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PLACE ATTACHMENT, CLIMATE CHANGE, AND THREAT PERCEPTIONS OF UTAH WILDERNESS

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ABSTRACT

Place Attachment is the emotional and functional relationships that tie humans to natural environments. It has been shown to impact a person's ability to perceive threats significantly. This study compares the varying levels of Place Attachment with individual knowledge associated with the negative impacts of Climate Change. This study tested three hypotheses to investigate the relationships between individual levels of place attachment and awareness of current climate risks. Using an online questionnaire distributed to individuals (N= 110) associated with the University of Utah in Salt Lake City, we found significant relationships between Place Attachment styles and personal perceptions of Climate Change. These findings suggest that as individuals develop stronger attachment levels, they display more knowledge of climate threats impacting Utah wilderness areas. Climate-related threats will continue to increase, and understanding the possible relationship between individuals and place can serve as a motivational factor to induce change.

Keywords: Place Attachment, Climate Change, Wilderness, Utah

INTRODUCTION

The Utah Governor's Office of Economic Opportunity (2017, 2022) reports that over 72% of Utah residents participate in some form of recreational activities. Outdoor recreation contributes more than $6.4 billion to the Utah economy, employing more than 83,000 people, and is the primary driver for the state's tourism industry. In a state with nearly 34 million acres of public land, national parks, state parks, and fourteen major ski resorts, identifying the possible future impacts caused by climate change is imperative as is finding new ways to encourage solutions. Understanding how people develop personal perceptions of Climate Change through attachment interactions with the local natural environment is the primary focus of this study. This study will investigate the role of Place Attachment in the development of Climate Perceptions. Its findings can be used to foster a more environmentally conscious community and highlight successful methods of addressing Climate Change.

Climate Change

With each passing decade, the planet's surface temperature has increased steadily at a rate that prevents natural adaption (IPCC, 2013). Accompanying this warming trend, organizations have recorded increased levels of ocean acidification, higher extinction rates of flora and fauna, excessive snow and ice cap melt-off, rises in sea levels, and changes to historic climate norms (IPCC, 2013). Negative feedback loops, self-reinforcing in nature, could push the Earth towards a planetary threshold that, once crossed, could destabilize the climate and continue the current warming trend exponentially. If current conditions continue, the Earth system will be pushed towards a Hothouse Earth, a pathway that could not be reversed. This destabilization can result in hotter global average temperatures that risk causing severe disruptions to ecosystems, society, and economies (Steffen et al., 2018).

Global changes in climate influence local climates greatly. Environmental scientists have been recording an increase in the local average temperature, reaching levels of 1.4 degrees Fahrenheit (EPA, 2016). NASA's Earth Observatory (2021) has found that since the 2000s, the snowmelt has begun to melt earlier, which ultimately impacts vegetation growing habits and animal behavior. NASA observed that premature mass melting of snow in the mountains allows more significant levels of atmospheric evaporation. Agencies like the Environmental Protection agency have already started to note changes in the local flora and fauna due to the increasing prevalence of drought and hotter temperatures. The Utah State Hazard Mitigation plan notes that intense storms will result in flash flooding, and changes in precipitation will impact both rain and snow (Utah Department of Public Safety, 2019). Higher temperatures will increase the incidence of droughts, wildfires, and risks of severe weather. Each of these has the potential to impact Utah dramatically.

Outdoor recreation is a primary draw for the state, and many individuals participate in a range of sports and leisure activities in Utah's vast wilderness areas. If what the EPA and Department of Public Safety state come true, the state could be facing an increased prevalence of severe storms, wildfires, the threat of invasive species, and drought. These are climate impacts already witnessed. As the planet moves towards a Hothouse Earth path, these can be expected to become the new norm. These changes to the local weather patterns and climate are highly detrimental owing to their potential to alter local landscapes, causing irreversible damage to local wilderness areas. However, even though the damage will be excessive, minimal action has occurred to address the threat of Climate Change. The topic of Climate Change is highly polarizing. Studies have demonstrated that political orientation explains personal levels of Climate Change concern; however, there is growing evidence that other factors may play a significant role (Driscoll, 2019). Recent research has begun to investigate how humans form

bonds to natural landscapes as one possible avenue for addressing climate concerns. One of the leading ideas in this field of research tends to focus on place attachment.

