- f. People in developing countries
- g. People in modern industrialized countries
- h. The next generation of people
- i. Plant and animal species within 10 years
- j. Plant and animal species 10 or more years from now
**H3:** Individuals with strong place attachment will express resistance to moving from their residential place due to local climate change threats if they have a positive place identity to their residential place.

**Measure solution-oriented and optimistic-type responses to questions about local climate change.**

**First, measure solution-oriented and optimistic-type responses to questions about local climate change.**

Participant responds positively to the following questions: Q19, 22, 23, 25, and 29

**Q22.** Please tell me whether you strongly agree, somewhat agree, somewhat disagree, or strongly disagree with each of the following statements.

a. I could likely or possibly change my mind about climate change.
b. The actions of a single individual won’t make any difference in climate change.
c. New technologies can solve climate change without individuals having to make big changes in their lives.
H3: Individuals with strong place attachment will express resistance to moving from their residential place due to local climate change threats if they have a positive place identity to their residential place.

Measure solution-oriented and optimistic-type responses to questions about local climate change.

First, measure solution-oriented and optimistic-type responses to questions about local climate change.

Participant responds positively to the following questions: Q19, 22, 23, 25, and 29

Q23. Which one of the following statements comes closest to your view?
   a. I have personally experienced the effects of climate change
   b. Climate change isn’t happening
   c. Humans can’t reduce climate change, even if it is happening
   d. Humans could reduce climate change, but people aren’t willing to change their behavior, so we’re not going to
   e. Humans could reduce climate change, but it’s unclear at this point whether we will do what’s needed
   f. Humans can reduce climate change, and we are going to do so successfully

Q25. If Colorado were to switch from fossil fuels like coal and oil to cleaner energy sources like solar and wind, do you think it would...
   a. Increase economic growth and the number of jobs in Colorado
   b. Have no effect on the economic growth and number of jobs in Colorado
   c. Decrease economic growth and the number of jobs in Colorado
H3: Individuals with strong place attachment will express resistance to moving from their residential place due to local climate change threats if they have a positive place identity to their residential place.

Measure solution-oriented and optimistic-type responses to questions about local climate change.

First, measure solution-oriented and optimistic-type responses to questions about local climate change.

Participant responds positively to the following questions. Q 19, 22, 23, 25, and 29

Q29. If a recent scientific study reported that Colorado is the most polluting and environmentally-damaging state in the Union and given this statement to be true, please indicate how much you agree or disagree with the following statements.

a. I think that within Colorado, environmental damaging violators should be punished.
b. I intend to only support companies operating in Colorado that publicly support efforts to clean up Colorado's environment.
c. It is our duty to take care of the environmental problems that we caused.
d. We should compensate those living in Colorado who have to suffer from our environmental damage.
e. We should compensate those living in the United States who have to suffer from our environmental damage.
### H3: Individuals with strong place attachment will express resistance to moving from their residential place due to local climate change threats if they have a positive place identity to their residential place.

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<th>Measure solution-oriented and optimistic-type responses to questions about local climate change.</th>
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<th>Second, compare the results from the solution-oriented and optimistic-type responses to questions about emotional reactions to local climate change.</th>
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<th>Compare responses to questions 19, 22, 23, and 25 to questions 35, 36, 39, and 40.</th>
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