HOPELESS & MINDFUL

IN RESPONSE TO ABRUPT CLIMATE CHANGE

by

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ABSTRACT

Anthropogenic climate change has initiated increases in both atmospheric water vapor, and methane from marine hydrates: two powerful self-reinforcing feedback loops now vastly increasing the rate of global warming (Chung, Soden, Sohn & Shi, 2014; Shakhova, 2010; Kennett et al., 2003). The new rate is currently 10,000 times faster than any vertebrate can adapt, and may result in near-term human extinction (NTHE) before mid-century (Quintero & Weins, 2013; McPherson, 2013). Climate scientists, and other environmental professionals and students, are experiencing profound indirect psychological impacts from encountering this narratives on catastrophic abrupt climate change (Doherty & Clayton, 2011; Van Susteren 2011). I surveyed 100 adult members of online groups for those concerned about NTHE due to anthropogenic climate change, and discovered a suite of impacts including anger, depression, anxiety, complicated grief, existential despair, lethargy, hopelessness, weak attachment, social isolation, and compartmentalization. One third of the respondents report losing relationships as a result of discussing this topic, and 80% have family members with whom they cannot share their views. Fifteen percent can only discuss this narrative online with strangers. Positive effects include relief, gratitude, acceptance, revised priorities, and enhanced connection with nature. Thirty-two percent think humans cannot stop global warming, and 55% think we won't. Accepting the futility of their actions did not dissuade 80% of respondents from continuing their pro-environmental behaviors. Respondents considered these behaviors to be the right thing to do, or a part of their identity. A majority relinquished their political activism, deeming it ineffective, whilst increasing their community volunteerism. Previous depression was common amongst the sample and a surprising 60% of those in my study used mindfulness practice as a coping mechanism. Eighty-five percent of mindfulness practitioners obtained relief from the emotional distress they suffered upon encountering this traumatic narrative.

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By completing this study, I hope to celebrate the remarkable group of Earthlings who shared their innermost experiences of this important transitional time in the story of our planet. It was truly a privilege to see through their eyes. It is with each of them in mind that I publish this thesis. Extraordinary thanks to Justis Biggart, my son, without whose dreams, competence, reliability, and sacrifice, I would not have completed the program; and Alyxzandrea Yarbrough, my daughter, for her patience, humor, and looking after her brother over the decades, as I chipped away at my education; Shangrila Wynn, my thesis reader for giving form to my concept; Brian Fallon for being fabulous; Martin Stamper, for first letting me, and then making me, follow my heart; Guy McPherson for speaking out about abrupt climate change; Mike Ferrigan for the SG & Extinction Radio FM; and Bud Nye for the excellent Extinction Support Group Tacoma; The Evergreen State College for opening the Masters of Environmental Studies program to an interdisciplinary student body; Julia Rankin for a wonderful home in Olympia; The Guest House for the never-ending slumber party; Debbe Kelly for the adult supervision; Jim Monson for sharing his home; Susan Dever, Nina Fonoroff and Bryan Konefsky from The University of New Mexico Cinematic Arts Department for learnin' me good; Chris Biggart, Doo Crowder, Tracy Tuck, Barbara Treadwell, Paige Penland, Daniel Freeman and Juniper Bowers, Jamie Drummond, Tim Spencer, Heavon Fegan, Juliana Feldman, Robert Wagoner, Margie Wagoner, Sue Wagoner, & Rod Wagoner for their love and support; and Roderic L. Wagoner PhD. Ed, (1929-1983), former Associate Dean of Education at The University of New Mexico, and my father, for setting the bar.

"The gods envy us. They envy us because we're mortal, because any moment may be our last. Everything is more beautiful because we're doomed. You will never be lovelier than you are now. We will never be here again."

~Homer, The Iliad~

Chapter One: Introduction

"The loss of certainty that there will be a future is the pivotal psychological reality of our time."

~Joanna Macy (2007)~

Farewell to The Anthropocene

Narratives warning of global collapse have made appearances in scientific discourse as early as 1798 with Thomas Malthus' *An Essay on the Principle of Population.* Although not based in prophecy, this cleric elucidated converging crises of overpopulation and soil degradation that would require strict management in order to avoid the eventual collapse of civilization.

Again in 1956, nuclear physicist Harrison Brown brought up the dangers of human biomass and resource depletion in *The Challenge of Man's Future*, and *Silent Spring* painted a vision of a lifeless planet that finally bore the gestating Environmental Movement in 1962, christening biologist Rachel Carson as its fledgling spokesperson.

Stanford University professor Paul R. Ehrlich and his uncredited wife Anne, published *The Population Bomb i*n 1968; a restatement of Malthusian theory with a catastrophic prediction for the planet, one that the authors admitted in 2009 had been "too optimistic" (Ehrlich & Ehrlich, 2009).

In 1972, Donella an Dennis Meadows, Jørgen Randers, and William W. Behrens III had run an early computer simulations of exponential growth of economy and population within finite environmental constraints. Their rational indictment of our voracious

economic paradigm, dubbed "Limits to Growth" (LtG) was ridiculed by economists for 30 years following its release (Kaysen, 1972; Solow, 1973; Turner, 2008). More warnings followed in 1984, and annually afterward, in the Worldwatch Institute's influential *State of the World* reports, detailing our failures to act.

Three years later, *Our Common Future* (aka: The Brundtland Report) was published by the United Nation's fundamentally diametrically opposed World Commission on Environment *and* Development, introducing important concepts such as gender equality, and redistribution to the conversation, acknowledging the interlocking nature of complex social and environmental problems. The report also coined the impossible oxymoron of "sustainable development."

On June 24th, 1988, James Hansen of the United States National Aeronautics and Space Administration (NASA) appeared before the United States Congress to confirm the existence of global warming with a 99% certainty that it was caused by anthropogenic carbon dioxide (CO2) emissions, warning that devastation for humanity would follow, if unabated (Shabecoff, 1988).

It took 4 years for Al Gore's environmental treatise, *Earth in The Balance: Ecology and the Human Spirit* to follow, in which the then US Senator unveiled his *Global Marshall Plan* for enacting population control, appropriate technologies, monitoring and assessment, international agreements, and global environmental education. The Marshall Plan is now offered as a set of courses at The Global Marshall Plan Academy in Hamburg, Germany.

In 1999, Journalist Mark Hertsgaard published 6 years worth of his own observations of global environmental atrocities in *Earth Odyssey.*

Two thousand-five saw Jared Diamond's influential *Collapse: How societies choose to fail or succeed,* which offered case studies of societies that succumbed to a handful of factors: hostile neighbors; collapse of essential trading partners; climate change environmental problems; and failure to adapt to environmental issues. Diamond considers overpopulation to lie at the center of most problems facing societies: anthropogenic climate change; buildup of toxins in the environment; energy shortages; increased per-capita impact of people; water management problems; overfishing; overhunting; deforestation and habitat destruction; soil erosion, salinization, and fertility losses; effects of introduced species on native species, and full human use of the Earth's photosynthetic capacity.

Following up on the projections made by 1972's Limits to Growth, Graham Turner from the Commonwealth Scientific and Industrial Research Organisation (CSIRO), published *A Comparison of `The Limits to Growth` with Thirty Years of Reality,* in 2008. Turner discovered that rates of pollution, and production of both industry and agriculture mirrored the LtG 'business as usual' scenario, which forecasted societal and economic collapse by mid-21st century (Turner & Graham, 2008).

In 2013, conservation biologist Guy McPherson published *Going Dark* in which he spoke plainly about the acceleration of climate change due to documented irreversible, self-reinforcing feedback loops, and the resulting loss of all habitat for vertebrates; and possibly all oxygen, and temperature-dependent life on Earth before 2050.

These narratives collect alongside the other cultural ephemera in the Western unconscious: Hollywood disaster movies, apocalyptic science fiction, sensationalist television reporting, psychic prognostications, appropriated indigenous prophecies, and

religious eschatology. Keeping this kind of company can tarnish the empirical reputation of an unsuspecting narrative, potentially casting all such accounts in the same light of hyperbole. In addition, the public at large has been saturated and desensitized by disaster capitalism (Klein, 2007), and in this opportunistic environment, sound scientific warnings, if they appear in the media at all, may simply be seen as manipulative. However, the potential for near-term human extinction (NTHE) is not unreasonable when contextualized within the large body of warning works that preceded Earth's current, and sixth, mass-extinction (Steffen, Crutzen & McNeill, 2007).

Although both the concept of The Anthropocene Epoch, and its date of origin are under debate (Steppen, Crutzen, Grinevald & McNeil, 2011), I consider it to have begun 8000 years ago, when humans first began altering Earth's climate in order to provide greater food security through the invention of agriculture (Ruddiman, 2003). As an epoch, The Anthropocene had a short run, but no other organism has affected the planet so drastically since photosynthetic plant life began increasing oxygen in our atmosphere.

The imbalance in greenhouse gas emissions arising from the combination of our contained feeding operations (CFO's), petroleum-based fertilizers, land use change, deforestation, combustion engines, burning coal, cement production, and recently triggered climate feedback loops, has resulted in excess global heating equivalent to exploding 400,000 Hiroshima atomic bombs every 24 hours (Hansen, 2012).

In a 2008 paper, University of Utah physics professor Tim Garret determined that Industrial Civilization (IC) is a heat engine with a 1990 inflation adjusted United States dollar earned for every 9.7 milliwatts produced, consistently throughout its history. He concluded that dismantling IC was the only chance we had to prevent the 2˚C global

average temperature rise that had been the target at the time. Eight years later, we have only increased our emissions.

A study in the journal Nature Climate Change from Stephen Smith et al. has confirmed Earth is now entering a phase of accelerated warming (Smith, 2015), and acceleration is bad news for adaptation. In 2013, comparing past adaptation to rates of environmental change, Quintero and Weins discovered that Earth's climate was changing 10,000 times faster than any vertebrate could possibly adapt. In fact, according to international watch group DARA (2015) climate change and high carbon economies are already killing 5 million people every year.

The Lancet and University College of London Global Health Commission have stated that climate change is the biggest global health threat of the 21st Century (Costello, et al., 2009). Health impacts from climate change are often considered to be physical challenges, for example: asthma attacks from increased pollen and dust; risk of injury from flying debris during a hurricane; or malnutrition from loss of flood damaged crops. These direct, physical health impacts have been studied to a large extent since 1990's First Assessment Report from the Intergovernmental Panel on Climate Change (IPCC, 1990).

In 2011, The American Psychological Association (APA) followed suit, announcing that climate change is also the greatest threat to global public *mental* health of the 21st Century (Swim, et al., 2011). Direct, psychological impacts of climate change are now being studied, and there is much overlap with Disaster Psychology to provide a framework. A fisherman's loss of identity when ocean acidification decimates the marine fisheries industry and he can no longer provide for his family is a direct, psychological

impact.

However, a new topic of study has emerged, on the *indirect* psychological impacts of climate change. A recent example is the story of a 17 year-old Melbourne boy who was brought to a psychiatric hospital because he stopped drinking out of guilt about what the impact of quenching his thirst would do to his drought stricken area. Although the source of this story is not a peer-reviewed journal of psychology, even as fiction it makes its point: generally speaking, indirect psychological impacts include worry about things that have not yet occurred; anxiety or guilt about things that have happened to others, or torment from uncertainty about the future.

Populations at increased risk of suffering the indirect psychological impacts of climate change are those who have not yet personally experienced the devastating direct physical or psychological impacts, but who have knowledge of what is occurring, or will occur. Environmental professionals, scientists, policy makers, investigative journalists, students and activists are more likely to seek out exposure to especially alarming scientific climate change research, including that which is being published on crossed tipping points, and irreversible, self-reinforcing climate feedback loops. Whether it be from atmospheric increases in water vapor, or the outgassing of sub-sea methane, or the dozens of other complex, interlinking feedbacks in the climate system, those who are closely following the story are becoming aware that we have initiated a runaway greenhouse event that is driving previously linear temperature increases, exponential. It was 30KC (91˚F) in Eagle, Alaska on May 23rd, 2015; 30˚ higher than average highs for the area. The resulting loss of habitat for humans and our food sources has already begun (DARA, 2015), and when population die-off reaches a critical point, our global grid power and

nuclear infrastructure maintenance will give-way. There are more than 460 nuclear power stations around the world, ensuring global extinction, some estimate as early as mid-century (McPherson, 2013; Light, 2012; Shakhova, 2010).

Saying farewell to the Anthropocene is a singular event, worthy of focused attention by the totality of Earth's inhabitants. We deserve to decide together, how we will bear-witness to the end of our world. Yet, the complete story is still not reaching the greater public. On a small scale, these narratives on the current extinction event are being disseminated by conservation biologist and author Guy McPherson, independent journalist Dahr Jamail, ecopsychologist Joanna Macy, author philosopher Dimitri Orlov, journalist Chris Hedges, life coach Carolyn Baker, activist Paul Killingsnorth, author James Howard Knustler, journalist Ahmed Nafeez;,and activist author Derrick Jensen, amongst others, through their publications, live presentations, blogs, podcasts, radio, community television, social media, and on internet news sites like *Huff Post, Grist, Truthdig*, and *Salon.* While the television series *Years of Living Dangerously* was a bold attempt to educate the public about climate change, and Neil Degrasse Tyson made no apologies about the existence of global warming on his remake of the television series *Cosmos*, both fell short of raising the alarm about the potential for catastrophic abrupt climate change (ACC) and near-term human extinction (NTHE). When some bit of urgent climate change information does reach the mainstream media (MSM), it rarely proceeds beyond the news desk. Only six US megacorporations own 90% of all media outlets in the country; that's television, radio *and* newspapers (FrugalDad, 2013). These megacorporations share board members and investments with professionals from the greenhouse gas emitting industries: oil, industrial agriculture, and petrochemicals

(Standlea, 2006). Governments worldwide, which have crafted our high-carbon lifestyles (Foster, 1981), and are subsidizing the fossil-fuel industry at $548 billion annually (Coady, Parry, Sears, & Shang, 2015), are also entrusted with oversight of the Intergovernmental Panel on Climate Change *Summaries for Policymakers*, and therefore have censorship power over the assessment supplied to the media. In an email dated April 17, 2014, Robert Stavins, Co-Coordinating Lead Author (CLA) of Chapter 13, "International Cooperation: Agreements and Instruments," of Working Group III (Mitigation) of the Fifth Assessment Report (AR5) of the IPCC, criticizes the panel's approval process, stating that:

> It became clear that the only way the assembled government representatives would approve text for SPM.5.2 was essentially to remove all 'controversial' text (that is, text that was uncomfortable for any one individual government), which meant deleting almost 75% of the text, including nearly all explications and examples under the bolded headings. In more than one instance, specific examples or sentences were removed at the will of only one or two countries, because under IPCC rules, the dissent of one country is sufficient to grind the entire approval process to a halt...

Climate scientists themselves are succumbing to the government, and conservative academic censorship wars. In 2012, Brysse, Oreskes, O'Reilly, and Oppenheimer, found that a majority of climate scientists would err on the side of least drama (ESLD) when reporting on alarming findings in their original research.

Not to mention that the very study of existential risk itself is sorely lacking in academia. Oxford University professor Nick Bostrom shares this graph on academic priorities in a 2008 Ted Talk (see *Fig. 1*). Without funding, studies are not run.

That The End of The World has such a meager audience is no testament to the irrelevance of the event, but to the efficacy of the censors.

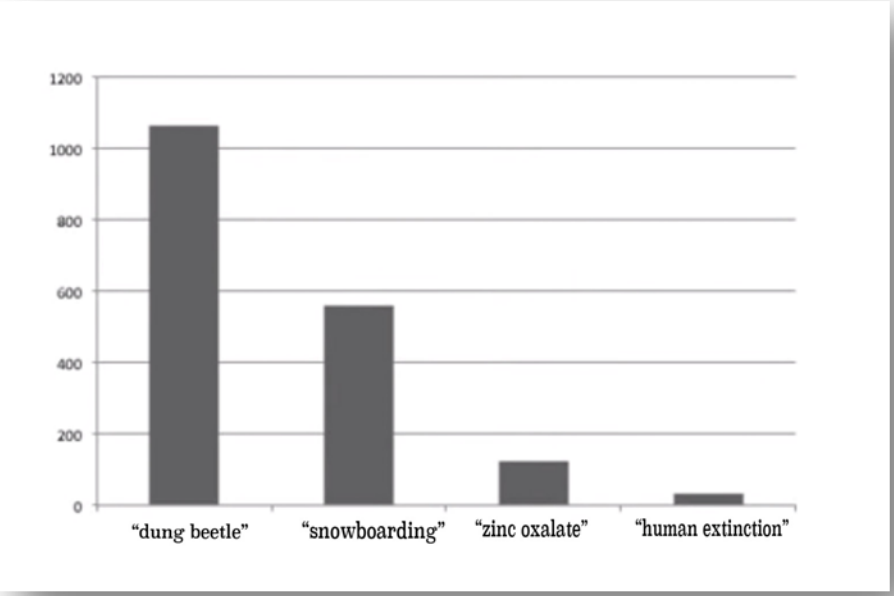

Figure 1. Academic Priorities: number of studies (Bostrom, 2008).