Place Attachment

Current literature defines Place Attachment as the level of emotional or functional attachment an individual has to a specific location-dependent resource or landscape (Bricker & Kerstetter, 2010; Larson et al., 2018; Marchand & Millard, 2019). As shown in previous studies, Place Attachment as a whole is complex and encompasses a range of human-landscape relationships. Ramkissoon et al. (2011) summarized the four components of Place Attachment: Place Dependence, Place Identity, Affective Attachment, and Social Bonding. Dependence is the functional use and interaction with a place. The greater one's dependence on a place is, the less likely they are to change locations. Place identity is both the cognitive and affective connection between place and self. It encompasses the connection between place and the development of one's identity (Proshansky, 1978). Affective Attachment is the emotional bond an individual develops and shares with a location that holds meaning. This level of attachment is highly varied and can range from a generalized emotional connection to a profoundly intense bond (Ramkissoon et al., 2011). This level of attachment contributes to a generalized sense of psychological wellbeing (Kaplan & Talbot, 1983) and pro-environmental behaviors (Kals et al., 1999). Social bonding centers on the interpersonal aspect of interactions occurring in a specific place as individuals become more attached to locations facilitating these interactions (Scannell & Gifford, 2010). A place can foster a sense of community and social ties that result in belonging and neighborhood attachment (Lewicka, 2005). Each of these components was found to influence attachment and the development of pro-environmental behavior of the individual (Ramkissoon et al., 2011)

Individuals with Place Attachment tend to form strong relationships with specific sites with emotional meaning. These relationships can develop through exposure to the natural environment. Larson et al. (2018) found that individuals who regularly interacted with the natural landscape displayed higher levels of attachment, primarily attributed to the frequency of visitations, nature of the activity, and proximity to the landscape. This finding was supported by another study showing that individuals who actively participate in a range of recreational experiences exhibit higher attachment levels (Wilkins & Urioste-Stone, 2017). Individuals with this attachment to place also were found to be more perceptive of possible risks and show greater sensitivity to various impacts or threats (Guillard et al., 2019; Smaldone et al., 2005). People who claim to experience more marked climate impacts exhibit more substantial place attachment and environmental engagement (Nicolosi & Corbett, 2018). These studies provide data suggesting that as one participates more frequently in nature, their attachment increase. Not only that, but they also exhibit more threat perception regarding environmental risks.

Prominent investigations in the field focus on how Place Attachment pertains to individuals' behavioral responses or identity formation. For the most part, studies have shown that individuals who rank high in Place Attachment levels are more connected to their location. It has been established that Place Attachment can lead to a rise in pro-environmental behaviors, but there are limited studies assessing climate perceptions. Therefore, the primary purpose of this study is to assess whether there is a causal relationship between Place Attachment on the development of Climate Change Perceptions. Moreover, this study seeks to see if the frequency of activity and activity type foster the development of attachment as previously found in other research attempts. This study hypothesizes the following:

I. Those who score higher in place attachment scores overall will report more knowledge relating to climate change than those who scored lower.

II. Individuals who participate more frequently in nature-based outdoor recreational activities will have higher levels of place attachment.
III. Individuals who score higher in place dependence will exhibit more threat perception regarding climate change than the other attachment dimensions.

METHODS

Participants

To assess the three hypotheses being investigated by this study, an online survey was distributed across the University of Utah through the platform Qualtrics XM. Participants completed this survey on their mobile or desktop device. The survey was available online until approximately 100 surveys were completed; at that point, participants who were in the process of completing the survey were permitted to finish while new responses were not collected. Sampling is a combination of convenience and snowball sampling methods. To increase participant response, I offered a monetary incentive. After the fifteen-minute anonymous survey, participants could include an email and enter a randomized drawing to win one of three $10 electronic gift cards. Winners were notified after the conclusion of the data collection period. Other than the emails, no other personally identifying information was collected. Participants were recruited from the wider university population by contacting university faculty who teach undergraduate courses with large student numbers and faculty with whom I had taken a course previously. Professors were asked to share the survey link and details with students, and some shared the link with their department email newsletter. Additionally, posters with QR codes linking directly to the survey were hung in the most frequently populated campus buildings, like the library and student union, and online posts featuring the surveys link were shared with university social media platforms.

In all, 167 responses were initially collected. Due to being incomplete, 43 survey responses were omitted from the data set. An additional 14 more response sets were removed for failing an implanted control assessment; this question was incorporated to ensure that students were paying adequate attention and answering questions earnestly. A total of N= 110 participant responses or 65.87% of collected data were used for final analysis. The age of the respondents varied from 19 to 39 years (M=22.37; SD=.34). Most participants identify as white (N=87, 79.1%) and female (N=81, 73.6 %). Participants generally had completed some college (N=64, 58.2%). Approximately half of the participants have resided in Utah for ten or more years (N=62, 56.4%) and are more politically liberal at various levels (N=90, 81.8%). Due to the significance of religion in the state of Utah, participants were asked how much guidance religion provides them. Some participants (N=10, 9.1%) claimed that religion played a great deal of guidance, while the rest ranged around no guidance (N=59, 53.6%). Data relating to recreational activity involvement and frequency was collected. For a more detailed breakdown of sample demographics, please see Appendix X.

Measurements

Upon opening the survey link, participants were told that the purpose of the study was to examine both psychological attributes related to climate knowledge-based components. Due to its polarizing nature, the term Climate Change was omitted from the initial description for fear that it may lead to biased responses. At the conclusion of the survey, a more detailed description of the survey's intent was shared with participants. After reading through the description of the study and providing consent, participants were prompted to answer questions relating to the recreational activities that they regularly participate in the natural non-urbanized area of Utah.

