

# The Impact of Global Climate Change on Provoked Anxiety and Depression

## A Primer for Counselors

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#### Abstract

A vast majority of climate change researchers are motivated by the preservation of human lives and the environmental conditions which enable them. Global climate change as a scientific issue has in the past several decades become by way of a game of chess played by two players, contention, and politics. Consequently, the rise of anxiety due to unpredictability of these moves become crucial for human beings. This article describes the impact of four classes of climate change (rising temperature, rising sea levels, increasing CO<sub>2</sub>, and more extreme weather); two modes of exposures (audio visual exposure and no exposure); and three threats as the source of anxiety (threat to physiological needs, threat to safety and security needs, and threat to human relationship). The recent analysis shows that across a spectrum of research domains only threat to physiological needs and safety and security needs provokes anxiety. Furthermore, the most impacting classes of climate change which contributed to the incitement of anxiety were impacts of more extreme weather, rising temperature, and increasing CO<sub>2</sub>. Additionally, the analysis of data suggests that interaction effects of different classes of climate change in regard to sources of threats and modes of exposure were significant, where the mode of exposure by itself as main effect was not significant. Climate change's desolation, from severe storms and droughts to heat waves and more-polluted air, is a complex phenomenon that manifest itself to increase humans' rates of anxiety, depression, and traumatization. Allocation of resources to raise the awareness of public to fragility of our planet and policy developers are in a grave need.

*Keywords:* Global, Climate change, Anxiety, Greenhouse gas, Psychological well-being.

#### Introduction

Rapid changes in the global climate are attributable to human behavior (Swim, Clayton, & Howard, 2011). The debate on the impact of the phenomenon of global climate change on the planet and its residents can be sadly illustrated as a dance of pawns on the chess board of coexistence. Moves and countermoves of greed and common sense have been steering the choreography of chaos. Ignorant of the forces of nature, proposals to silence the voice of logic and the fragility of this blue planet and its residences has reached a critical point. In the lieu of these

moves, people's anxiety and distress about this phenomenon are the threatening mental health and well-being of the global population, according to the U.S. Global Change Research Program (2016). Hulme believes that the full story of climate change is an unfolding story which is transforming the way we think, feel, and act (2009, p. xxviii).

## Literature Review

Climate change is a term that refers to major changes in temperature, rainfall, snow, or wind patterns lasting for decades or longer (EPA, 2010) and the greatest contributing factor to these changes has scientifically correlated to the greenhouse gas indicator. Earth is surrounded by a cover of gases, an atmosphere which permits most of the light from the sun and other cosmic rays to pass through and ultimately reach the surface. Light is absorbed by the earth's surface and converted into heat energy. This heat energy is re-emitted by the surface of the earth during night. Due to the excessive presence of some gasses in the atmosphere, this escape of heat from the earth's surface is prevented, resulting in increased temperature referred to as global warming. The gasses which are responsible for causing global warming are called 'greenhouse gasses' (IPCC, 2013). The cause of climate change is either initiated by people or nature resulting in a shift in Earth's equilibrium (NASA, 2016). Clearly, human consumption of fossil fuels, deforestation, over-developing lands for farming, and expansion of cities and roads greatly increase the release of greenhouse gases into the atmosphere. Alternatively, the natural causes include changes in the Earth's orbit, the sun's intensity, the circulation of the ocean and atmosphere, and volcanic activity. Although the Earth's climate has changed many times throughout history, the rapid warming seen today cannot be explained by natural process (EPA, 2010).

Today's scientific community is largely in agreement that human activities have a drastic effect on the ecology of this planet due to accumulation of greenhouse gases, increasing temperatures, and changes in the hydraulic cycle of our planet (Doppelt, 2016 and Wier, 2016). According to the World Health Organization (WHO), these climatological alterations are having significant and devastating consequences on a wide variety of health issues including psychological distress (WHO, 2007). These catastrophic changes are being witnessed in many forms including heat waves, prolonged droughts, catastrophically powerful storms, the rise in sea level, and polluted air (Haines, A. & Patz, J, 2004) all of which have astronomical psycho-economic costs. According to an estimate by Psychologist for Social Responsibility (PSR), billions of dollars in human capital will be lost as people, jobs, and families are displaced and infrastructure is damaged or destroyed (PSR, 2015), and ultimately people struggle with excruciating psychological responses to all of climate change's harm. An ever-growing body of research in this area points to the grave impact climate change is having on mental health and people's sense of well-being, particularly in the population of those with preexisting serious mental illness (Costello et al., 2009; Fritze, Blashki, Burke, & Wiesman, 2008; Page & Howard, 2010). Sadly, this chaotic game of chess appears to be rapidly coming to an end. As we delay our commitment to make changes and slow our responses with outdated attitudes toward climate change we increase the potential that our action, or lack of action, causes more psychological and physical harm (Neria, P. & Shultz, M, 2012). In another words, at the rate we are going with regard to our contribution to greenhouse gas emissions, the ultimate checkmate is inevitable.