Herein, I am researching the indirect psychological impacts of abrupt climate change, and in service to that goal, I ask the following research question:

"How has ascribing to the narrative on abrupt climate change impacted individuals' emotional well being, life choices, and pro-environmental behaviors?"

Chapter Organization

At the end of this Introduction begins my two-part Literature Review. In Part One, I present the physical science basis of abrupt climate change. It will be necessary to elucidate certain aspects of complex systems theory when discussing the physical science basis for the conclusion that we have triggered abrupt climate change, and I will attempt to do so by introducing the concepts of tipping points and feedback loops. Then I will describe the feedbacks which are of major concern to climate scientists, being powerful enough on their own to cause runaway global warming, but which are not included in the

Intergovernmental Panel on Climate Change (IPCC) assessments. A comprehensive list of reported feedbacks and tipping points in the climate system are located in *Appendix F*. In Part Two of my literature review, I survey the small extant research published specifically on the psychological effects of worrying about climate change *prior* to any personal catastrophic physical effects. These psychological responses have been termed: *pretraumatic stress disorder*, and *ecoanxiety*. I supplement this segment with background information on *complicated grief*, clinical depression, *weak attachment*, and the aggression inducing effects of social exclusion, as related processes. Elements of these emotional reactions are also described in the literature as a form of *existential despair*, and I provide references to recent works on existential philosophy and the despair associated with human extinction.

Continuing with background for my research question, I address the maintenance of subjects' pro-environmental behaviors in the face of hopelessness, and the Literature Review exhibits a swath of foundational studies on the origins of (and barriers to) these behaviors. Many models have been suggested to describe the evolution of pro-environmental agency, and I first list the theoretical underpinnings for the evolution of this research: from *rational self-interest* and *pro-social* theories; through development of moral and social *norms*; to *perceived behavioral control* (PBC); and *attribution of intent*. I also touch on the theories of environmental attitudes and identity. Risk perception is treated as a major contributor to value-laden agency, *motivated reasoning*, and troublesome *cognitive biases*, and I specifically, discuss the foundations of the *cultural cognition* theory of risk assessment. Following the Literature Review is a chapter dedicated to presenting my methodology. Here, I share the theoretical frameworks behind

the creation of the survey instrument; and describe the rationale for my chosen methods of data collection and analysis. I also give examples of the coding method I used in analysis of qualitative data.

The Results chapter shares respondents' perspectives, reinforced by the quantitative data. Topics include demographics, any direct observations of abrupt climate change phenomena, pathways to this knowledge, and a breadth of emotional and behavioral responses.

In the Conclusion chapter, I reflect upon the key findings and orient my respondents within the Global Warming's Six Americas, and Cultural Cognition frameworks. I then recount the challenges of this study, and finally, make recommendations for further research.

Moving forward, we will survey the literature that has informed this emerging topic of the indirect impacts of abrupt climate change, beginning with a look at the physical basis of that phenomenon.

Chapter Two: Literature Review

Part One: The Physical Science Basis of Abrupt Climate Change

″Anthropogenic warming could lead to some effects that are abrupt or irreversible, depending upon the rate and magnitude of the climate change.” ~IPCC, Fourth Assessment Report~

A Complex Climate System

If we accounted for every variable affecting the climate system, we could accurately predict future outcomes, but we are incapable of knowing every variable. Edward Lorenz, founder of Chaos Theory, describes the concept of deterministic chaos as, "When the present determines the future, but the approximate present does not approximately determine the future" (Lorenz, 2006, p. 89). We know Earth's climate exhibits defining characteristics of complex dynamic systems, two of which we will be discussing here (Kastens et al., 2009). Non-linear interactions reveal a tendency for small changes in one variable to potentially result in large changes in the structure or functionality of the system. Self-reinforcing feedback loops occur when a change in one variable results in amplifying that change and are a mechanism of non-linearity. Changing one aspect of a system can cause a reinforcing feedback loop that triggers unforeseen events. If unchecked, these feedback loops can bring about cascades, like dominoes, of ever-greater simplification to a system.

Tipping points are critical thresholds when sufficient change has occurred for one system state to change into another, indicating a shift in the basic structure and dynamics of the system. Until the tipping point or threshold is reached, things appear to progress in a linear fashion. After the tipping point, or threshold, progression toward the new state

can increase exponentially. This new state can be catastrophic, and unsustainable, simply collapsing once the regime shift is complete (Möllman, Folke, Edwards & Conversi, 2015). The crossing of a tipping point is often identified by the onset of reinforcing feedbacks. All reinforcing feedbacks must be considered when evaluating any system, and their cumulative effects tabulated, for according to complex systems theorist Donella Meadows (Meadows & Wright, 2008, p. 32), "They will lead to exponential growth or to runaway collapse over time."

Tipping Points & Feedback Loops

In this portion of the Literature Review I present the peer-reviewed literature documenting the tipping points and self-reinforcing feedback loops now underway which are powerful enough to initiate runaway global warming in the near-term. These changes in the complex climate system are not considered in the Intergovernmental Panel on Climate Change assessment reports.

Summer Arctic sea-ice loss. The rapid loss of summer Arctic sea ice is a major climate tipping point initiated by anthropogenic CO2 emissions. The feedback loop of decreasing *albedo* then exacerbates the loss. Albedo is described as the amount of reflectivity characteristic for a given substance, and snow and ice reflect 90% of light energy. Oceans, soil, and forests absorb this same amount, and reflect 10% due to their darker color. Loss of albedo has caused 25% of all anthropogenic warming to date (Pistone, Eisenman & Ramanathan, 2014). The feedback occurs as albedo decreases further, due to ice-loss from the warming, thus melting more ice. The 2014 Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report uses model simulations of sea ice extent that predict sea ice lasting until 2050, with medium

confidence. But when adding physical observations of sea ice volume and enhanced transport through the Fram Straight, (Rampal eta l., 2011) Arctic modeler Wieslaw Maslowski expects the Arctic to be ice-free in summer by 2016 (Maslowski, 2012).

Polar Jet Stream collapse. Sea-ice loss has decreased the temperature differential between the poles and the Equator. This temperature differential has maintained the existence of Earth's three jet streams. Jet streams are high winds, in excess of 100 mph, bringing patterned weather, like seasonal monsoons, around the globe at 30,000 ft altitude. But beginning in 2012, the temperature differential decreased past a critical threshold, and the Northern Hemisphere Polar Jet Stream weakened, and has finally collapsed in response (Francis & Vavrus, 2012). As the jet stream weakens, cold air moves thousands of miles south in teardrop patterns called Rossby Waves. These waves, cause blocking patterns that can trap Polar Vortex cold pockets in lower latitudes, and dry heat in upper-latitudes for weeks at a time (see *Fig. 2*). The result is unpredictable weather, and reduced global food security. The Polar Jet Stream will no longer assume a recognizable pattern as it stumbles, spits and languishes around the globe (see *Fig. 3*).

Large Arctic surface waves. Additional feedbacks occur because wind passes over the summer ice-free open water in the Arctic Ocean, for increasingly longer distances. This increased *fetch* generates uncharacteristically large surface waves called *sea and swell* that mechanically break apart the remaining sea ice (Thomson & Rogers, 2014), and erode shoreline permafrost, facilitating the release of methane and carbon from the thawing bluffs (Overeem, et al., 2011).

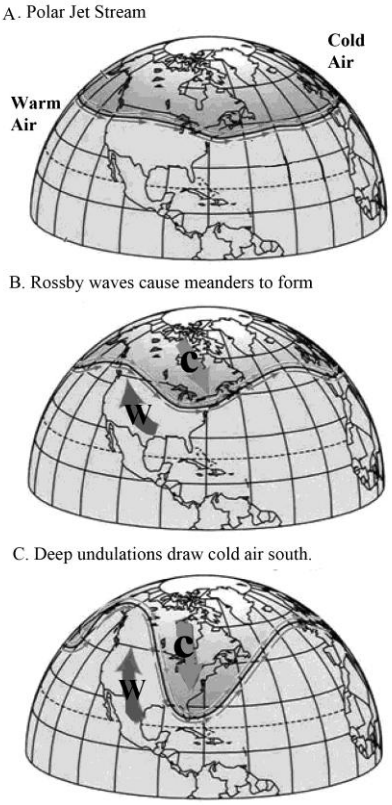

Figure 2. Polar Jet Stream collapse (University of Colorado, Atmospheric Sciences)

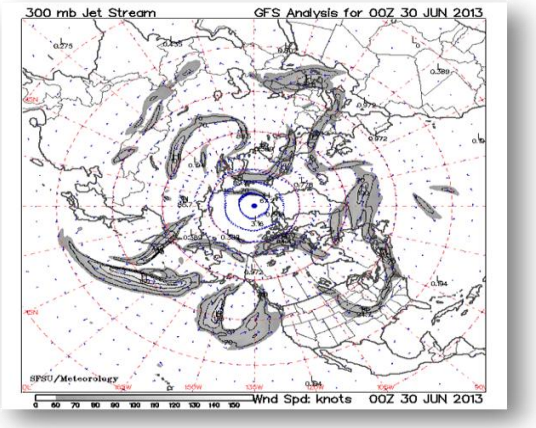

Figure 3. Fragmented Polar Jet Stream Jan 30, 2013 (SFSU)

Moistening of the upper-troposphere. Although CO2 is the focus of all international climate policy goals, a 2014 study on the climate forcing potential of water vapor (H2O) has shown that it is now the most influential greenhouse gas (GHG), driving up to 75% of warming (Chung, Soden, Sohn & Shi, 2014). As CO2 warms the atmosphere, it becomes increasingly capable of retaining moisture. Vapor lasts in the troposphere for about nine days before it is replaced. While CO2 traps long wave radiation, H2O traps even more energetic short wave radiation. Atmospheric water vapor is increasing, which leads to runaway global warming.

Subsea Arctic Methane Release. This colorful Tweet from glaciologist Jason Box is referring to the *Methane Clathrate Gun Hypothesis* (Kennet, Cannariato, Hendy & Behl, 2003) posits catastrophic release of stores of methane (CH4) from the melting clathrate structures under the seabed along continental margins, as warming oceans destabilize the high pressure, low temperature gas hydrate stability zone (GHSZ). The East Siberian Arctic Shelf (ESAS) is estimated to contain the largest stores of hydrocarbons in the world, with 500 gigatonnes (Gt) of organic carbon in thawing permafrost, and 1000 Gt in

frozen clathrate structures and 700 Gt in free gas. Most of the area is affected by seismic and tectonic activity; activity that has been shown to increase under global warming, adding greater opportunity for gas migration pathways to the surface. While climate modeler David Archer, maintains that deep ocean clathrates, are still thousands of years from destabilizing (Archer, 2009), we turn our eyes to Natalia Shakhova observing the ESAS where 75% of the seafloor is 50 meters deep or less and will be exposed to far warmer temperatures than the deep ocean clathrates. Shakhova (2010) documented observations of 80% of the ESAS seabed acting as a methane source to the water column, with methane plumes 1000 kilometers across. Methane release from the seabed has now been confirmed off the coast of Washington state, the East Coast of the United States, and New Zealand (Hauta et al., 2014; Skark, NOAA, 2013; Mountjoy, 2014), and high CH4 levels are occurring in Antarctica (Carana, 2013).

Although CO2 has not quite doubled in the atmosphere since the Industrial Revolution (IR), atmospheric methane (CH4) has tripled (Carana, 2015). Methane has 150 times the global warming potential (GWP) of CO2 over a 5 year period (Dessus, Laponche & Le Treut, 2009). Only considering the addition of 2013 Arctic atmospheric methane concentrations of a conservative 2000 ppb (Carana, 2013) raises the equivalent local CO2 concentrations from 400 to 600 ppm (Dessus, Laponche & Le Treut, 2012), with the resulting warming effects. Research points to the release of 3,000-gigatons of carbon (GtC) in the form of CH4 during the Paleocene-Eocene Thermal Maximum (PETM) 55.8 millions of years ago, an event that increased Earth's temperature 6-10˚ C over a 13-year period (Wright & Schaller, 2013).

Complex feedback interactions. Each of the summer Arctic sea ice-loss; the Methane Clathrate Gun; and the H2O vapor feedbacks, are sufficient to initiate a new phase of abrupt runaway global warming individually, yet as parts of a complex system, there are dozens of other feedback loops reinforcing these major feedback loops. A change in one variable affects the others, and can lead to eventual simplification of the system.

For instance, the residence time for CH4 in the atmosphere is commonly considered to be 12 years due to its eventual break down into CO2 and H2O by hydroxyl radical (HO) in the lower atmosphere (troposphere). Recent research identifies three feedbacks interrupting the HO cycle, thereby increasing CH4 atmospheric residence time, and its GWP. The first feedback is saturation. The hydroxyl radical is being depleted by increasingly higher concentrations of CH4 (USEPA, 2010).

Another feedback reducing HO occurs because it is produced through a process of *phytolysis*, in an interaction between light energy and ozone, and both are decreasing in the Arctic. Low levels of light already exist at the poles, and exposed soil and ocean replacing snow and ice in the Polar Regions, further limits the amount of available light for the formation of HO. In addition, ozone has been depleted by industrial chemicals including propellant chlorofluorocarbons (Voulgarakis, Yang & Pyle, 2009).

The third reduction in HO is occurring through a hole in the tropopause, discovered above the Southern Ocean. This hole is over a square kilometer across, and allows long lived greenhouse gasses (LLGHG) like CH4 to escape unmolested to the high altitudes of the stratosphere, where they can exist in full GWP for an indefinite period (Rex, et al., 2014).

In summary, dozens of tipping points and feedback loops exist in the complex climate system. An important tipping point we are crossing now is the loss of summer Arctic sea-ice which lowers Earth's albedo, driving 25% of anthropogenic warming, and decreasing the temperature differential between the poles and Equator. This trend toward global temperature equilibrium has collapsed the Polar Jet Stream responsible for large-scale agriculture in the Northern Hemisphere. The two feedbacks now driving warming have surpassed CO2 in importance, and are increased atmospheric water vapor; and methane released from sub-sea stores at continental margins, especially in the East Siberian Arctic Shelf.

Now that we have introduced the traumatizing stimuli: the narrative on catastrophic abrupt climate change, we will move forward to the larger part of our story.

Part Two: The Indirect Psychosocial Impacts of Abrupt Climate Change

Threats to Emotional Well-being

The Psychology of Climate Change is a fledgling discipline, and only a small body of work has been published on those behavioral effects that occur prior to any acute environmental disaster context. This gap in the research is one of my motivations for embarking on this study of psychological and behavioral responses to abrupt climate change in particular. The APA recognized the existence of these phenomena when they published the statement: "Even in the absence of direct impacts, the perception and fear of climate change may threaten mental health," (Swim et al., 2011, p. 8).

Doherty & Clayton in 2011 summarized three classes of psychological impacts of climate change as being direct, indirect and psychosocial. However, the impacts of narratives on abrupt climate change are both psychosocial *and* indirect.