In order to assess individual place attachment levels, participants were then prompted to think of a place that is significant to them before responding to a series of questions. This area

was described to participants as being one close to their hearts or an area of functional use that is their personal favorite. This area was to be located in the state of Utah and a place in nature. For this study, nature is related to non-urban areas outside the city or town limit (i.e., National parks, wilderness areas, or the foothills/mountains surrounding the Utah valley). All questions referred to this one specific place, and before continuing, respondents were required to confirm that they understood what was being asked of them. These questions are adapted from the 16-item questionnaire used by Wynveen et al.'s (2014) four-dimensional assessment that was, in turn, modeled after Kyle, Mowen, et al. (2004). Place Identity, Place Dependence, Affective Attachment, and Social Bonding were assessed using a 5-point scale where participants individuated their level of agreement from "strongly disagree" (0) to "strongly agree" (5). An average of the generated values was used to provide an attachment score for each dimension, and then the four dimensions were averaged to provide a grand mean value for personal Place Attachment.

To gauge the perception of climate-related threats, participants answered a series of questions that prompted respondents to consider various current environmental factors that impact Utah wilderness areas. These impacts were identified by the Utah Department of State (2019) and were subsequently listed in the survey as water quantity, water quality, snow quantity, snow quality, air quality, the severity of storms, wildfires, and invasive species. Respondents were asked to indicate their levels of concern on a 5-point scale ranging from "extremely concerned" (5) to "not at all concerned" (0). Similarly, participants ranked their awareness of the impact concerning Utah from "extremely aware" (5) to "not at all aware" (0). Using the same environmental impacts as before, participants were asked to identify if each of the factors mentioned earlier impacted their outdoor recreational experiences. They answered on another 5-point scale, gauging the level of impact from levels of concern on a 5-point scale ranging from "significantly" (5) to "not at all" (0). Like the attachment portion, values were averaged to provide a mean total for each Climate component before these components were averaged again to provide a grand mean for Climate Change Perception. Finally, participants were asked general demographic questions and asked to rate the level of "Attention paid relating to Climate Change" and rank their self-reported "Experience of Climate Change Impacts".

Analysis

The collected data sets were processed through IBM SPSS Statistics 27. It should be noted that the five-point scale was reversed for the statement "The time I spent here could have just as easily been spent somewhere else," so it could be compared to the other functional statements. Initially, the question was based on a "strongly disagree" (0) to "strongly agree" (5) scale, but in this case, answers of strongly disagree would indicate more attachment; thus, the scale was adjusted, and the final scale was "strongly disagree" (5) to "strongly agree" (1). This reversal of scale values was repeated for the questions of the frequency of recreational activity and attention paid to climate change. The averages of each Place Attachment subsection were calculated. The composite variables were computed by calculating the mean of the four questions comprising each dimension set. These item means were used to calculate each participant's total mean Place Attachment Score. These steps were repeated for the Climate Change factors and calculated the grand mean for Climate Change Perception. Values greater than three for each factor were determined to indicate higher levels of attachment; those closer to 5 are more attached, while those closer to zero display less attachment. It was determined important not to parcel the place attachment dimensions because previous research (Raymond et al., 2011; Wynveen et al., 2014) has indicated that each dimension may have a unique relationship with the other variables.

Cronbach's alpha assessments were conducted for each attachment and climate factor to assess internal reliability. Two principal component analyses (PCA) with Varimax rotation were conducted to create factor scores for the Place Attachment dimensions (4 items) and the Climate Change Perception dimensions (3 items) (McCreary, 2018). We ran several regression models to analyze each hypothesis thoroughly. For each, the dependent variable was compared against the independent variable and all control variables: gender, sex, age, ethnicity, education, income, residence in Utah, political identification, religion, attention paid relating to Climate Change and self-reported experience of Climate Change.

Table 1. Place Attachment Scale – Items, Means, Factor Loads, and Reliabilities

Factored dimension (item)	Item *M*	Factor loading	*SE*	Factor *M* (*SD*)	Cronbach's α
Place Dependence (PD)				3.43 (.99)	.68
PD_1 My favorite place is the BEST place for the recreation activities that I enjoy.	3.75	.87	.10		
PD_2 I CAN NOT imagine a better place for what I like to do.	3.10	.87	.12		
PD_3 I feel that a lot of other areas that I could visit CAN substitute for my favorite place.	—	—	—		
PD_4 Compared with my favorite place there are few other places that are satisfactory alternatives.	—	—	—		
Place Identity (PI)				3.62 (1.02)	.89
PI_1 I feel that my favorite place is a part of me.	3.70	.87	.12		
PI_2 I identify with my favorite place.	3.71	.87	.11		
PI_3 I feel that my identity is reflected in my favorite place.	3.49	.87	.11		
PI_4 Visiting my favorite place says a lot about who I am.	3.58	.85	.11		
Affective Attachment (AA)				4.29 (.75)	.85
AA_1 I have a strong emotional bond to my favorite place.	4.05	.86	.10		
AA_2 I really enjoy my favorite place.	4.69	.74	.06		
AA_3 My favorite place means a lot to me.	4.36	.89	.09		
AA_4 I feel a strong sense of belonging to my favorite place.	4.05	.86	.09		
Social Bonding (SB)				4.38 (.78)	.83
SB_1 Time spent in nature allows me to bond with my family and friends.	4.58	.76	.07		
SB_2 I have a lot of fond memories of past experiences with family and friends in my favorite place.	4.46	.73	.10		
SB_3 Visiting my favorite place allows me to spend time with my family and friends.	4.44	.78	.08		
SB_4 I associate people in my life with my favorite place.	4.02	.49	.11		