## Greenhouse Gas (GHG)

Since the notion of ecology consists of distributions, abundance, and relations of organisms and their interactions with the environment (Kerbs, 2009), the balance between the chemistry of the planet and its residences becomes vitally important. This orchestrated harmony requires a diligent stability between activities and functions of plants, animals, and the human population for evading catastrophic consequences (Wolfson, 2011). Unfortunately, the overwhelming reservoir of greenhouse gas emissions has been created by the industrialized countries. Thus, threatening the balance of this harmony between nature and people. The human footprint has been left all over the planet (NASA, 2016).

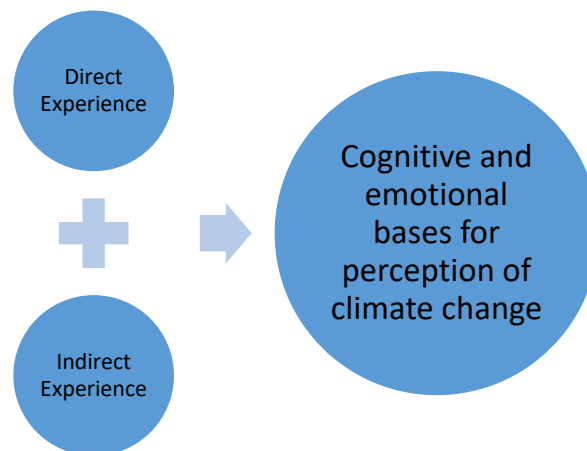
Greenhouse gas is a form of gas in the earth's atmosphere that absorbs and releases radiation from the sun within the thermal infrared range (Sathaye & Meyers, 2010). The primary greenhouse gases in the Earth's atmosphere are water vapor (H<sub>2</sub>O), carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), CFC's (Chlorofluorocarbons- Freon gas), and ozone (O<sub>3</sub>) (Karl and Trenberth, 2003). In addition to these main greenhouse gases, NASA (2016) has identified other gases which have a high potential to cause global warming, including: Sulfur Hexafluoride, hydrofluorocarbons, perfluorocarbons, and nitrogen trifluoride. Without greenhouse gases, the average temperature of Earth's surface would be approximately – 18 degrees Celsius, which is equivalent to 0 degrees Fahrenheit; rather than the current average of 15 degrees Celsius, which is roughly equivalent to 59 degrees Fahrenheit (GISS, 2016). In addition, infrared light is used in heat lamps in restaurants to keep food warm and is also emitted from ordinary light bulbs and these proportionally contribute to the greenhouse gas emission phenomenon (World Resources Institute, 2015). If the air gets too hot, Kitchen (2014) reported, the balance of life will be disrupted. Species of plants and animals will die and the food chain could be disturbed. Mora (2013) predicated if the greenhouse gas emissions continue at the existing rate, Earth's surface temperature could exceed historical levels as early as 2047, with potentially harmful effects on ecosystems, biodiversity, and the livelihood of humans on this planet. Subsequently Earth absorbs radiant energy received from the sun and reflects some of it back in the form of light and heat. Earth's temperature balance becomes dependent on this equilibrium of incoming and outgoing energy (Kitchen, 2014). Since global warming leads to an imbalance of Earth's temperature, this energy balance translates to drastic changes in temperature (EPA, 2016). Basically, carbon dioxide absorbs heat. The more carbon dioxide there is in the atmosphere, the warmer the air will be.

### How People Perceive Climate Change?

Over one third of the people on Earth are not aware of climate change and conversely, two thirds of Earth's population is perceiving climate change in a wide range of ways from an unfathomable phenomenon to a comprehensible problem (Berett, 2009). Over that past three decades, there has been growing interest and increased awareness in the impact of climate change on mental health (NASA & GISS, 2016). Since the climate continues to change, the risks to human physical and psychological health will increase, escalating existing health threats and creating new public health challenges, consequently impacting more people of all ages in more places globally (Kitchen, 2014). According to the International Disaster Database (IDD) the perceived climate change and its impact on cognitive and emotional domains are generally provoked by direct or indirect exposure of people to both fact and fiction about climate change (IDD, 2011). According