Pre-traumatic Stress Disorder. Washington DC forensic psychologist Lise Van Susteren has co-authored the World Wildlife Federation report *The Psychological Effects of Global Warming on the United States and why the US mental health care system is not adequately prepared* (2011). Her report identifies climate change activists and scientists, public officials and academics as being at high risk due to their daily exposure to material that elicits feelings of hopelessness, anger, existential despair (Coyle & Van Susteren, 2011). Although not included in the report, Dr Van Susteren has used the term "pre-traumatic stress disorder," in 2014, when asked by Grist reporter Madeline Thomas about the psychological distress experienced by environmental activists who begin emotionally preparing. I wanted to include this information here, as this was a diagnosis that Dr Van Susteren uses outside of the official report. Within the report, the authors identify a need for improved assessment, diagnosis, and treatment for individuals experiencing climate related trauma. They continue with a bold call for an entirely new discipline to support practitioners and those in the public health field to prepare for the behavioral effects of climate change.

Ecoanxiety. A 2014 Report by The APA entitled *Beyond Storms and Droughts: Psychological Impacts of Climate Change* offers the term *ecoanxiety,* coined by Australian philosopher Glenn Albrecht (2011), which describes not a medical anxiety, but an existential anxiety. Albrecht's term "solastalgia" describes the feeling of when home has changed. The report includes a category called "gradual impacts," which is

partially described as "worrying about the future for self, children, and later generations" (p. 22). Of course, if this worry is based upon direct impacts from climate change, it doesn't qualify as an indirect impact.

The additional worry of climate change is shown to exacerbate any already extant stress-related issues like anxiety, depression and substance abuse (Neria & Shultz, 2012; Willox, et al., 2012) as well as increasing feelings of powerlessness, exhaustion anger and fear (Moser, 2007). Using qualitative methods again in 2013, Moser found that when people felt they were not making progress at stopping climate change, some experienced deep feelings of frustration, loss and helplessness. Since observing alarming literature could constitute observation of impacts, it is worth considering.

Existential despair. Eschatology is a branch of study often undertaken by theologians seeking to understand and describe the final events of human history. Secular eschatology can involve discussion of transhumanism, or of other human-made or natural existential threats, including climate change. Existential despair has been suggested as a component of the emotional landscape when contemplating effects of abrupt climate change, so I will include some recent references to this experience as it relates to human extinction.

In *Death and the Afterlife*, (2013) Samuel Scheffler contends that we care more about people not born yet than we care about ourselves, because the threat of human extinction worries us more than the threat of our own deaths. The potential for human extinction prevents us from leading whole-hearted, fully engaged, value-laden lives. In effect, we are dependent upon people from the future to exist, so that we can be happy.

James Lenman, in *On Becoming Extinct* (2012), argues that human extinction only matters from a generational perspective, we want to live in order to have a long life,

complete projects, and be there for our children or grandchildren. Otherwise, he believes, we don't care about human extinction. Since we all die, from a timeless perspective, timing of human extinction is neither good, nor bad.

Weak attachment. The emotional responses of those who are experiencing trauma from fears of near-term human extinction (NTHE) are in line with emotional responses of those experiencing weak attachment to the biosphere and the rest of humanity. According to Attachment Theory, secure bonds to authority figures, family, and lovers are necessary for fostering adaptation and openness to new information. Weak bonds to authority figures, and potentially to the biosphere and the rest of humanity, cause both anxious grasping and avoidance of attachments, and may trigger anger, depression, detachment, and a rigidity, and hyper-vigilance regarding uncertainty (Johnson, 2004). The planet provides us security by satisfying our physical, emotional and even spiritual needs, but with planetary death comes our own abandonment. Eco-psychologists like *Joanna Macy* (2007) acknowledge our psychological interdependence with Earth systems, tracing a fundamental source of human mental illness to our physical, and relational split from the natural world. That we are emotionally dependent upon, and have co-evolved with our environment, is illustrated by the therapeutic effects of inhaling *Mycobacterium vaccae*, a soil biota that Chris Lowry (2007) determined to reinforce neural pathways that enhance mood, including those that increase serotonin.

Major Depressive Disorder. Ferrari et al. (2013) reported that Major Depressive Disorder (MDD), or clinical depression, was identified as the second leading cause of years lived with a disability (YLD). According to the National Institute of Mental Health (NIMH), those who suffer from MDD can endure feelings of hopelessness and sadness

that may overwhelm them episodically for weeks, or even years. Symptoms include a loss of joy in formerly pleasurable activities, leading to the feeling that life is no longer worth the trouble; confusion and memory loss; sleep disturbances, or over-sleeping; fatigue; lowered libido; head and body aches; digestion problems that are unresponsive to treatment; and weight loss or gain; with an increase in risk of death. A milder form of chronic depression is called "dysthymia."

Complicated grief. Distinct from depression or anxiety is a pathological form of bereavement. Early non-pathological bereavement shares certain symptoms with pathological depression including decreased socialization, sadness, sleep disturbance, tearfulness, and decreased appetite, sometimes confusing the diagnosis. Tomarken, et al. (2008) studied bereavement in cancer patient caregivers, but it was noted that grief could occur with the loss of a relationship or lifestyle, or in the form of anticipatory grief. A pathological form, or "complicated grief," is described as an "intense yearning." The subject has great difficulty in coming to terms with the death, and can experience emotional numbness, strong feelings of bitterness, and emptiness. There can be a fear of resuming one's life because of the belief that the future holds more disappointment.

Aggression. One important risk factor for complicated grief is a compromised social support system. Support is measured in terms of supportive climate/environment, perceived availability, dynamics of social networks, and support seeking behaviors. This may be important when considering the effects of social exclusion that often occurs when individuals attempt to share taboo, anxiety provoking narratives on abrupt climate change. We are hard-wired to be socially engaged. Social exclusion has a dehumanizing effect on subjects and has been shown to cause aggression (Baumeister, DeWall &

Ciarrocco, 2006) by frustrating a human need as basic as breathing. Exclusion destroys people's self-control (Twenge, Baumeister, Tice & Stucke, 2001), self-esteem, and sense of meaning (Zadro, Williams, & Richardson, 2004). This effect occurs even when the perpetrators are seen as repugnant (Gonsalkorale & Williams, 2007; Williams, Cheung, & Choi, 2000), or are inanimate objects, like computers (Zadro et al., 2004).

Neuroses. Challenges to processing strong emotional responses to abrupt climate change may also occur in some subjects due to neuroses that have developed from Western cultural repression of the subjects of death and dying generally (Feifel, 1969).

In summary, threats to emotional well-being resulting from indirect psychological impacts of exposure to narratives on abrupt climate change have not been studied extensively. The literature most relevant to the emotional responses experienced by those who suffer from this pre-traumatic disorder describes an ecoanxiety, resulting in bouts of sadness, depression, and anxiety. Threats to one's attachment to a disappearing biosphere and one's own species can trigger grasping, anger, and avoidance of attachment. Ostracization from friends and family due to the unpopularity of the subject of NTHE can lead to further detachment, social isolation, and aggression. Major Depressive Disorder (MDD) may bring sleep disturbance; loss of joy, sex drive, appetite and memory; physical pain; weight fluctuation, and confusion. Complicated grief may cause bitterness, emotional numbness, yearning, and emptiness. Existential despair leaves us unable to engage in value-laden lives. These impacts exacerbate any preexisting psychosocial issues, and can trigger neurotic episodes if repression the topic of death has prevented processing of the underlying emotions. These people need support.

Let us proceed now to the section of the Literature Review, which investigates origins and barriers to pro-environmental agency, another term for *action*. Here I analyze the process that leads to an individual engaging in the behavior, and at what stage they may fail to acquire, or lose, the necessary predictors.

Determinants of Pro-environmental Agency

The origins of and barriers to pro-environmental behaviors have been studied extensively over the years within the broad discipline of Environmental Psychology, which came into being in the 1960s to examine the complex interactions between humans and the environment (Kollmus & Agymann, 2010). Environmental psychologists have developed a variety of theoretical frameworks for understanding pro-environmental agency. So far, none has proven all-inclusive. At a basic level, the engaging in pro-environmental behaviors can be seen as a combination between rational self-interest and pro-social attitudes, with individual theoretical frameworks associated with each focus. If self-interest is the main driver, researchers tend to utilize rational choice models which can be found everywhere in micro-economic textbooks when discussing the act of human decision-making. That is because influential market economist Milton Friedman described *rationality* to mean that an individual balances costs against benefits to decide on a course of action that maximizes their personal advantage (Friedman, 1953). Later models of decision-making under risk argue that choice is not always rational (Lowenstein et al., 2001), nor consequentialist. Cognitive decisions are based upon probabilities, but emotional decisions are based upon vividness of imagined future outcomes. One theory assuming rational self-interest is the *Theory of Planned Behavior* (Ajzen, 1999), which also stresses the individual's consideration of physical limitation in

performing the environmentally beneficial action, called "perceived behavioral control" (PBC). In this theory, social norms may not directly influence agency as much as providing information about what behaviors are socially acceptable or easy to perform (Sherif, 1936).

Moral Norms. The pro-socially dominated theorists prefer the *Norm Activation Model* (Schwartz, 1977). Moral norms, posits Schwartz, are strong feelings of moral responsibility. Guilt is an important social norm that motivates a person to seek atonement through action (Weiner, 2000). These moral norms are likely formed and activated as a result of interactions between cognition and emotion (internal) and social (external) variables (Bierhoff, 2002). Various researchers have suggested a more unified theory, which includes moral norms as another independent predictor of intention (to act). Manstead (2000) and others (Harlan, Staats & Wilke, 1999) stated that its inclusion increased proportion of explained variance by as much as 10 percent. Moral norms, social norms, PBC, and attitude were the best independent predictors of intention according to Manstead, (2000). Stemming from the convergence of knowledge and emotion, in non-pathological individuals, a moral norm is developed and activated. Next, a social norm will give us more information about the acceptable way to go about doing something, and the PBC will tell us to what degree we are able. Of course, as cognition and emotion interact to form moral norms, cognition must be reprieved of the existence of environmental problems and actions to be taken, before the interaction with emotion will produce any moral norm like guilt, so knowledge itself is a precondition.

Impotency of pure knowledge. It is worthwhile to note here that hundreds of studies have examined the gulf between environmental knowledge and conservation deed, and

the direct links between knowledge and action are weak (Corner, 2012). There are lessons to learn about the manner in which individuals go about seeking knowledge, and the cognitive confirmation bias may account for a subject's inability to internalize environmental knowledge that conflicts with their cultural worldview. Those suffering from a confirmation bias will only pay attention to the information that reinforces the system of belief to which they have already ascribed. In fact, the more scientific knowledge an individual possesses, the more extreme the polarization on climate change beliefs becomes across cultural divides (Kahan, 2012). There are a number of cognitive biases that affect individual perceptions. Two of those affecting risk perception are particularly relevant to pro-environmental agency related to climate change, optimism bias and normalcy bias, which affect risk perception, our next category.

Cognitive optimism bias. When one believes in a positive outcome although the evidence does not support their view, this is optimism bias. Hatfield and Job explored cognitive optimism bias in 2000, as it related to environmental risk perception. They discovered that their research participants believed they were less likely than their peer group to suffer the damaging effects of noise, even though there was no rational reason to assume they were less vulnerable. Their study criteria included: knowledge of pro-environmental behavior, social norms, biospheric altruistic value orientation, personal experience of environmental hazards, and demographic variables.

Normalcy bias. This occurs when an individual fails to prepare for, or react in a realistic way to, dangers, so accustomed are they to a “normal” state of affairs. This cognitive bias is sometimes seen during natural disasters, when residents refuse to evacuate (Valentine & Smith, 2012). It can result in unnecessary deaths, and can be better

managed by disaster planners by: 1) public announcement that there may be a disaster; 2) dissemination of a plan of action; and 3) issuing of direct and repeated warnings that cannot be misunderstood (Valentine & Smith, 2012). When others are present and they are not reacting to an emergency, the effect is compounded. This is dubbed the "Bystander Effect," and was first demonstrated in an experiment by John Darley and Bibb Latané in 1968. This socially mediated phenomenon is based upon the diffusion of responsibility, whereby people are reluctant to help because they believe it is someone else's responsibility to do so. The opposite is also possible, and individuals can suffer cognitive bias in regard to the illusion of control (Langer, 1975) in which subjects have an unfounded sense that they control a situation, which is much larger than they conceive.

Motivated reasoning. An inferred justification strategy used in an attempt to resolve cognitive dissonance, motivated reasoning results in a tendency to interpret new information within pre-existing beliefs (Kunda, 1990, p.27). This takes place most often in individuals who are already highly engaged with the issue at hand, ie: who already have strong emotional and cultural associations with the topic. Motivated reasoning differs from other reasoning, according to neuroscientists (Weston, 2006) in that, when evaluating new information, a "heuristic process" is initiated, in which the subject considers how they *feel* about the new information. If they are emotionally invested in an opposing narrative, encountering this challenging information can strengthen the emotional attachment to their own narrative (Lodge & Tabor, 2013).

Risk Perception. O'Connor, et al., (1999) discovered that risk perception was a good indicator of intention to act. Risk perceptions; knowledge; general environmental beliefs; and demographic characteristics; were the factors he identified as central to pro-

environmental agency. Beliefs about risk are important elements of theories on self-protective behaviors. In the *Theory of Reasoned Action* (Fishben & Ajzen, 1975;Ajzen & Fishbein, 1980), a person's behavioral intention (BI) is dependent upon their attitude toward that behavior (A) and the subjective norms (SN) of other's attitudes toward the behavior.

The *Health Belief Model* (Janz & becker, 1984; Rosenstock, 1974) is one of the most ubiquitous behavior prediction models in health behavior research. In this model, an individual assesses risks and benefits of an action based on perceived severity of risk, perceived susceptibility to risk, perceived benefit of behavioral outcome, perceived barriers to action, and perceived self-efficacy. Modifying variables are also considered, and behavioral cues must be present to initiate the health behavior.

Protection Motivation Theory (Rogers, 1975, 1983; Rogers & Mewborn, 1976) was created to identify *fear appeals*, and posits that risk assessment is based upon perceived severity, probability (vulnerability), efficacy of behavioral remedy, and self-efficacy.

Cultural Theory of Risk (Douglas & Wildavsky, 1982). Anthropologist Mary Douglas and Political Scientist Aaron Wildavsky developed Cultural Theory to describe the relationship between culturally codified worldviews of risk, claiming that societies imbue their members with outlooks that maintain the social order. According to Yale's *Cultural Cognition Project* researcher Dan Kahan (2008), "Individuals can be expected to form beliefs about societal dangers that reflect and reinforce their commitments to one or another idealized form of social ordering" (p.1). Mary Douglas' *Group Grid Typology* (1970) categorizes sets of worldviews that are cultural norms competing on two crosscutting dimensions. Depending upon whether one is in solidarity to the group, or has

an individualistic orientation (GROUP axis), and if they believe that society is stratified by class, race, gender, occupation etc., or are more egalitarian (GRID axis), an individual will fall on in one of the quadrants depicted: *Fatalist, Hierarchist, Individualist* or *Egalitarian.* These worldviews appear to influence environmental risk perception to a greater degree than any other demographic variables (Kahan, 2007; Corner, 2012).