Table 2. Climate Change Perceptions – Items, Means, Factor Loads, and Reliabilities

Factored dimension (item)	Item *M*	Factor loading	*SE*	Factor *M* (*SD*)	Cronbach's α
Awareness of Climate Change (AWC)				3.15 (.74)	.84
AWC_1 Water Quantity	3.33	.73	.10		
AWC_2 Water Quality	2.83	.71	.11		
AWC_3 Snow Quantity	3.69	.78	.10		
AWC_4 Snow Quality	2.85	.71	.13		
AWC_5 Air Quality	4.22	.61	.08		
AWC_6 Severe storms/Extreme Weather	2.75	.68	.10		
AWC_7 Wildfires	3.42	.69	.11		
AWC_8 Invasive Species	2.09	.58	.10		
Level of Concern (LVLc)				3.60 (.76)	.83
$LVLc_1$ Water Quantity	4.05	.74	.10		
$LVLc_2$ Water Quality	3.29	.63	.12		
$LVLc_3$ Snow Quantity	4.06	.79	.10		
$LVLc_4$ Snow Quality	3.13	.78	.12		
$LVLc_5$ Air Quality	4.67	.53	.06		
$LVLc_6$ Severe storms/Extreme Weather	2.89	.68	.11		
$LVLc_7$ Wildfires	3.77	.74	.11		
$LVLc_8$ Invasive Species	2.90	.60	.11		
Level of Impact (LVLi)				3.86 (.86)	.75
$LVLi_1$ Low Water Quantity	4.01	.66	.13		
$LVLi_2$ Poor Water Quality	3.60	.76	.14		
$LVLi_3$ Low Snow Quantity	4.08	.61	.14		
$LVLi_4$ Poor Snow Quality	3.66	.68	.15		
$LVLi_5$ Poor Air Quality	—	—	—		
$LVLi_6$ Severe storms/Extreme Weather	3.72	.51	.14		
$LVLi_7$ Wildfires	4.17	.58	.13		
$LVLi_8$ Invasive Species	2.93	.63	.16		

RESULTS

Starting with a principle component analysis (PCA), we analyzed all aspects of the data to identify highly inter-correlated groups and factors. Components Eigenvalues, representative of magnitude or importance, were evaluated and ranged from 1.52 to 3.00. The four factors for attachment, Place Dependence (PD), Place Identity (PI), Affective Attachment (AA), and Social Bonding (SB), were assessed for low factor loads (<.40), as were the climate knowledge elements Level of Concern (LVLc), Level of Impact (LVLi), and Awareness of Change (AWC)

(table 1 and 2). Once these base PCA analyses were completed, all elements were combined to run a PCA of Place Attachment (PA) and Climate Change Perception (CCP), as shown in Table 3.

Table 3. Place Attachment and Climate Change Perception – Items, Means, and Factor Loads

Factored dimension (item)	Item *M*	Factor loading	*SE*	Factor *M* (*SD*)
Place Attachment (PA)				3.93 (.69)
Place Dependence (PD)	3.43	.62	.09	
Place Identity (PI)	3.62	.85	.10	
Affective Attachment (AA)	4.29	.89	.07	
Social Bonding (SB)	4.38	.75	.07	
Climate Change Perception (CCP)				3.53 (.64)
Awareness of Climate Change (AWC)	3.15	.87	.07	
Level of Concern (LVLc)	3.60	.87	.08	
Level of Impact (LVLi)	3.86	.71	.07	

Then we tested the measurement model of the variables hypothesized to measure the four factors of place attachment and the three factors of climate knowledge by assessing Cronbach's alpha. Two items were removed from the PD element to improve model fit (see table 1). As reported in Table 1, the internal consistency for each PA dimension was determined to be acceptable (α = .68-.89). The descriptive statistics showed that most participants reported some Place Attachment to Utah Wilderness (PD: *M* =3.43, *SD* =.99; PI: *M* =3.62, *SD* =1.02; AA: *M* =4.29, *SD* = .75; SB: *M* = 4.38, *SD* =.78). Finally, as reported in Table 2, the Cronbach's alpha for the aspects of CCP ranged from .75 to .84. The mean score for each of the aspects indicated that participants had more knowledge regarding the level of impact and had more level of concern regarding Climate Change (AWC: *M* =3.15, *SD* =.74; LVLc: *M* =3.60, *SD* =.76; LVLi: *M* =3.86, *SD* = .86).