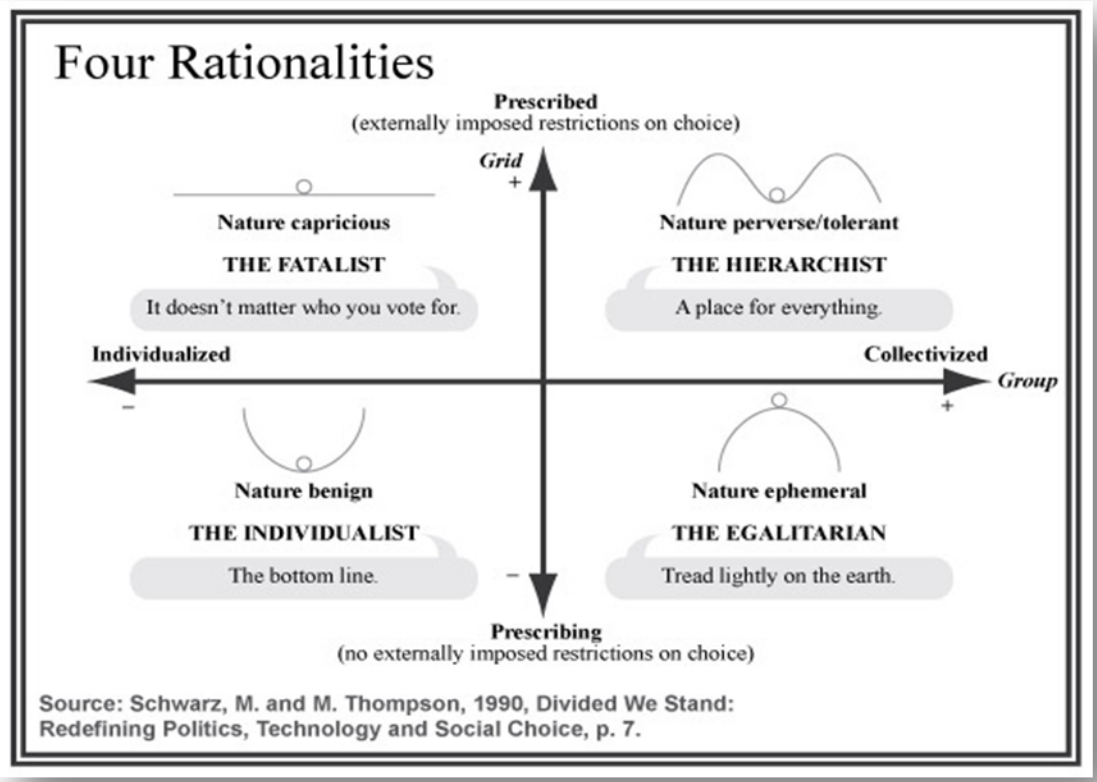

Figure 4. Group Grid Typology (Source: Schwartz & Thompson, 1990)

Risk worldviews extend to views on risks toward nature (see *Fig. 5*). Fatalists see nature as capricious, with outcomes dependent upon chance; Heirarchists see nature as resilient within bounds, and with sustainably manageable outcomes; Individualists see

nature as benign, with outcomes based upon personal responsibility; and Egalitarians see nature as ephemeral, for which outcomes require altruism and common effort (Douglas & Widavsky, 1982).

Cultural beliefs about climate change are even powerful enough to affect attribution of observed extreme weather events (Akerlof et al., 2013; Myers et al., 2012; Spence, Poortinga, Butler & Pidgeon, 2011), with those in denial of the phenomenon significantly failing to recall local temperature increases.

The Second National Risk and Culture Study was part of the Mechanisms of Cultural Cognition Project funded by the National Science Foundation (NSF) and the Oscar M. Ruebhausen Fund at Yale Law School. The study's sample base in 2007 included 5000 US residents. The survey tool they applied was the *Cultural Cognition Worldviews Scale*, partially based on the *Cultural Theory of Risk* first promoted by Mary Douglas and Aaron Wildavsky in their 1982 book *Risk and Culture: An Essay on the Selection of Technical and Environmental Dangers*. Douglas herself has criticized the use of values mainly found in conflicts over US politically charged debates that is unfairly harsh to Hierarchists (Douglas, 2003). I have chosen to utilize a version of The Second National Risk and Culture Study, called the *Cultural Cognition Quiz*, as a part of my data collection to help contextualize my sample population within a larger framework of cultural worldviews. I estimate that they would fall on the Egalitarian quadrant, seeing nature as ephemeral.

Environmental Attitudes & Identities. Researchers have been creating tools to measure environmental identities and attitudes since 1973, when Maloney and Ward tested *The Measurement of Ecological Attitudes and Knowledge* (MEAK) scale,

comprised of verbal commitment, actual commitment, affect, and knowledge. They returned in 1975 with G.N. Braught, and a simplified revision of their scale. Verbal commitment turns out to be a predictive factor in this scale.

Jody Hines, (1986-1987) found a correlation between feelings of moral responsibility for protecting the environment and conservation behaviors. Synthesizing the earlier studies on determinants of pro-environmental behavior, hers was an influential meta-analysis, comparing 128 studies which yielded 6 variables associated with environmentally responsible behavior: 1) knowledge of issues; 2) knowledge of action strategies; 3) locus of control; 4) attitudes; 5) verbal commitment; and 6) an individual's sense of responsibility.

The Ecological Worldview Scale from N.W.H. Blaikie (1992) defined 7 sub-scales: 1) use/abuse of the natural environment, 2) precariousness of the natural environment, 3) conservation of the natural environment, 4) sacrifices for the environment, 5) confidence in science and technology, 6) problems of economic growth, and 7) conservation of natural resources.

Harrison White, in his book *Identity and Control* (1992) asserts that the concept of "person" is unhelpful and disagreeable to social scientists and proposes instead, "identity" which he describes as, “any source of action not explicable from biophysical regularities, and to which observers can attribute meaning” (White, 1992, p. 6). Identities are created through “physical contingencies and social contentions” due to the need for footing (control) in physical and social contexts. Identities that establish a social footing can possess a stance, which allows them to make meaningful connections to other simple identities to form *netdoms* or network domains. As these identities experience contentions

and contingencies associated with new situations, they again attempt to gain a footing. The identity evolves, and eventually can reflect upon its previous state, adding a depth of perception as these past and present identities are reconciled, new senses of identity emerge.

Gagnon and Barton (1994) looked at the dynamic between environmental attitudes identified as *ecocentrism* and *anthropocentrism*. Ecocentric individuals value nature intrinsically, while anthropocentric individuals value the products and services nature provides to humans. These scales measure general apathy toward, or enthusiasm for environmental issues.

In 1995, Guagnano and Markee researched regional differences in the degree to which subjects agreed with four positions on the *Environmental Attitudes Scale*. Trust: business, industry, and politicians are honestly trying to protect the environment (a=.78); Responsibility: responsibility for the environment lies in the hands of business and government (a=.81); Complexity: actions needed to protect the environment are complicated (a=.77); and Economic tradeoffs: protecting the environment has substantial economic consequences in terms of jobs and business competitiveness (a=.56).

P.W. Schultz, (2001) tested the Inclusion of *Nature in Self* (INS) scales, which is also significantly correlated with the *Environmental Motives Scale*: biospheric concern (r=.31, p=<.01); and altruistic concern (r=.18, p<.05); as well as the *New Ecological Paradigm* revised scale (r=.20, p<.01). *The Environmental Motives Scale* describes three orientations: egoistic, altruistic, and biospheric.

Psychologist Susan Clayton (2003) describes the *Environmental Identity Scale* (EID) as a measure of the extent to which individuals identify with the natural world and

therefore, environmental causes. Scores showed a significant correlation to environmental behaviors, (r=0.64). This scale has 24 statements about actions and attitudes reflecting the importance of nature in the subject's self-image. Clayton states that environmental identities help us to recognize that "our immediate local actions can have global consequences, and that remote environmental threats are personally significant."

Following up on Jody Hines' study 20 years later, Sebastian Bamberg and Guido Mosier (2007) conducted another meta-analysis on 56 studies that fit their specific criteria. They found support for an integrated approach to the self-interest/pro-social dichotomy, and for moral norms as an independent predictor of intention, along side social norms, PBC, attitude, and *attribution*. Attribution refers to a process of assigning explanations for our behaviors, and the behaviors of others. If one explains behavior in terms of situational attribution, then the behavior was situation dependent. Dispositional attribution implies that the individual agent acted out of a quality of their personality traits or motives. The *fundamental attribution error* is overestimating the dispositional influence of another's behavior, whilst underestimating the situational influence. The opposite is true for the *self-serving bias*.

The Global Warming's Six Americas (GWSA) research conducted by Yale Project on Climate Change Communication in conjunction with George Mason University (2008-present), divides respondents into 6 categories: *The Alarmed, The Concerned, The Cautious, The Disengaged, The Doubtful, and The Dismissive,* each characterized by a unique pattern of attitudes, policy preferences, and behaviors regarding climate change (See *Fig. 6*). The scale spans a continuum of attitudes with those accepting and those

rejecting climate science at either end. In the middle are the less-engaged members of US society These survey questions require that participants share their beliefs on climate change; how much they worry about it; humanity's capacity to successfully address global warming; the proper priority fighting climate change should occupy in policy and budget; as well as the frequency of personal activism and conservation, like: switching to low wattage light bulbs;

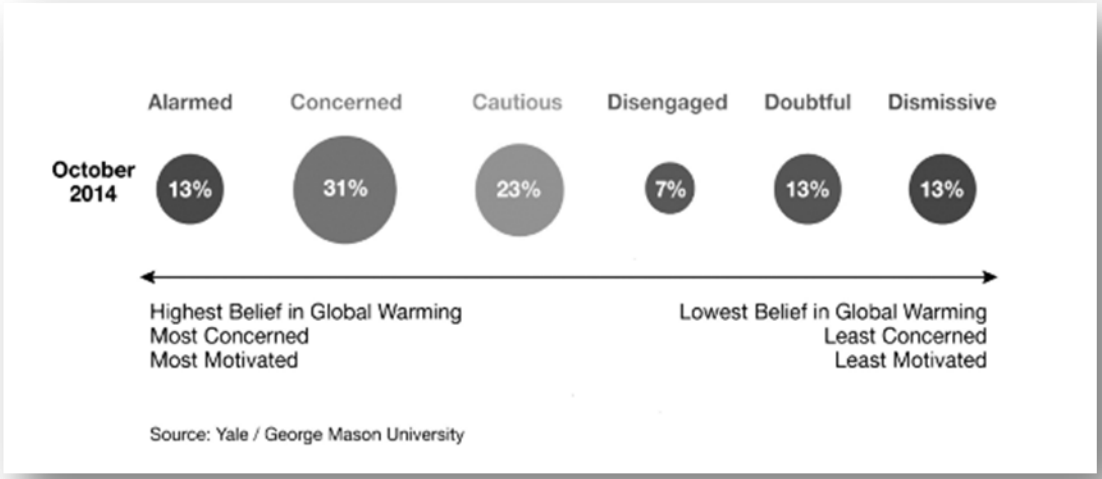

Figure 5. Global Warming's Six Americas (George Mason U., 2012)

boycotting corporate polluters; discussing climate change topics; writing their representatives, or biking to work. I estimated that my respondents would have fallen within The Alarmed category prior to their knowledge of NTHE, but what would be different today? Selected questions from the GWSA survey will appear as a portion of my data collection method, to track my respondents' beliefs and pro-environmental behaviors.

In summary, the basic concepts of rational self-interest, and pro-social behavior combine, with non-rational decision-making under risk considered as a possibility. Through interaction, individuals create plastic identities, stimulating development of moral and social (cultural) norms, and informing the individual's *Perceived Behavioral Control* (PBC or locus of control), decision-making, and beliefs. As the knowledge of environmental problems and suitable actions are encountered, new moral and social norms and new identities develop. If the presence of interconnections between basic behavioral drivers is increasingly at odds with novel, irrational economic and political contingencies, this can create cognitive dissonance, alienation and learned helplessness. Cultural cognition influences risk perception, and both are evident in environmental attitudes, and environmental identities. Risk perception affects decision-making, which can be cognitive, based on probabilities, or emotional, based upon vividness of imagined outcomes. Verbal and actual commitments to pro-environmental agency are socially reinforced contracts. When these factors are combined with other demographic variables, a snapshot of the forces acting upon the individual begins to emerge. My population of interest has traveled this road to arrive at their current level of pro-environmental agency.

In the next chapters, I elaborate upon the methods I chose to answer my research question, and then describe my results.

Chapter III: Methodology

The Participants

The sample population was composed of 100 self-selected adult members of online communities that revolve around near-term human extinction (NTHE) as a likely outcome of a perfect storm of threats, primarily involving the effects of anthropogenic global warming (AGW). There were 186 individuals who answered my post on social media, and 100 who completed the research.

Data Collection

In order to answer the research question thoroughly, it was necessary to cast a wide net. I collected both quantitative, and qualitative data using a survey. The qualitative data was in the form of 13 open-ended, respondent originated narratives. The quantitative data was in the form of answers to multiple-choice questions, 30 from Global Warming's Six Americas climate change attitudes survey, another 20 from the Cultural Cognition worldviews quiz, and 18 on demographics.

The primary advantages of the survey method is that surveys are relatively easy to administer online, are less time consuming than many other methods, are inexpensive, can potentially collect data from a large number of respondents, and most importantly, can facilitate collection of subjective data on attitudes, beliefs, values, opinions, and behavior. The data collection tool I utilized for this mixed methods approach was survey created using Google Forms application. The benefits of this option are that the application is free for those who have online accounts, customizable, and it may be run online from a personal laptop.

The Survey. Most of the essay questions were placed at the beginning to take advantage of respondents' initial enthusiasm for the project, with multiple-choice questions following to account for their waning focus, with demographic responses completing the survey. A full transcript of the survey questions is available in the *Appendices.*

Privacy. In order to ensure privacy, participants' names were separated from their answers by using a 4 character Privacy Code. This Privacy Code was the first entry on the survey, and the only answer required for submission. Each code was linked to a participant email addresses on a spreadsheet that was used to keep track of individual participation and email communications. At the end of the study, I destroyed the data file.

Essay Questions. The essay questions elicited the bulk of qualitative data I was most interested in using to answer my research question. These spanned descriptions about abrupt climate change phenomena; narratives on abrupt climate change respondents have adopted; impacts the ACC narrative has had upon respondents' well-being, relationships, life choices and pro-environmental behaviors. There were additional essay questions asking for medical information, and one that allowed respondents to share anything they wanted to say.

Six Americas Survey. In the section following the essay questions, was a group of 30 multiple-choice questions from the Global Warming's Six Americas survey. These questions elicited quantitative data about belief in the risks of global warming; and our social support systems; past participation in pro-environmental behaviors and future intentions to do so. Utilizing these questions allowed me to compare my population's pro-environmental behaviors in the past with any recent changes in their future

intentions. I could also compare a snapshot of my population with those of the US national samples taken in 2008 and 2012, to see how my sample is categorized within the Six Americas framework: Alarmed, Concerned, Cautious, Disengaged, Doubtful or Dismissive.

Cultural Cognition Quiz. After the GWSA section, 20 multiple-choice questions from the Cultural Cognition Quiz were presented. Yale researchers categorize individuals by risk worldview based upon their beliefs in an ideal society, resulting in one of four possible profiles: Fatalist, Hierarchist, Individualist or Egalitarian. From this additional quantitative data, I could glimpse a picture of my generic respondent's worldview, and discover how they imagine nature to respond to the risk of climate change.

Medical Review. In five questions that combine multiple choice and essay answers, respondents are asked if they have sought therapy for emotional problems occurring as a result of the narratives in question, participated in mindfulness practice, or were prescribed medications.

Demographics. Respondents were asked to provide their age, gender, relationship status, political affiliation, religion, nationality and race, to their education, income and occupation; whether they have children or grandchildren, pets, gardens, live in the city, suburbs, rural village, farm or wild land interface; and their preferred news sources. Through these questions a picture of the typical respondent was assembled.

Permissions. Respondents were asked to use quotes from their essays, and whether they preferred the quotes were attributed to them, or to want to remain anonymous.

Data Analysis

Quantitative data from the multiple-choice questions taken from Global Warming's Six Americas and Cultural Cognition Quiz and gathered using Google Forms was fed into a spreadsheet and processed by the application Google Analytics. Google Analytics produces pie charts and histograms of the data automatically. The simplicity of displaying my results as percentages was welcome, since 100 respondents conveniently participated. The drawback of using the Google Analytics application was that it was not always a reliable and representative tool for processing and displaying all the data as the respondents entered them.

I also used color-coding for the essays that identified recurring themes for each question. Using this color-coding to identify each themed entry, the number of responses that mentioned each theme was summed for each question, and the percentages calculated. Examples of color-coding themes can be found in *Appendix G*.

Qualitative data analysis consisted of my reading all of the essays and narratively summarizing the recurring responses, while acknowledging the unique responses. Themes emerging from the essay questions are listed below.

Essay: Personal experiences with abrupt climate change phenomena

Themes: Extreme and unpredictable weather, drought, flood and heavy rain, plant effects, animal effects, older weather, hotter weather, sea level rise, no observable evidence, and discussion of actions attitudes and goals.

Essay: Sharing of the abrupt climate change narrative

Themes: Open conversation, sharing some aspects, and positive experiences, or withheld narratives due to fear, shaming, social isolation or other negative reaction, uncomfortable or forced conversations, and online or Facebook interactions,

Essay: Pathways for encountering the abrupt climate change narrative

Themes: Observation, Michael Rupert, Guy McPherson, other author, and Facebook.

Essay: Ascribing to a climate change narrative

Themes: Food security, abrupt/runaway climate change, Arctic methane release, hydrogen sulfide release, nuclear accident/war, Guy McPherson, ocean (sea level rise, acidification), jet stream collapse, feedbacks/tipping points, and time frames.

Essay: Personal research of abrupt climate change narratives

Themes: General research/reading, personal observation of climate change, scientific and peer-reviewed literature, and no personal research

Essay: Emotional well-being

Themes: unidentified emotional distress, anxiety and panic, depression and sadness, anger, grief, relief, excess /risk, instability, and pre-existing condition

Essay: Pro-environmental agency

Themes: Increased pro-environmental agency decreased pro-environmental agency, and

no change in pro-environmental agency. Emergent themes were decrease in political activism and increase in local volunteerism.

Essay: Lifestyle changes

Themes: Current proactive changes toward preparing for collapse, future plans to prep for collapse, and divestment of investments (monetary, physical and emotional).

Essay: Seeking therapy

Themes: Yes, subject has sought therapy, subject has intention to seek therapy, and no, the subject has not sought/will not seek therapy.

Those who had exhibited emotional disturbances, and a history of medications prior to encountering the narrative on abrupt climate change were included because some of my population of interest has been fighting environmental degradation for decades, and depression is a likely outcome of such work. Those who had personally experienced abrupt climate change-related phenomena were not excluded despite the direct nature of the impacts, because abrupt climate change is happening now for all to experience.

Chapter IV: Results

This chapter is a discussion of the responses that I found most representative of the answers to my research question. To begin, I will relay the findings that help to describe the sample population, and their experiences with the narratives and effects of abrupt climate change. Then I share the results of questions focused on threats to emotional well-being. Finally, I will discuss the results from the section on pro-environmental agency.

Demographics

The average participant was a married white non-religious heterosexual, aged 45 to 64 who was an environmentalist, with either Green or zero political affiliation, and a masters degree; retired, and earning between $20k and $40k/year; living the US in an urban or suburban neighborhood; would prefer to live in a rural village, farm, or wild land interface. They are a consumer of independent and online news, Facebook, Huffpost, Aljazeera, British Broadcasting Corporation, New York Times and National Public Radio*;* have a food-producing garden, and one or more children, and one or more pets. Rating as "Egalitarian" in the Cultural Cognition world-view quiz, with an opinion that nature is ephemeral; and rating on the far left side of "The Alarmed" category in terms of responses to the Six Americas Global Warming survey, with some important exceptions, described in the Discussion chapter. A full breakdown of answers can be found in the *Appendices.*

Narratives on Abrupt Climate Change

The histogram in *Fig. 7* illustrates the number of responses out of the 100 for each phenomenon experienced by the respondents. Four had only experienced abrupt climate change through the media; seven saw no observable evidence; and two had no answer.

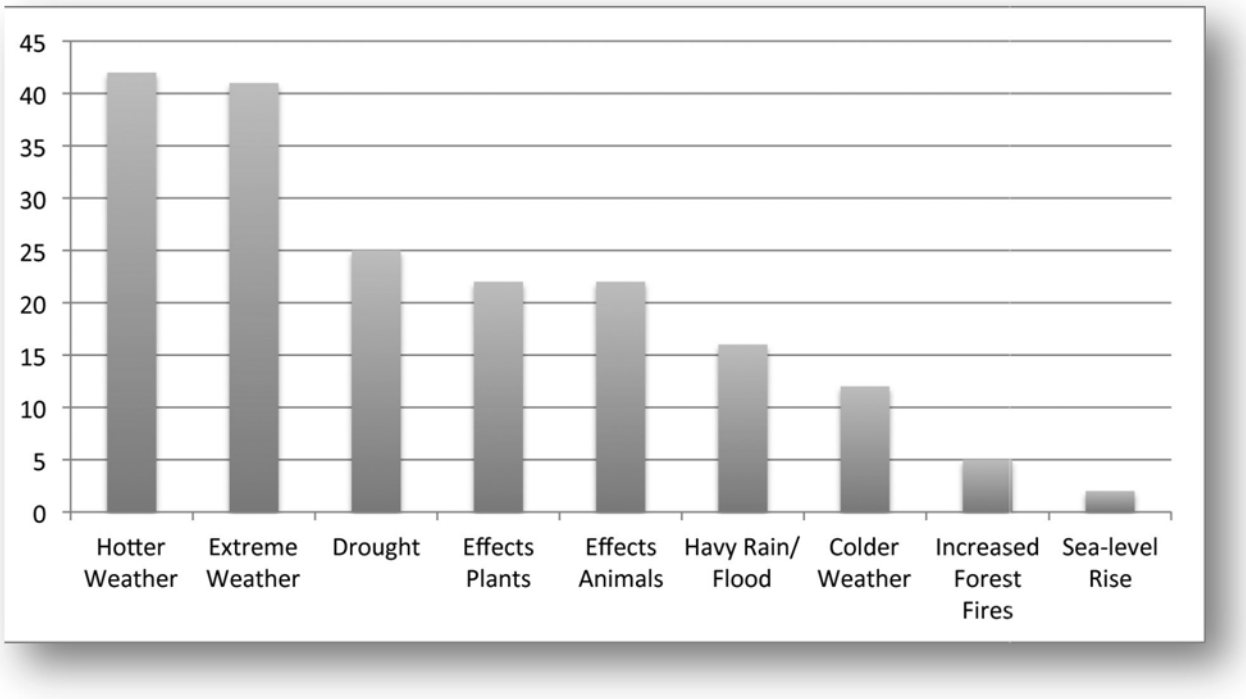

Figure 6. Subjects experiencing abrupt climate change-related phenomena

The essays on respondents' personal experiences of abrupt climate change speak volumes about the engagement of this population with the natural world. Many are gardeners, and others who spend a great deal of time on the land. Their first-hand accounts of the changes in their local environments are riveting. Respondents noticed their local weather shifting to a new state.

"I live in CA, so I am living the drought, and our summers are hotter and we no longer have foggy evenings."

Weather extremes and unpredictability played a large part in the conversation. Increased weather unpredictability was considered a major cause of plant life failure to thrive. Warmer winters and extension of the growing season brought about a noticeable increase in pest populations due to increased breeding opportunities. A decrease in biodiversity, and a change in plant and animal behaviors, frequency, and distribution were discussed in approximately 1/3 of the essays as well. The collapse of the Polar Jet Stream and the ensuing Polar Vortex were also common topics of conversation. This iconic extreme weather event has introduced a wide array of individuals to the reality of abrupt climate change.

"I was in Florida in Jan. 2014 where the temperature was 1c colder (9c) than my home in northern Alberta (10c)."

There were comments about the human dimension of abrupt climate change as well. One respondent noted that over the past 8 years, strangers on walks have increasingly mentioned in regard to the weather, "This isn't natural." Other respondents mentioned noticing higher food prices, an increase in asthma, and an increase in stress-related behaviors like existential anguish, extreme opinions, and argumentativeness.

Personal narrative. The histogram below is a representation of the data furnished by respondents who noted that they had specifically encountered and agreed with narratives on abrupt climate change, rather than gradual climate change or the greater ecological crisis. Thirty respondents mentioned NTHE specifically; 27 mentioned methane; 27 mentioned abrupt or runaway scenarios; 22 mentioned tipping points and/or feedback loops; 13 mentioned famine; 12 mentioned nuclear fallout; 12 mentioned ocean warming and/or acidification/deoxygenation; 8 mentioned Dr. McPherson's narrative; 8 mentioned a collapsed Jet Stream; 5 mentioned hydrogen sulfide (see *Fig. 8).*

"I believe abrupt climate change will remove habitat for humans by 2030, plus or minus a few years. I am only 99% certain humans will be extinct by 2030. I am much more certain humans will be extinct by 2050." ~Guy McPherson

Of those who offered a timeframe for NTHE: 18 thought human extinction would occur within 2-3 decades; 7 thought it would happen in less than 20 years; and 4 believed it was happening now.

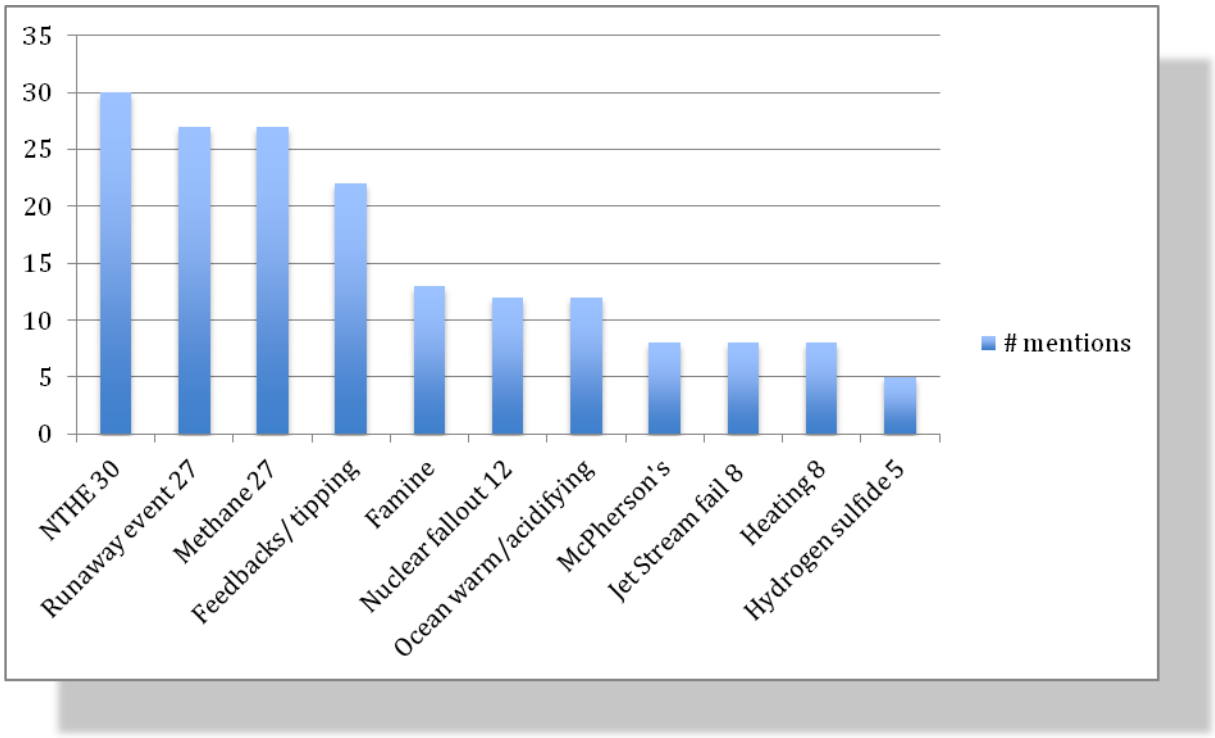

Figure 7. Number of mentions of each abrupt climate change variable

Paths to the narrative. Of the 93 participants who answered, 54 encountered their narrative from Michael Rupert, 46 from Guy McPherson, 11 from Facebook, and 55 from other authors, websites and sources. Twenty-four encountered the narrative before Y2K and 30 encountered it after. Eight had only learned of the narrative within the last year. Michael Rupert and Guy McPherson were common pathways for many.

"Yes, from Michael C. Ruppert's Internet radio show, The Lifeboat Hour, from 2012 to 2014; and from Guy McPherson's show, Nature Bats Last. Both these sources

gathered scientific reports and opinion from many sources."

As older environmental advocates, many of their stories were rich with cultural and academic references.

Individual research. I asked participants if they had researched this topic themselves, and of the 73 respondents who answered, 36 mentioned general research, reading; 26 mentioned peer-reviewed or scientific research; 6 mentioned witnessing evidence; and 5 had performed scientific research themselves:

Paul Beckwith graduate student from University of Ottowa answered:

"Yes I have. In fact I have generated many of these narratives in my research… my PhD thesis work over the past 4 years or so has been on abrupt climate change."

A master's degree was the average level of education my respondents had attained, and many appeared eager to follow up on the research they encountered with the skills they learned while studying in their own disciplines. Others are not scientifically trained but consider themselves, "widely read and not scientifically illiterate." Some watch the weather and news as they unfold. Academic and non-academic experiences were related, giving a full picture of their qualifications for evaluating the research on abrupt climate change. Overall, this group was highly engaged in the vetting of scientific data about abrupt climate change and NTHE.

Threats to Emotional Well-being

For those who have accepted that the abrupt climate change narrative is inevitable, irreversible and occurring now, the distress experienced is exacerbated by pervasive suspicions regarding the soberness of their conclusion. One responded confided, "There is a certain feeling of insanity when your world view is different than the majority." This

dynamic can result in the breakdown of their self-confidence, reputations and primary relationships. A surprising 80% of participants have family members with whom they cannot discuss NTHE, as expressed matter-of-factly by one participant, "I do not share this with family because they have informed me that they do not believe it and do not want to hear it." Due to this difficulty in sharing this information with others, many respondents compartmentalize that area of their lives, leading, in essence, "double lives." When considering sharing their narrative on abrupt climate change, 69% reported withholding their narrative due to negative responses from others, or from fear of social exclusion, while 24% powered ahead with uncomfortable or forced conversations about NTHE despite discomfort. This social isolation resulting is especially difficult for those accustomed to, or dependent upon, a high degree of social contact and approval. The resulting social exclusion has been shown to cause aggression, which can exacerbate the underlying issues. Relationships are breaking down because of strained communications between participants and their support systems, with 30% of participants having lost friendships, or other close relationships because of discussing NTHE.

My sample population had all participated to some degree with online communities for NTHE. The majority considers social media to have been an important therapeutic agent to ease the anxiety and depression, which is exacerbated by the social isolation occurring due to sharing unpopular views on abrupt climate change and NTHE. Sadly, 15% of respondents can only discuss NTHE online with strangers and are otherwise completely isolated with this knowledge. The opportunity to participate in conversations about this taboo topic has shown the most potential for therapy.

All of the respondents report experiencing some level of emotional distress from

accepting the common narrative, and 35% sought behavioral treatment. Typical complaints were: anxiety, panic attack, sadness, a loss of motivation, withdrawal, fatigue, physical pain, burdened, mental confusion, and loss of meaning. Many respondents already had a history of depression or anxiety related to prolonged exposure to increasingly pronounced environmental degradation, and 55% had been taking medication for symptoms of depression, anxiety or bipolar prior to adapting their current narrative on abrupt climate change. Several admitted to self-medicating with marijuana. As noted in the literature, in some instances, this depression may be advantageous for circumventing normalcy or optimism biases that inhibit realistic risk assessment. Subjects' maintenance states of depression become complicated by bereavement, as they grieve for the planet, and the future of everyone and everything that is, or could ever have been. Complicated grief is driving a wedge between respondents and their friends and family members. Deep feelings of hopelessness, shame, and anger exist.

I also found that for those able to work through trauma, commonly reported positive experiences of accepting NTHE include feelings of vindication, relief, presence, immediacy, gratitude, and acceptance of, and appreciation for, life as it really is; as well as increased motivations to achieve life goals, volunteer for personally meaningful service, forgive transgressions, connect with loved-ones, and commune with nature. This quote was particularly illustrative:

> "Accepting our 'inevitable extinction' has left me feeling calm and peaceful after years of anger and frustration. I feel pity for the various agents of habitat destruction these days, as opposed to my previous fury and hostility."

Pro-environmental Agency

Additional stress occurs when the planet saving rituals individuals have followed in their

daily lives, their hobbies, and even their careers, lose the meaning they once had after this inconsolable defeat. The pro-environmental behaviors were goal-directed and originated from an urge to survive; yet they also contained elements of the sacred, driven by an acknowledgement of Earth as life's source. These behaviors also cemented my subjects' cultural identities, and bonded them with their peer group. In addition to the loss of meaning incurred from recognition that one's actions are futile, as there is no hope to create a better future and no history to judge us, the loss of practical motivation for pro-environmental agency causes the agent distress, as they must reassess their engagement in even long-held domestic habits of second nature. Abandoning their extended engagement in the fight to protect that, which is valued, can be antithetical, or can cause relief when they learn the battle was lost long ago.

The majority of my research participants (80%) continued their low-carbon lifestyles despite their own high confidence that near-term human extinction will be the result of anthropogenic drivers despite their belief that abrupt climate change is unstoppable.