Hypothesis 1 – Activity Type & Activity Frequency Relationship

Due to an error that occurred in data selection where a large portion of the data was lost, N=41 data sets of the N=110 study population were compared to assess the relationships between recreational activity type (AT), activity frequency (AF), and PA components. A Pearson correlational assessment showed that AT and AF had significant correlations with almost all PA and some CCP factors (table 4). To assess the individual causal relationships between the variables and AT and AF, linear regressions were conducted, as seen in table 5.

Table 4. Correlations for Place Attachment, and Recreational Activity Type and Frequency

	Activity Type	Activity Frequency
Place Dependence (PD)	.17	.36*
Place Identity (PI)	.37*	.47**
Affective Attachment (AA)	.35*	.38*
Social Bonding (SB)	.43**	.22
Place Attachment (PA)	.41**	.45**

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 5. Regressions for Place Attachment, Attachment Factors, and Recreational Activity Type and Frequency

Variable	Place Attachment	Place Dependence	Place Identity	Affective Attachment	Social Bonding
Constant	1.28	2.09	2.00	1.43	1.73
Gender	.33	.53	.51	.37	.44
Sex (Male = 1)	.42	.68	.65	.47	.56
Education	.12**	.20***	.19	.14	.17
Income	.03	.05	.05	.04	.05
Age	.03	.05	.04	.03	.04
Residence in Utah	.07	.11	.11*	.08**	.10
Religion	.05**	.08	.08	.06*	.07***
Political Ideology (Conservative high)	.09	.15	.14	.10	.13
Ethnicity (White = 1)	.07	.11	.11	.08	.09
Attention paid on CC	.13***	.21***	.20**	.14	.17
Experience of CC	.17*	.23	.26	.19**	.23
Activity Type	.17***	.28	.27	.19**	.23***
Activity Frequency	.06**	.10	.10**	.07*	.09
Adjusted R-square	.45	.28	.25	.37	.28

legend: *p< .10; **p<.05;***p<.01

Hypothesis 2 – Place Attachment and Climate Perceptions

All N=110 data sets were compared to assess the relationships between place attachment and climate perception. A Pearson correlational assessment showed that PA has significant correlations with all CCP factors (table 6). To assess the individual causal relationships between PA and CCP, linear regressions were conducted (table 7).

Table 6. Correlations for Place Attachment and Climate Perception

	Place Dependence (PD)	Place Identity (PI)	Affective Attachment (AA)	Social Bonding (SB)	Place Attachment (PA)
Level of Concern (LVLc)	.27**	.31**	.32**	.30**	.38**
Level of Impact (LVLi)	.17	.22*	.16	.09	.21*
Awareness of Climate Change (AWC)	.39**	.37**	.38**	.31**	.47**
Climate Change Perception (CCP)	.33**	.36**	.34**	.28**	.43**

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 7. Regressions for Place Attachment, Climate Change Perception, and Climate knowledge factors

Variable	Climate Change Perception	Level of Concern	Level of Impact	Awareness of Climate Change
Constant	.71	.79	1.08***	.77
Gender	.19	.21	.29	.20
Sex	.23	.25	.34	.24
Education	.07	.08	.11	.08
Income	.02	.02	.03	.02
Age	.02	.02	.03	.02
Residence in Utah	.04	.04	.06	.04
Religion	.03*	.04*	.05	.03**
Political ID	.05	.05	.07	.05
Ethnicity	.04	.05	.06	.04
Attention paid on CC	.06**	.07**	.10	.07***
Experience of CC	.10	.11**	.15	.11
Place Attachment	.09***	.09***	.13*	.09***
Adjusted R-square	.21	.31	-.02	.32

legend: *p< .10; **p<.05;***p<.01

Hypothesis 3 – Place Attachment Dimensions and Climate Perceptions

Again all N=110 data sets were compared to assess the relationships between attachment components and climate perception. A Pearson correlational assessment shows how each has significant correlations with the CCP factors (table 6). To assess the causal relationships between PA dimensions and CCP dimensions, linear regressions were conducted (tables 8-11).

Table 8. Regressions for Place Dependence, Climate Change Perception, and Climate knowledge factors

Variable	Climate Change Perception	Level of Concern	Level of Impact	Awareness of Climate Change
Constant	.70***	.78*	1.04***	.76
Gender	.20	.22	.30	.22
Sex	.24	.27	.35	.26
Education	.08	.09	.11	.08
Income	.02	.02	.03	.02
Age	.02	.02	.03	.02
Residence in Utah	.04	.05	.06	.04*
Religion	.03	.04	.05	.04
Political ID	.05	.06	.08	.06
Ethnicity	.04	.05	.06	.05
Attention paid on CC	.07**	.07**	.10	.07***
Experience of CC	.11	.12*	.16	.12
Place Dependence	.06***	.07***	.10	.07***
Adjusted R-square	.16	.25	-.03	.26

legend: *p< .1; **p<.05;***p<.0

Table 9. Regressions for Place Identity, Climate Change Perception, and Climate knowledge factors