"The Doomed." My sample population fell primarily within the Global Warming's Six Americas category of The Alarmed, with some interesting exceptions. Generally, respondents rated on the high ends of The Alarmed scale, with 72% of respondents saying they were "very worried" about global warming and only 59% of The Alarmed saying they were "very worried." Also, 58% of my respondents had contacted a public official about global warming in the last 12 months compared to 40% of The Alarmed. The Alarmed was primarily Democrat and my respondents are primarily Green Party or no party. But when it came to the question about human ability to stop global warming, only 1% of The Alarmed said we could not stop it, while the opposite end of

the GWSA scale, 29% of The Dismissive, believed we can't stop it, and a full 32% of my respondents believed we can't stop it. While my population is more knowledgeable, more active and more worried about global warming than the average Alarmed, they still don't think their actions will make any difference. I think that this discrepancy is substantial enough to warrant adding "Doomer" signal, in past responses, but claims in a recent personal email to me that it is less than the five percent of the population necessary for a new category. What is driving these environmentalists if not the potential to save the planet? Sometimes, refusal to allow those perceived as responsible for our plight to triumph is partial motivation for participants to continue to conserve. Sometimes, a hope that other life may survive the devastation keeps them engaged, or the goal of easing suffering in the interim between life and death.

Although pro-environmental behaviors continue, there is less guilt in their lapsing. This participant goes on to illustrate the trend whereby a majority (78%) no longer participate in forms of political activism, believing them to be ineffective, yet continuing to exhibit a proportional increase in volunteer activities, especially with causes close to home, and with special interest to family and community needs:

> "I still fight for causes that I feel will reduce suffering for people and animals. I have reduced my contributions to environmental organizations, which I no longer believe can have any impact on climate change, and I've increased my contributions to local food banks, women's shelters and homeless shelters."

Reproduction decisions were impacted in 25% of participants, who have decided not to have children because of the abrupt climate change narrative, while 50% have advised others to not have children.

A pervasive theme for this group was building community, with 70% of respondents

intending to move to a less populated area where they can grow food and share with a group as a way to survive the coming chaos a little longer.

Cultural Cognition Worldview. Respondents rated as Egalitarian with some evidence of Individualist tendencies on the Group Grid Typology rubric. Egalitarians think wealth should be equitably distributed, and believe that it takes mutual responsibility and cooperation in order to protect nature, which they view as fragile and ephemeral. Individualists want to be left to their own devices, valuing competition, lassez faire, and pragmatic materialism. They view nature as robust.

Mindfulness. Buddhists make up 7.1% of the world population (Johnson & Grim, 2013), and only 6.45% of the sample base identified as Buddhist; yet 63.4% of the study population engages in some form of mindfulness practice between .5 and 7.5 hours per week. 85% of them have found it helpful as a response to the stress induced by narratives on abrupt climate change, 13% don't know if they obtain relief, and 1% did not obtain relief. Popular foci are meditating on impermanence and detaching their desire for outcomes from their personal conservation behaviors. Respondents shared their personal sentiments on the practice, such as "Anarcho-Buddhism keeps me sane."

Chapter V: CONCLUSION

Environmentalists now on the frontline of the emerging climate change narrative are suffering from indirect psychosocial impacts of exposure to the mounting evidence that self-reinforcing irreversible feedback loops in the complex climate system are exacerbating anthropogenic global warming as we enter a phase of abrupt climate change that will likely lead to near term human extinction (NTHE) by midcentury. Individuals in this study are experiencing a suite of threats to their emotional well-being, described collectively as ecoanxiety, which include cyclical and varying degrees of anxiety, panic, depression with fatigue, physical pain and lethargy, sadness, complicated grief with risk-taking and loss of meaning, existential despair, weak attachment, hopelessness, shame, and anger. This pretraumatic stress is increased by prevalent social isolation resulting from unsuccessful attempts to share the distressing narrative with co-workers, friends and family who refuse to engage. One respondent remarked, "So essentially, seeing the end of life on Earth puts you in a closet for that aspect of your life." Compartmentalization is a common result of this ostracization. Social media is an important way for these individuals to access emotional support on this topic. Mindfulness practice is a response by the majority to the emotional stress caused by the NTHE narrative. Once they process the painful emotions, many individuals experience feelings of relief, acceptance, appreciation, compassion and gratitude for their lives. They also deepen their connection with the natural world.

Although they consider their pro-environmental behaviors and conservation efforts to be futile for prolonging human life on Earth, the vast majority of these long-time environmentalists are continuing to engage in conservation efforts either because these

actions are a part of their cultural identity, embody a moral imperative, or increase chances for non-humans to escape extinction. The trend shows that this group is less active politically, and increasing local volunteerism. Primarily retired, the focus of their future plans revolves around the formation of off-grid farming communities where they can ride out the collapse of industrial civilization. The Doomed are an emergent population of unique attitudes and beliefs about climate change, who may be worthy of a seventh designation within the Yale University Project on Climate Change Communication rubric of the Global Warming's Six Americas. Although hopeless of a solution, this group is mindful of being present, bearing witness, and living out their last years with joy and integrity.

Limitations & Challenges

Since, according to Ioannidis (2005), the majority, and possibly the vast majority, of published research findings are demonstrably false, I offer a disclaimer here. The survey could not capture opinions of non-English speakers, children, those with no computer access, or those incapable of participating in an in-depth written survey. Participants may not provide accurate, or honest answers; they may feel uncomfortable providing answers that present themselves in a unfavorable light. Multiple-choice questions may have lower validity than other types of questions. Non-responses may cause data errors or biases, and "somewhat agree" may mean something different to each participant.

Time constraints prevented me from utilizing emotional assessment indices such as the *Beck Inventories* for quantifying anxiety and depression levels. The indices would have increased the risk factor for my study participants, as some questions can cause a strong emotional response. These additional risks would have required a Human Subjects

Review Board process through the college, taking time that was not available to me as a graduate student. This step would have added a finer grain to my research, allowing for greater clinical application of the findings, and I believe the study suffers for it.

Obtaining access to the Global Warming's Six Americas raw data to compare to my results would have allowed a more complete analysis of the variation within the six categories: Alarmed, Concerned, Cautious, Disengaged, Doubtful and Dismissive. This further analysis would potentially allow me to draw stronger conclusions about the emergence of a seventh category. Although I sent emails to the appropriate sources listed on their website, I have not received a response about using the data.

Further Research

"I think we should listen to more music and be good to one another more frequently"

~Anonymous Doomer

Fertile research opportunities exist to reformulate Yale's GWSA survey for the purpose of identifying the signal of The Doomed from the background noise of The Alarmed and The Dismissive. I continue to request the raw data for comparison.

There would be tremendous benefit in beginning immediately to arrange support for environmental professionals in crisis. These individuals need to express and receive validation for what they are experiencing.

As others become aware of the collapse, it will be imperative to establish means of outreach for modeling compassionate scenarios, perhaps through independent media, citizen journalism, and radio, humanitarian aid organizations, neighborhood meetings, faith-based groups, parents, gleaners, farmers, etc to define what a compassionate collapse would look like, and support those coming to grips with the narrative's terminal

diagnosis. Topics like safe space enforcement, equitable distribution of remaining resources, to prepare communities for the coming shocks to the supply chain. Important areas to research are what it would take to establish climate change support centers, which could provide counselors to train communities in mindfulness-based cognitive therapy, and foraging skills, and that, could also hold space for regular support groups for individuals, and families to make meaning through art, and help one another bear-witness to the Anthropocene Extinction. During Earth's transition to a state of planetary hospice (Woodbury, 2014), it would benefit all to pledge to maintain our humanity, dignity, and compassion, while minimizing suffering, by offering palliative care, assisted suicide and sanitary burial. Having these protocols in place would ease a great deal of the fear individuals are experiencing about the uncertainty of the coming events.

APPENDICES

Appendix A

Essay questions

1) Have you personally experienced abrupt climate change related phenomena? If so, please describe below.

2) Have you encountered narratives on abrupt climate change? ("Narratives" are defined as explanations about the potential for abrupt climate change and what will happen if /when abrupt climate change takes place.) If yes, please describe these narratives, including where and when you first encountered them.

3) Have you researched this topic on your own? If yes, what is your scientific background? Provide your most important primary sources, and describe in what ways your own research has confirmed or contradicted the narratives you have encountered.

4) What is the narrative on climate change to which you currently ascribe, and with what percentage of confidence?

5) Do you share your views on this topic with anyone? How has ascribing to this narrative impacted your relationships with family, friends, colleagues, organizations, and the natural world?

6) How has ascribing to this narrative impacted your physical and emotional well-being?

7) How has ascribing to this narrative impacted your conservation behaviors, volunteerism, or activism?

8) How has ascribing to this narrative impacted your choice of investments, career,

education, residence, travel, reproduction, or other plans for the future?

9) Have you considered seeking therapy for your emotional distress?

10) Have you experienced any kind of threats, or censorship while attempting to share or increase, your understanding of the narratives on abrupt climate change? If so, describe these experiences in as much detail as you feel comfortable, including evidence for any perceived motive for this censorship.

11) Have you sought treatment for behavioral symptoms resulting from your experience with narratives on catastrophic abrupt climate change? If yes, please describe below. Include symptoms and prescribed medications.

12) Were you taking prescribed medications for behavioral symptoms which existed prior to your encounter with narratives on catastrophic abrupt climate change?

If yes, please list medications and conditions they were prescribed to treat.

13) Do you currently practice meditation / mindfulness? If no, please skip to Section VI.

13a. If you answered "yes" to question V3 above, how many hours per week do you practice on the average?

.5-1/1.5-3/3.5-5/ 5.5-7/ 7.5-10/10+

13b) If you answered "yes" to question V3 do you find that practicing meditation / mindfulness been helpful in coping with your feelings of depression and/ or anxiety related to catastrophic abrupt climate change? Yes/No/Don't know

Appendix B

Global Warming's Six Americas: Full Results

1) *Which of the following comes closest to your view:*

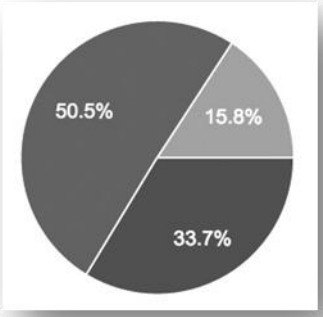

Figure 8. Humans are not going to reduce AGW

a) Humans can't reduce global warming, even if it is happening. 33.7%

b) Humans could reduce global warming, but people aren't willing to change their behavior so we're not going to. 50.5%

c) Humans could reduce global warming, but it's unclear at this point whether we will do what's needed. 15.8%

d) Humans can reduce global warming, and we are going to do so successfully. 0%

e) Global warming isn't happening. 0%

2) *The actions of a single individual won't make a difference in global warming.*

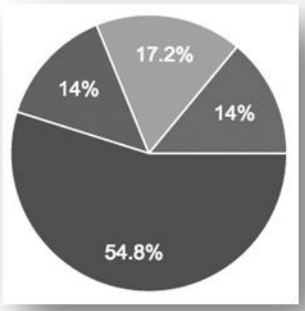

Figure 9. Individual won't make a difference in AGW

a) Strongly agree 54.8%

b) Somewhat agree 14%

c) Somewhat disagree 17.2%

d) Strongly disagree 14%

3) *New technologies can solve global warming without individuals making big changes in their lives.*

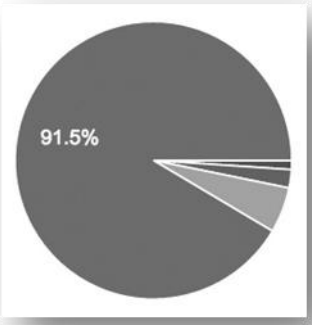

Figure 10. New technologies cannot solve AGW

a) Strongly agree 1.1%

b) Somewhat agree 2.1%

c) Somewhat disagree 5.3%

d) Strongly disagree 91.5%

4) Think back to the energy-saving actions you're already doing and those you'd like to do over the next 12 months. If you did most of these things, how much do you think it would reduce your personal contribution to global warming?

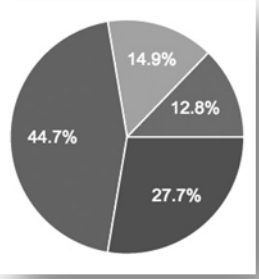

Figure 11. Could reduce my carbon foot print a little

a) Not at all 27.7%

b) A little 44.7%

c) Some 14.9%

d) A lot 12.8%

5) If most people in the modern industrialized countries around the world did these same actions, how much would it reduce global warming?

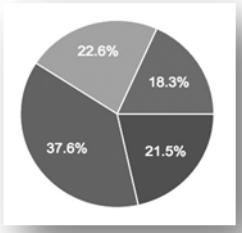

Figure 12. Could reduce industrial carbon foot print a little

a) Not at all 21.5%

b) A little 37.6%

c) Some 22.6%

d) A lot 18.3%

6) How worried are you about global warming?

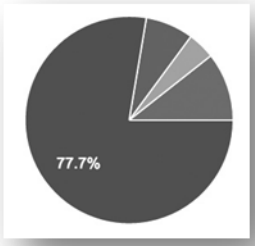

Figure 13. Very worried about AGW

a) Very worried 77.7%

b) Somewhat worried 7.4%

c) Not very worried 4.3%

d) Not at all worried 10.6%

7) 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 minds. For global warming, where would you place yourself?

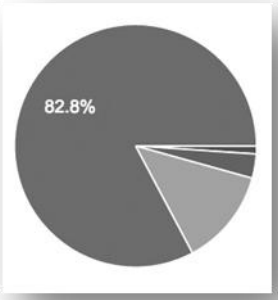

Figure 14. Don't need more information to make up my mind about AGW

a) I need a lot more information 1.1%

b) I need some more information 3.2%

c) I need a little more information 12.9%

d) I do not need any more information 82.8%

8) How important is the issue of global warming to you personally?

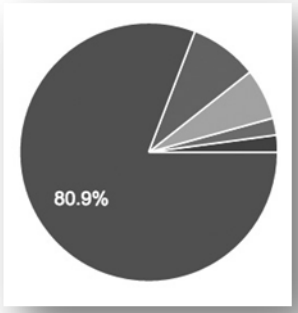

Figure 15. AGW is extremely important

a) Extremely important 80.9%

b) Very important 8.5%

c) Somewhat important 6.4%

d) Not too important 2.1%

e) Not at all important 2.1%

9) How much do you agree or disagree with the following statement: "I could easily change my mind about global warming."

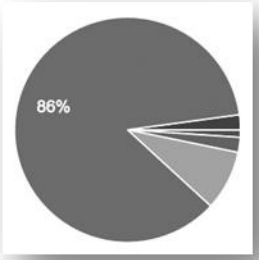

Figure 16. Couldn't easily change my mind about AGW

a) Strongly agree 1.1%

b) Somewhat agree 2.2%

c) Somewhat disagree 8.6%

d) Strongly disagree 86.0%

e) Don't know 2.2%

10) How much do you agree or disagree with the following statement: "I have personally experienced the effects of global warming."

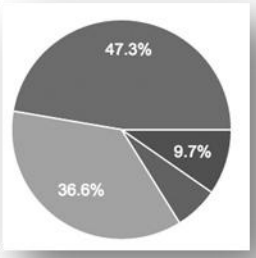

Figure 17. Have experienced effects of AGW

a) Strongly disagree 9.7%

b) Somewhat disagree 6.5%

c) Somewhat agree 36.6%

d) Strongly agree 47.3%

11) How often do you discuss global warming with your family and friends?

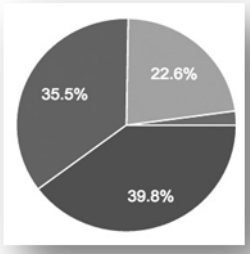

Figure 18. Discuss AGW very often

a) Very often	39.8%
b) Occasionally	35.5%
c) Rarely	22.6%
d) Never	2.2%

12) How many of your friends share your views on global warming?

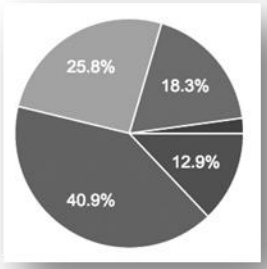

Figure 19. Few friends share my views on AGW

a) None	12.9%
b) A few	40.9%
c) Some	25.8%
d) Most	18.3%
e) All	*2.2%*

13) Over the past 12 months, how often have you written letters, emailed, or phoned government officials to urge them to take action to reduce global warming?