Variable	Climate Change Perception	Level of Concern	Level of Impact	Awareness of Climate Change
Constant	.72**	.80	1.06***	.78
Gender	.19	.22	.29	.21
Sex	.23	.26	.34	.25
Education	.07	.08	.11	.08
Income	.02	.02	.03*	.02
Age	.02	.02	.03	.02
Residence in Utah	.04	.05	.06	.04**
Religion	.03	.04	.05	.04**
Political ID	.05	.06	.07	.05
Ethnicity	.04	.05	.06	.05
Attention paid on CC	.07**	.07***	.10	.07***
Experience of CC	.11	.12***	.15	.11
Place Identity	.06***	.06***	.08*	.06***
Adjusted R-square	.18	.27	-.01	.27

legend: *p< .1; **p<.05;***p<.0

Table 10. Regressions for Affective Attachment, Climate Change Perception, and Climate knowledge factors

Variable	Climate Change Perception	Level of Concern	Level of Impact	Awareness of Climate Change
Constant	.74**	.82	1.09***	.80
Gender	.20	.22	.29	.21
Sex	.23	.26	.34	.25
Education	.07	.08	.03	.08
Income	.02	.02	.03*	.02
Age	.02	.02	.03	.02
Residence in Utah	.04	.05	.06	.05
Religion	.03	.04	.05	.04**
Political ID	.05	.06	.07	.05
Ethnicity	.04	.05	.06	.05
Attention paid on CC	.07***	.07***	.10	.07***
Experience of CC	.11	.12**	.16	.11
Affective attachment	.08***	.09***	.12	.09***
Adjusted R-square	.25	.26	-.04	.26

legend: *p< .1; **p<.05;***p<.0

Table 11. Regressions for Social Bonding, Climate Change Perception, and Climate knowledge factors

Variable	Climate Change Perception	Level of Concern	Level of Impact	Awareness of Climate Change
Constant	.75**	.82	1.10***	.81
Gender	.20	.22	.29	.22
Sex	.24	.26	.35	.26
Education	.07	.08	.11	.08
Income	.02	.02	.03*	.02
Age	.02	.02	.03	.02
Residence in Utah	.04	.05	.06	.05*
Religion	.03*	.04***	.05	.04**
Political ID	.05	.06	.08	.05*
Ethnicity	.04	.05	.06	.05
Attention paid on CC	.07***	.07***	.10	.07***
Experience of CC	.11	.12**	.16	.12
Social Bonding	.08***	.08***	.11	.08***
Adjusted R-square	.13	.24	-.05	.24

legend: *p< .1; **p<.05;***p<.01

DISCUSSION

This data was found to be a reliable measurement of the attachment and perceptions dimensions. All factors were identified as sufficient after removing three items due to either low Cronbach's α or factor loading. The calculated grand mean data from shows that most participants displayed some level of place attachment (M=3.93) and were aware of climate change to a degree (M=3.53), with answers scoring 3 to 5, signifying high attachment or knowledge. While participants reported experiencing Place Dependence and Place Identity, overall, more participants had Affective Attachments and Social Bonding experiences with nature in the state of Utah. This goes to say that a majority of the participants felt either emotional bonds with a location of significance or place aided in facilitating social groups and, as a result, was attributed to personal significance. It is interesting to note the lower levels of dependence on a place and the incorporation of place into personal forms of identity expression exhibited by the participants in this study. Most participants held equal understandings of levels of concern, impact, and awareness of change occurring within the state, showing that they were equally knowledgeable of all climate dimensions.

Looking more specifically at the results, Place attachment and attachment dimensions were correlated with the type and frequency of recreational activities. Although this was looking at only a subset of the data (N=41), activity type was significantly correlated with Social Bonding and Place Attachment. As individuals participate in activities classified as highly impacted by climate change, such as snow or water sports, they tend to display higher levels of attachment through social bonds and cumulatively higher levels of Place Attachment. Activity Frequency was also found to be significantly correlated with attachment factors. As seen with activity type, as the frequency of recreational activities increases, to say one to two times a week, participants report having higher Place Identity and Place Attachment levels. When appraising the regression analyses, activity type and frequency were shown to have a significant causal relationship with the dependent variables; Place Attachment and attachment dimensions. Activity characteristics were significant when compared to their relationship with Place Attachment (AT: p<.01; AF: p<.05), showing that individuals participating in more climate-dependent activities more frequently have higher levels of attachment than those who do not. Activity frequency was also significant in its relationship with Place Identity (p<.05) and with Affective Attachment (p<.10). The more often an individual was reported to interact with a location of significance the more they incorporated it into their identity expression and the stronger their emotional bond. Activity type was significant concerning Affective Attachment (p<.05) and Social Bonding (p<.01). This may be attributed to the dependency on climate and site-specific locations for recreational activities, leading to stronger emotional and social ties. Additionally, most climate-dependent sports classified by this study already exist as highly socialized sports. Sports dependent on the climate, such as water or snow sports are seldom done in isolation, with certain regard to backcountry activities. This could be one explanation for the significant causal relationship between type and social bonding. Overall the frequency of the activity and the level of climate dependency were found to have significant relations with all attachment dimensions.