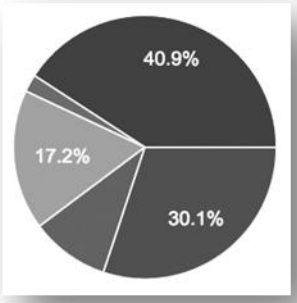

Figure 20. Have never in 12 months contacted official re: AGW

a) Many times (6+) 30.1%

b) Several times (4-5) 9.7%

c) A few times (2-3) 17.2%

d) Once 2.2%

e) Never 40.9%

f) Don't know 0%

14) Over the past 12 months, how often have you rewarded companies that are taking steps to reduce global warming by buying their products?

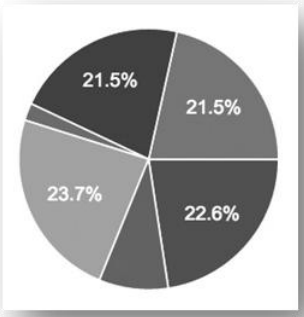

Figure 21. Rewarded companies a few times for fighting AGW

a) Many times (6+) 22.6%

b) Several times (4-5) 8.6%

c) A few times (2-3) 23.7%

d) Once 2.2%

e) Never 21.5%

f) Don't know 21.5%

15) Over the past 12 months, how often have you punished companies that are opposing steps to reduce global warming by NOT buying their products?

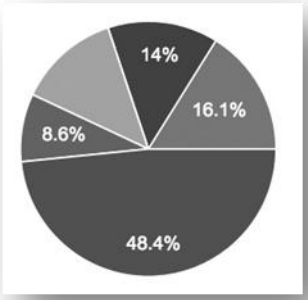

Figure 22. Have punished companies many times for not fighting AGW

a) Many times (6+) 48.4%

b) Several times (4-5) 8.6%

c) A few times (2-3) 12.9%

d) Once 0%

e) Never 14%

f) Don't know 16.1%

16) Over the next 12 months do you intend to buy the products of companies that are taking steps to reduce global warming…

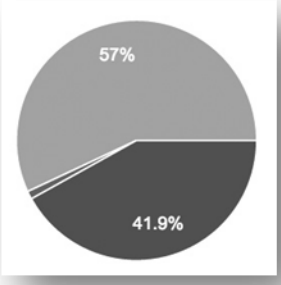

Figure 23. Reward companies more frequently for fighting AGW

a) More frequently 41.9%

b) Less frequently 1.1%

c) About the same 57%

17) Over the next 12 months would you like to punish companies that are opposing steps to reduce global warming by NOT buying their products…

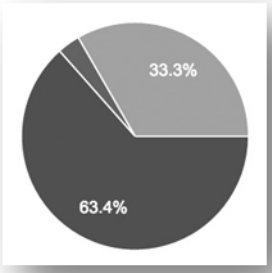

Figure 24. Would like to punish companies who don't fight AGW more frequently

a) More frequently 63.4%

b) Less frequently 3.2%

c) About the same 33.3%

18) How often do you in the winter, set the thermostat to 68 degrees or cooler?

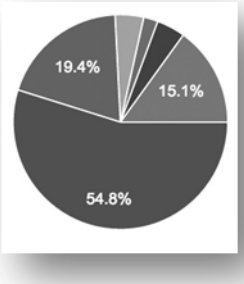

Figure 25. Always set thermostat to 68˚F

a) Always 54.8%

b) Often 19.4%

c) Sometimes 4.3%

d) Rarely 2.2%

e) Never 4.3%

f) Not applicable 15.1%

19) Over the next 12 months, would you like to turn down the thermostat in winter to 68 degrees or cooler…

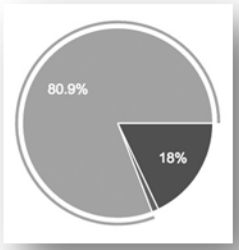

Figure 26. Like to set thermostat on 68˚F same amount

a) More frequently 18%

b) Less frequently 1.1%

c) About the same 80.9%

20) How often do you use public transportation or car pool?

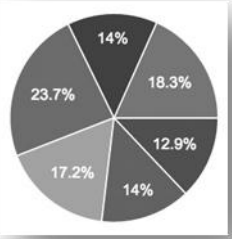

Figure 27. Rarely use public transport or carpool

a) Always	12.9%
b) Often	14%
c) Sometimes	17.2%
d) Rarely	23.7%
e) Never	14%
f) Not applicable	18.3%

21) Over the next 12 months, would you like to use public transportation or car pool…

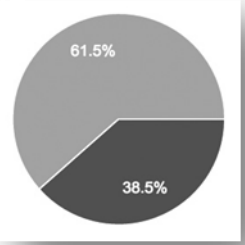

Figure 28. Like to use public transport or carpool same amount

a) More frequently	38.5%
b) Less frequently	0%
c) About the same	61.5%

22) How often do you walk or bike instead of driving?

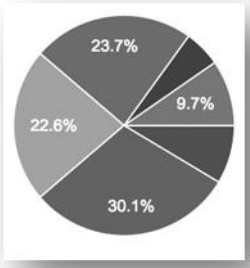

Figure 29. Walk or bike instead of driving often

a) Always	8.6%
b) Often	30.1%
c) Sometimes	22.6%
d) Rarely	23.7%
e) Never	5.4%
f) Not applicable	9.7%

23) Over the next 12 months, would you like to walk or bike instead of driving…

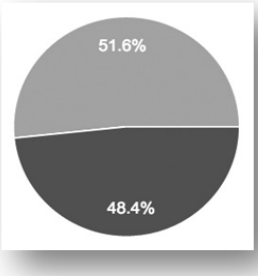

Figure 30. Like to walk or bike same amount

a) More frequently	*48.4%*
b) Less frequently	*0%*
c) About the same	*51.6%*

24) How many of the light bulbs in your home are energy-efficient compact fluorescents (CFLs)?

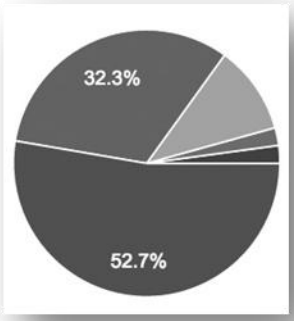

Figure 31. All CFL bulbs

a) All 52.7%

b) Most 32.3%

c) Some 10.8%

d) A few 2.2%

e) None 2.2%

f) Don't Know 0%

25.) If none or few light bulbs are CFL, over the next 12 months, how likely are you to change most of the light bulbs in your home to energy-efficient compact fluorescent lights (CFLs)?

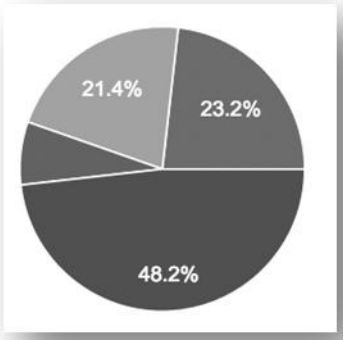

Figure 32. Will change remaining bulbs to CFL

a) Yes, I'd like to and I probably will	48.2%
b) Yes, I'd like to but probably won't	7.1%
c) No	21.4%
d) Don't know	23.2%

26) Do you think global warming should be a low, medium, high, or very high priority for the next president and Congress?

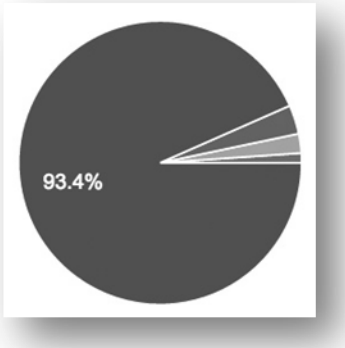

Figure 33. AGW should be very high priority for president/Congress

a) Very high 93.4%

b) High 3.3%

c) Medium 2.2%

d) Low 1.1%

27) Do you think corporations and industry should be doing more or less to address global warming?

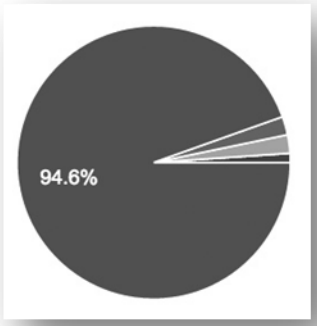

Figure 34. Industry should be doing much more to fight AGW

1) Much more 87.0%

2) More 10.9%

3) Currently doing the right amount 2.2%

4) Less 0%

5) Much less 0%

28) Do you think citizens themselves should be doing more or less to address global warming?

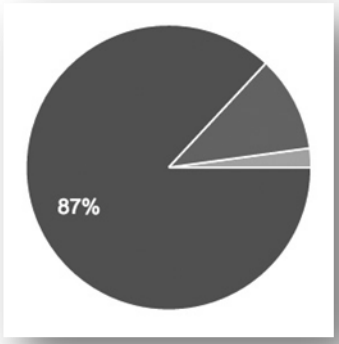

Figure 35. Citizens should be doing much more to stop AGW

1) Much more	87%
2) More	10.9%
3) Currently doing the right amount	2.2%
4) Less	0%
5) Much less	0%

29) How big an effort should the United States make to reduce global warming?

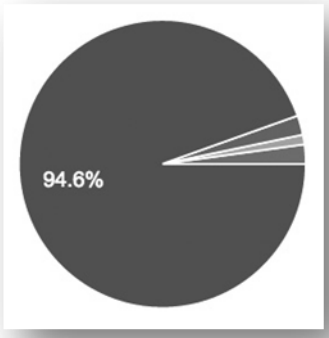

Figure 36. US should make large scale effort to fight AGW

1) A large-scale effort even if it has large economic consequences	94.6%
2) A medium-scale effort even if it has moderate economic consequences.	2.2%

3) A small-scale effort even if it has small economic consequences 1.1%

4) No effort 2.2%

30) People disagree whether the United States should reduce greenhouse gas emissions on its own, or make reductions only if other countries do too. Which of the following statements comes closest to your own point of view?

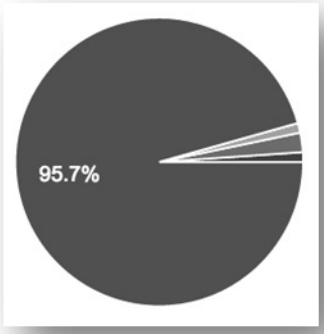

Figure 37. US should reduce GHG emissions regardless of other countries

1) Regardless of what other countries do. 95.7%

2) Only if other industrialized countries (such as England, Germany and Japan) reduce their emissions. 0%

3) Only if other industrialized countries and developing countries (such as China, India and Brazil) reduce their emissions 1.1%

4) The US should not reduce its emissions. 2.2%

5) Don't know 1.1%

Appendix C

Cultural Cognition Quiz: Full Results

(Higher number for odd questions =Individualistic; higher number for even numbered questions= = Communitarian)

1) The government interferes too much in our everyday lives.

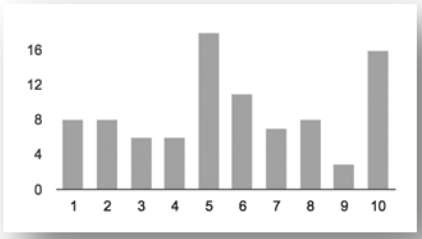

Figure 38. Government interferes

2) Government needs to make laws that keep people from hurting themselves.

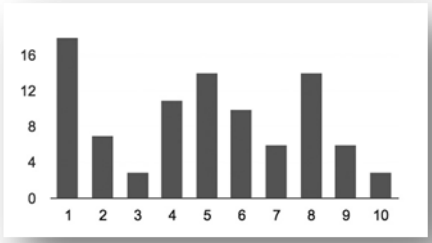

Figure 39. Government keeps people from hurting

3) The government should stop telling people how to live their lives.

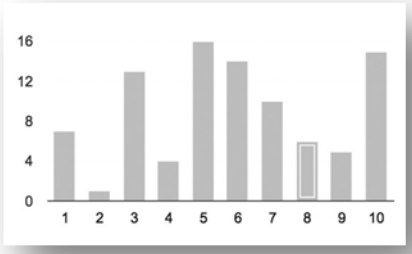

Figure 40. Government stop telling

4) The government should do more to advance society's goals, even if that means limiting the freedom and choices of individuals.

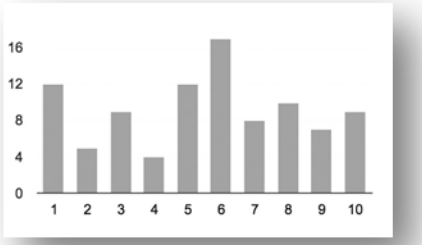

Figure 41. Government advance society

5) Too many people today expect society to do things for them that they should have to do for themselves.

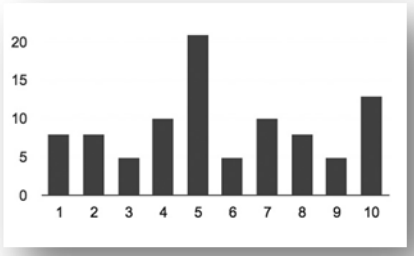

Figure 42. Expect society

6) People should be able to rely on the government for help when they need it.

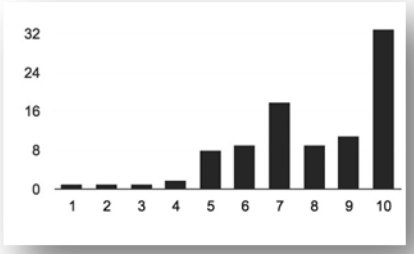

Figure 43. Rely on government

7) Society works best when it lets individuals take responsibility for their own lives without telling them what to do.

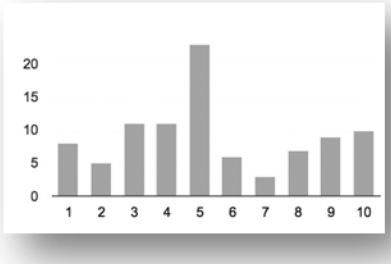

Figure 44. Take responsibility

8) It's society's responsibility to make sure everyone's basic needs are met.

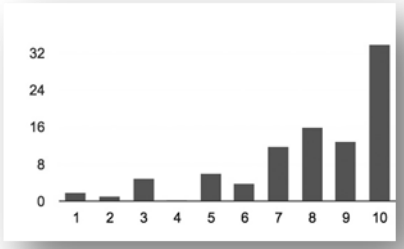

Figure 45. Government's responsibility

9) People who are successful in business have a right to enjoy their wealth as they see fit.

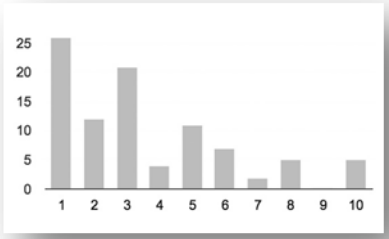

Figure 46. Spend wealth

10) Taxes should be higher on the wealthy as a fair way of getting them to share the benefits society gives them.

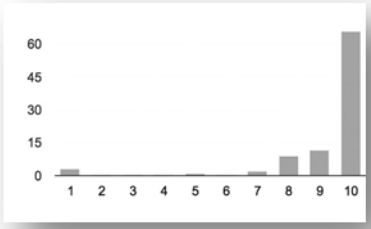

Figure 47. Higher taxes

Part Two: Higher Odd =Egalitarian; Higher Even= Hierarchist

11) Our society would be better off if the distribution of wealth was more equal.

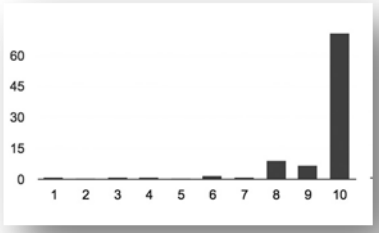

Figure 48. Equal distribution

12) Nowadays it seems like there is just as much discrimination against whites as there is against blacks.

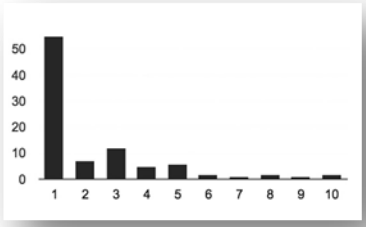

Figure 49. Discrimination

13) We need to dramatically reduce inequalities between the rich and the poor, whites and people of color, and men and women.