A correlational matrix showed significantly positive correlations between place attachment and level of concern, awareness of change, and climate change perceptions. This suggests that as one's place attachment increases, the individual also reports higher levels of concern, more awareness of change, and overall higher levels of climate change perceptions. Place Attachment has a significant causal relationship (p<.10, p<.01) with these climate factors as identified through regression assessment, lending strength to our hypothesis that increased levels of Place Attachment influence levels of Climate Change Perceptions and its contributing

factors. When broken down further, the dimensions of Place Attachment were found to have significant relationships of their own with the climate perception dimensions. Individuals with higher levels of attachment reported more knowledge of climate change; this trend is not isolated to a specific attachment dimension. However, this finding does not apply to every Climate Change Perception dimension. Place Dependency, Affective Attachment, and Social Bonding failed to have any significant correlational relationships with the variable Level of Impact, yet Place Identity did. Individuals that incorporate natural areas into their identity at a higher rate are more perceptive of climate impacts affecting Utah. The other attachment dimensions were shown to have significant causal relationships with levels of concern, awareness, and overall Climate Change Perception. However, unlike what was hypothesized, place dependence was not the most impactful attachment dimension. This data provides reason to believe that an individual's emotional connections and their affective attachment to a place are the most impactful in understanding their personal perceptions of Climate Change.

This study has some limitations that should be addressed. One is the participants' gender identity and biological sex breakdown. This study incorporated an overwhelming amount of data from female-identifying individuals to warrant its consideration of the potential influence of skew on the results. Gender is known to have an impact on climate perceptions, with females being more concerned about Climate Change than males (McCright, 2010; Fletcher et al., 2021). Recruitment methods were primarily aimed at university students and can explain the significant majority of individuals identifying as white. These numbers partially mirror current university demographics as recorded by the University of Utah Office of Budget & Institutional Analysis (2021), with white individuals comprising 65.2% of the undergraduate population. There is a predominantly large white presence in the outdoor industry, with minority and marginalized populations far less likely to engage in nature-based outdoor recreation activities. While grassroots organizations are attempting to increase the number of minority populations in outdoor recreation, the numbers are still not as substantial (Gosalvez, 2020; Ghimire et al., 2014; Makopondo, 2006). Other studies have shown that there is a difference in the perceptions of climate change amongst different generations and against different cultures. This study was significantly limited by reach; thus, the average participant's age is restrictive. Younger generations in Western democracies tend to be more concerned regarding Climate Change than older cohorts, even though older generations observe more overall change (Lewis et al., 2018; Herman-Mercer et al., 2016). Similarly, communities dependent on natural areas for sustenance and survival could be more perceptive of climate changes and overall more concerned than those found in Utah. Utah is a state renowned for its outdoor culture; it attracts those already interested in nature. If these factors are at play, there is the potential for significant biases to present themselves, contributing to the study's higher recorded means for Place Attachment and Climate Change Perception levels. A study incorporating a more diverse participant pool is warranted. Additional research investigating the role of culture, age, and ethnicity in Place Attachment should also be considered. This could expand past outdoor recreational participants and should encompass minority cultures like immigrants, Native Americans, inner-city inhabitants, etcetera. Research should expand and look at international aspects, looking into the differences in lifestyle and quality of interactions, and reliance on natural areas.

CONCLUSION

Place Attachment can be utilized and address the detrimental impacts caused by Global Climate Change. The level of individuals participating in outdoor recreational activities has increased since 1998 as people begin to find meaning in both their attachment to natural

resources and their attachments to the activities with which they are engaged (Bricker & Kerstetter, 2010). When individuals participate in outdoor activities, they exhibit a stronger sense of place and attachment (Marchand & Millard, 2019). These claims are supported by the findings of this particular data set. Participants who were more engaged in activities displayed higher levels of attachment and were more perceptive of change. Smaldone et al. (2005) showed that visitors with higher levels of place attachment were more likely to show greater sensitivity to various impacts that degraded natural environments. This finding was not isolated and has been corroborated by other studies. Individuals with Place Attachment tend to be more aware of environmental risks and human-caused impacts (Sullivan & Young, 2020; Ferguson et al., 2018). Not only that, but studies have shown a link between Place Attachment and pro-environmental behaviors (McCreary et al., 2018; Larson et al., 2018; Ramkissoon et al., 2011; Upham et al., 2018). As the number of individuals interacting in nature increases, one can expect the personal levels of pro-environmental behaviors to do so as well. Staples et al. (2019) found that environmental attitudes were negatively impacted by a decline in outdoor time, resulting in a weakened connection to nature. Their study found that when children interacted with the natural environment in a meaningful way through art activities, higher levels of eco-awareness and environmental attitudes were recorded (Staples et al., 2019).