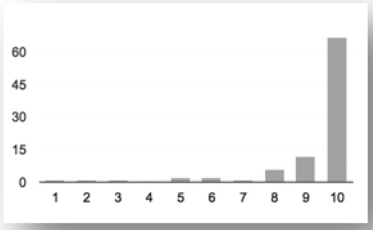

Figure 50. Reduce inequality

14) It seems like blacks, women, homosexuals and other groups don't want equal rights, they want special rights just for them.

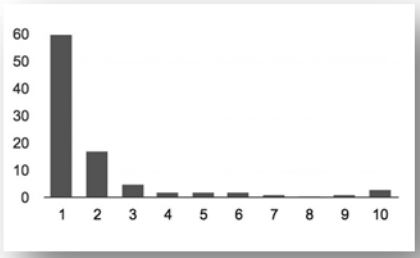

Figure 51. Special rights

15) It's old-fashioned and wrong to think that one culture's set of values is better than any other culture's way of seeing the world.

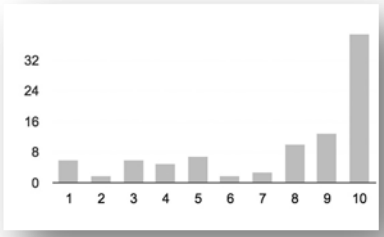

Figure 52. Culture values

16) The women's rights movement has gone too far.

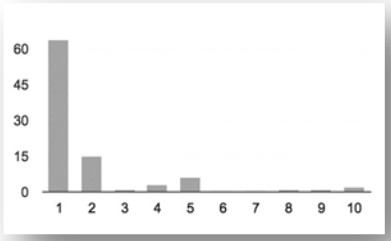

Figure 53. Women's movement

17) We live in a sexist society that that is fundamentally set up to discriminate against women.

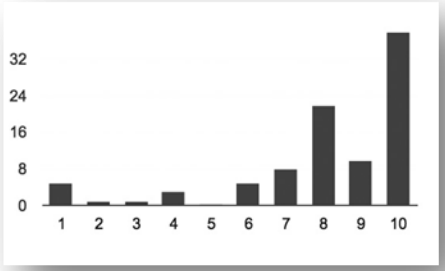

Figure 54. Sexist society

18) A lot of problems in our society today come from the decline in the traditional family, where the man works and the woman stays home.

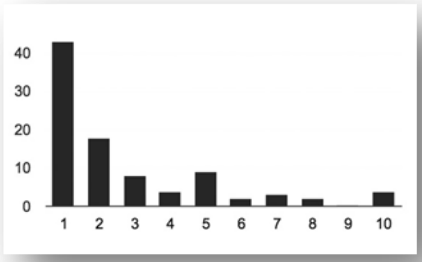

Figure 55. Decline in family

19) Parents should encourage young boys to be more sensitive and less rough and tough.

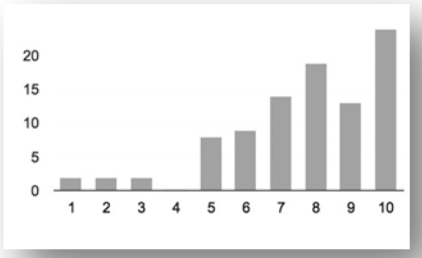

Figure 56. Sensitive boys

20) Society as a whole has become too soft.

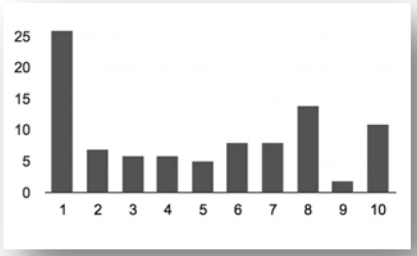

Figure 57. Society soft

Appendix D

Demographics

1) Fifty-percent of respondents was women, and 50% were men.

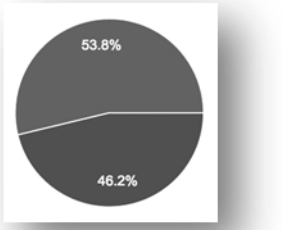

Figure 58. Gender

2) Seventy-eight point five percent was heterosexual; 6.5% was homosexual; 8.6% was bisexual; 4.3% was asexual; 2.2% say “other.”

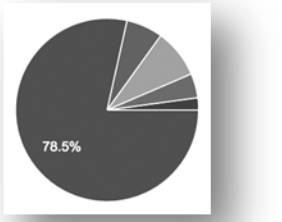

Figure 59. Sexual orientation

3) Eighty-five point nine percent of respondents was white; 7.6% was mixed race; 1.1% was Asian; 1.1% was Latino and 4.3% was "other."

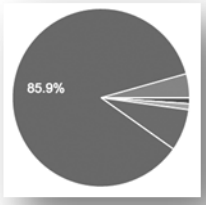

Figure 60. Ethnicity

3) Education

Twenty-one percent of respondents had taken some college courses; 21.5% have Bachelor's degrees; 11.8% had taken some graduate courses; 22.6% had Master's degrees; 15.1% have Doctoral degrees; 3.2% had been to trade school; 4.3% had attended secondary (high) school.

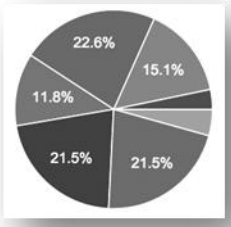

Figure 61. Education

4) Sixty-one percent of participants was between the ages of 45 and 64 years old. 20.4% was between 65-74 years old; 9.7% was between 25-44 years old; 3% was above 74 yrs.

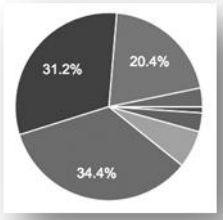

Figure 62. Age

5) **Political Affiliation Results of political demographic distribution, with "other" category**

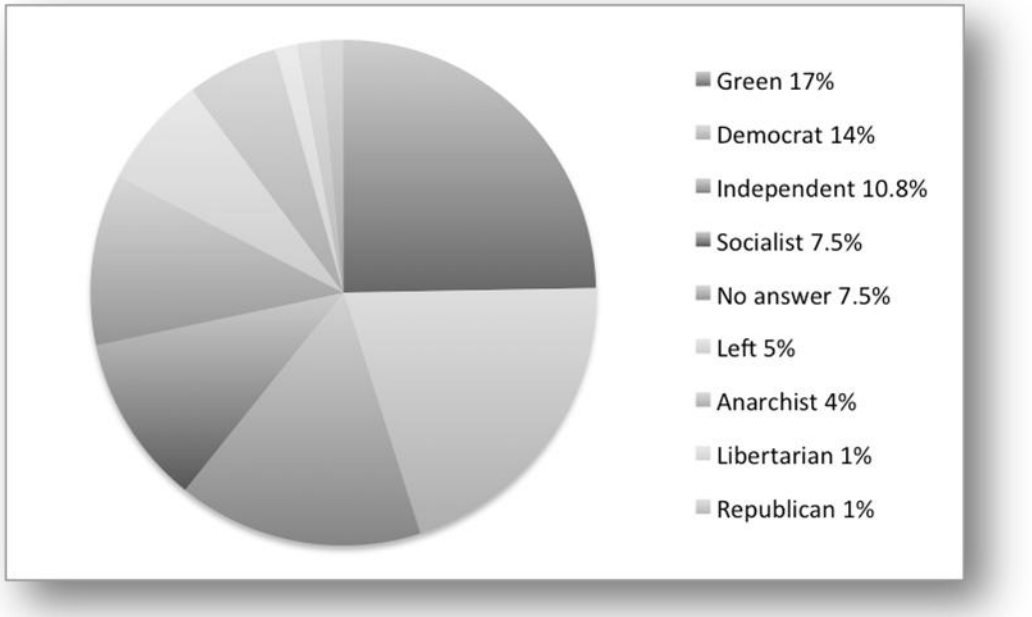

Figure 63. Political affiliation

Political Affiliation. Seventeen percent was Green; 17% had no political affiliation; 14% was Democrat, 10.8% was Independent; 7.5% was socialist or Marxist; 7.5% gave no answer; 5% identified as left; 4% identified as anarchist; 1% was Libertarian; one Republican; and one identified as "other." Interesting answers: "Egalitarian;" "non;" "disloyal democrat;" "Democrat – but; really Green;" "Anti-Republican;" "Green Party

(With Socialist Beliefs);" "Green capitalist;" "Zazenista;" "so far left it doesn't matter;" "Radical left wing / populist;" "you don't need to know that;" "Green by choice, D by default;" "Well left of centre;" "Raging Democrat;" "Anti-Corporate;" "Left wing anarchist;" "Democrat (but left of most)."

Religion. Thirty one percent of respondents was atheist, 13% was agnostic and 7.5% identified with some type of Christianity; 5.4% identified as pagan; 4.3% had no religion; 3% was spiritual; 2% identified with some form of Judaism; 1% with Islam.

Some of the more interesting responses were: "all and none"; "dyslectic church of dog"; "Quantum Physics"; "LOVE"; "earthling"; and "just another fuckn Jedi drunkard." Sixty percent of respondents used mindfulness practice, and many mentioned using Buddhist meditations on impermanence in order to cope with ACC.

Nationality. Sixty percent of respondents was a US citizen; 8.6% was Canadian; 8.6% had dual citizenship; and 8.6% did not answer; two percent was British; 2% was from New Zealand; one percent was from Australia and 1 percent was from Germany.

Occupation. Of the 70 respondents who answered, the occupational breakdown was as follows: Helping professions /moms 8%; agriculture/animals 7%; computers/technology 4%; activists 5%; engineer 2%; arts literature 9%; retail /business 10%; professions 3%; scientist 4%; retired 18%; education 9% unemployed 4%; disabled 2.

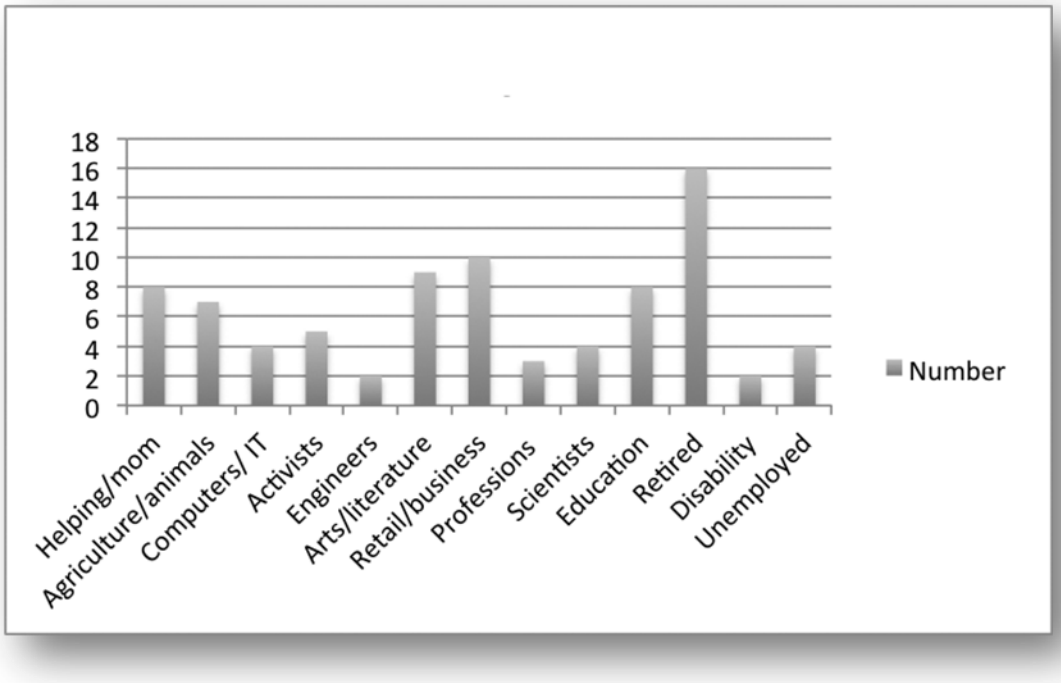

Figure 64. Occupation

Appendix E

Demographic Survey Questions

1) What is your age?

18-24

25-34

35-44

45-54

55-64

65-74

75-84

85-94

95+

2) What is your gender identity?

F

M

Other:

3) What is your sexual orientation?

Heterosexual

Homosexual

Bisexual

Asexual

Other:

4) What is your ethnicity?

Asian

Black

Latino

Mixed race

Native

Pacific Islander

White

Other:

5) What is your education level?

Primary school

Intermediate school

Secondary school

Some college

Bachelor's degree

Some graduate school

Master's degree

PhD

Trade school

Street smart

6) What is your religion?

Atheist

Agnostic

Other:

7) What are your preferred news sources?

8) What is your political affiliation?

9) What is your nationality?

10) What is your occupation?

11) What is your annual income?

$0-999

$1000-7999

$8000-14999

$15000-19999

$20000-39999

$40000-59999

$60000-99999

$100000-199999

$200000-499999

$500000-999999

$1000000+

12) What is your marital status?

Single

Married

Divorced

Widowed

Domestic Partnership

13) Do you have children?

Yes

No

14) Do you have grandchildren?

Yes

No

15) Where do you currently live?

Urban city

Suburban town

Rural village

Farm

Wild land interface

Other:

16) Where would you prefer to live?

Urban city

Suburban town

Rural village

Farm

Wild land interface

Other:

17) Do you have a food producing garden?

Yes

No

18) Do you have one or more pets?

Yes

No

19) Is there anything else you would like to tell the researcher about your experience with narratives on catastrophic abrupt climate change?

PERMISSIONS:

Do you agree to allow the researcher to publish direct quotes from your anonymous essays in her research paper?

Appendix F

Feedback loops and tipping points in the climate system

1) Arctic methane hydrates
2) Antarctic methane hydrates
3) New Zealand methane hydrates
4) Washington coast methane hydrates
5) Arctic Sea Ice melt
6) Antarctic ice melt
7) Siberian methane vents
8) Peat decomposition
9) Shrub invasion
10) Greenland Icesheet Darkening
11) Arctic fires
12) Increased lightning strikes
13) Increased glacier cracking due to CO_2
14) Beaufort Gyre reversing course
15) Increase of bacterial conversion of soil in sunlight
16) Microbes
17) SW drought dust lands on snowpack
18) Canadian floods into McKenzie Delta
19) Thermohaline conveyer belt collapses
20) Jet stream collapses
21) Decreased albedo
22) Drought induced tree mortality releases CO_2
23) Ocean acidification reduced release of DMS
24) Acidification favors jellyfish who add to CO_2
25) Sea level rise causes slope collapse CH_4 release
26) Ocean warming reduces plankton and O_2
27) Earthquakes cause CH_4 warming causes Eathquakes
28) Arctic ponds release CO_2
29) CH_4 mixed by jet stream raises local temps
30) Fewer clouds form /drought reduce albedo
31) Thawing permafrost biogenic methane.
32) Hole in the troposphere increases LLGHG
33) Deep ocean currents slow less CO_2 uptake
34) Increased CO_2 causes more soil CO_2. 35) Increased temps cause more soil CO_2
36) Less Arctic ice means bigger waves and less ice
37) Higher temps release ocean CO_2

38) Temps increase water vapor increases temps increase
39) Ocean stratification melts glaciers faster
40) Open ocean traps infra red heat
41) Arctic drilling
42) Decreased albedo decreases OH 43) Decreased ozone decreases OH
44) Isostatic rebound from glacial melt causes seismicity

Appendix G

Examples of coded responses:

1) Personal experiences of abrupt climate change related phenomena

Extreme or unpredictable weather/ storms = periwinkle
Flood heavy rain = royal blue
Drought = brown
Plant death, disease, migration, early bloom = green
colder weather = aqua
Animal/insect change in distribution/frequency/behavior = black
forest fires = orange
hotter weather = red
sea level rise = indigo
<u>other places on news</u> = underlined
no observeable evidence = italicized

2) Sharing narrative on abrupt climate change

Withhold/ negative response/ isolation = red
Yes/ open conversation/ some aspects/ positive experience =green
Actions/ attitudes/ goals details = black
online / facebook = pink

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