Place Attachment can mobilize individuals and reframe public perceptions of the risks of a hotter climate, drawing attention to the threats and invoking public engagement through the use of threat perceptions (Upham et al., 2018). Individuals who believed in Climate Change were more willing to try and reduce the risks associated with it (McCreary et al., 2018). Individuals are more likely to show environmental awareness when they conceive of issues in concrete and locally specific ways (Wheaton, 2007). Understanding the impacts affecting place increases the likelihood of place-protective behaviors (Relph, 1976). Emphasis should be placed on a community-based approach, highlighting all possible dangers to local space. Rollero (2014) found that social relations are an essential aspect in the development of attachments. These social relations can be used to increase the number of individuals participating in outdoor recreations. The impact of emotional bonds, too, should not be ignored. This data shows that emotional attachments to local areas are significant and lead to higher levels of concern and awareness regarding changes that threaten the place. Individuals largely absent from everyday interactions tend to display a lack of interest and involvement in natural areas, while those with higher levels of interactions were more involved and more affectively linked to an established place (Petrova et al., 2010). Place attachment not only contributes to higher pro-environmental behavior and support but a link has been seen in some data sets that attachment can be a valuable determinant of whether individuals would pay for climate adaptation (McCreary et al., 2018). Place relations lead to engagement with climate change solutions and the protection of the environment (Nicolosi & Corbett, 2018). Participation in outdoor sport and leisure encourages greater environmental awareness that leads to forms of political engagement (Mansfield & Wheaton, 2011). Even if individuals lack the knowledge, time, or resources to participate in advocacy, attachments to natural areas can still foster a sense of environmental responsibility (Larson et al., 2018). This study helps provide additional support for the influential role of Place Attachment on climate perceptions associated with the detrimental impacts that Climate Change is already starting to cause. Individuals in this study with higher values of Place Attachment demonstrated more concern and awareness of the detrimental impacts threatening natural environments in the state of Utah. If used correctly, Place Attachment could serve as a motivator, pushing society toward a more sustainable and environmentally conscious lifestyle.

APPENDIX

Appendix X. Study Demographics for N=110 Participants

Demographic and Activity Characteristics	Frequency	Percent
Gender Identity		
Male	23	20.9
Female	81	73.6
Non-Binary/Third Gender	5	4.5
Prefer not to say	1	0.9
Biological Sex		
Male	24	21.8
Female	85	77.3
Ethnicity		
White	87	79.1
Black/African American	3	2.7
Asian/Asian American	5	4.5
Native Hawaiian or Pacific Islander	2	1.8
Hispanic, Latino, or Spanish origin	12	10.9
Native American	1	0.9
Education		
High school or less	7	6.4
Some college	64	58.2
Two-year degree	16	14.5
Four-year degree	22	20
Professional degree	1	0.9
Annual Income for 2021		
Less than $10,000	41	37.3
$10,000 – $19,999	21	19.1
$20,000 – $29,999	15	13.6
$30,000 – $39,999	9	8.2
$40,000 – $49,999	5	4.5
$50,000 – $59,999	3	2.7
$60,000 – $69,999	2	1.8
$70,000 – $79,999	1	0.9
$80,000 – $89,999	1	0.9
$90,000 – $99,999	1	0.9
$100,000 – $149,999	10	9.1
More than $150,000	1	0.9

Residence in Utah		
Less than a year	12	10.9
1 – 3 years	15	13.6
3 – 5 years	12	10.9
5 – 10 years	9	8.2
10 years or more	62	56.4
Political Identification		
Very Liberal	38	34.5
Liberal	34	30.9
Somewhat Liberal	18	16.4
Moderate	10	9.1
Somewhat Conservative	3	2.7
Conservative	5	4.5
Very Conservative	2	1.8
Religion		
No guidance at all	59	53.6
2	19	17.3
3	4	3.6
4	10	9.1
5	5	4.5
6	3	2.7
A great deal of guidance	10	9.1
Attention Paid to Climate Change		
Never	1	0.9
Sometimes	17	15.5
About half the time	25	22.7
Most of the time	48	43.6
Always	19	17.3
Experience of Climate Change		
Defiantly not	–	–
Probably not	1	0.9
Might or might not	6	5.5
Probably yes	25	22.7
Defiantly yes	78	70.9
Once a week	7	17.1
2 – 3 times a week	7	17.1

Appendix XI. Study Demographics for N=41 Participants

Demographic and Activity Characteristics	Frequency	Percent
Activity Type		
No participation	2	4.9
Activities not impacted by climate	16	39
Participation in both	21	51.2
Activities impacted by climate	2	4.9
Frequency of Activity		
No participation	2	4.9
2 – 3 times a year	9	22
Once a month	6	14.6
2 – 3 times a month	10	24.4
Once a week	7	17.1
2 – 3 times a week	7	17.1

Appendix XII. Study Demographics for N=110 Participants

Demographic and Activity Characteristics	Mean	Std. Error	Min	Max
Age in years				
Mean years	22.37	.34	19	39

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