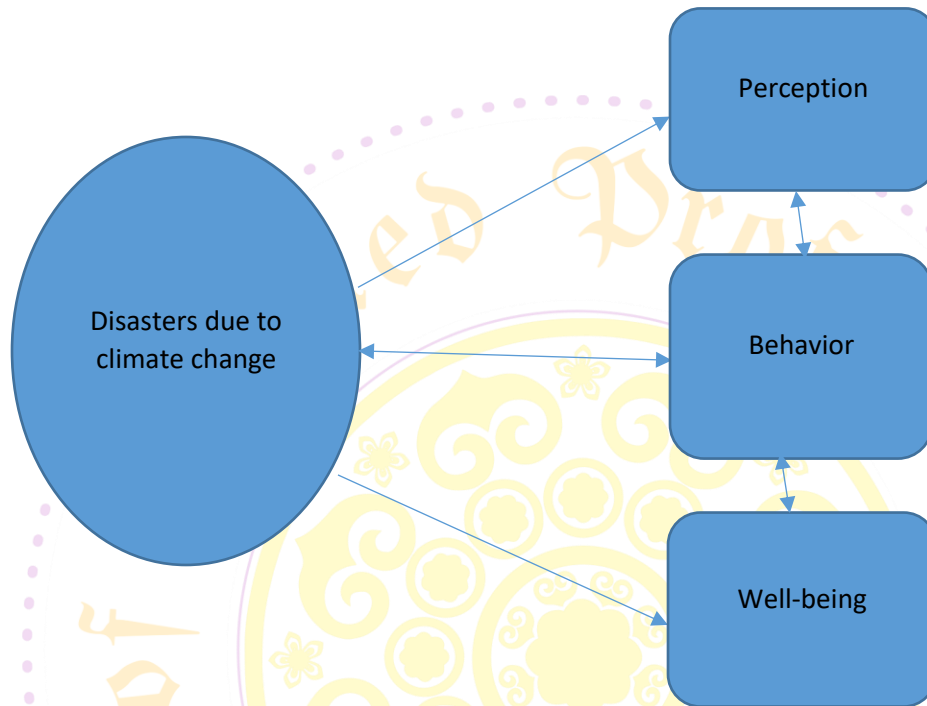
to this report, direct exposure constitutes being a victim of one of the catastrophic natural climate events. Indirect exposure constitutes gaining information from media, personal reading, or hearing from others. Figure 1 illustrates a general model of how people perceive climate change independent from their beliefs about the notion of climate change. Individuals perceive climate change either by directly or indirectly being exposed to these changes (heat waves, prolonged droughts, more powerful storms, rise of sea level, air pollution, etc.) Based on the IDD data bank, cognitive and emotional structures form neurological patterns of behaviors which regulate the individual's emotional responses, ranging from manageable to pathological.



**Figure 1:** Pattern of people's perception climate change

The impact of global climate change on human emotional regulation, particularly in regard to anxiety and depression has been the subject of several researchers (Kitchen, 2014). Furthermore, the effects of disasters precipitated by global climate change is evident in the form of anxiety, depression, post-traumatic stress, interpersonal conflict, family stress, persistent grief, and child behavioral and academic problems (Rosenzweig<sup>1</sup>, David Karoly<sup>2</sup>, & et al, 2008) . Doherty and Clayton (2011) reported three classes of psychological impact of climate change: direct (acute or traumatic effects of extreme weather events and changed environment); indirect (threats to emotional well-being based on observation of impact and concern or uncertainty about future risks); and psychosocial (chronic social and community effects of factors such as heat, drought, migrations, climate-related conflicts, and post disaster adjustment.) According to a study by Carroll, Morbey, Balogh, and Araoz (2009) devastating floods can cause panic attacks, difficulty sleeping, low motivation, and obsessive behavior. Persistent distress and anxiety may be especially prevalent in children and youth (Simpson, Weissbecker, & Sephton, 2011). In a study of young people who were in a drought-affected area, Carnie, Berry, Blinkhorn, and Hart (2011) discovered that young people felt excessive levels of distress and reported being anxious about their families, overwhelmed, isolated, and worried about the future. The initial severe trauma of the disaster is often replaced with a set of long-standing psychological stressors (Crabtree, 2012; Alderman, Turner, & Tong, 2012; and Simpson, Weissbecker, & Sephton, 2011). These debilitating psychological consequences are due to exposure to catastrophic climate change. They include stress-related disorders resulting from abnormal responses to acute or prolonged anxiety, distorted perception, and other harmful psychological consequences (Lowe, Manove, & Rhodes, 2013). Stress can also be accompanied by depression, worry about future disasters, feelings of

vulnerability, helplessness, mourning, grief, and despair (Neria & Shultz, 2012). These devastating psychological consequences due to exposure to catastrophic climate change severely impacts human perception, feelings and behavior. Figure 2 illustrates the linkage between climate change disasters and human perception, behavior and well-being.



**Figure 2:** Processing disasters caused by climate change

A vast body of research has identified various results of climate change on human well-being, including psychological trauma (Neria and Shorts, 2012); grief (Shears et al, 2011); loss of autonomy (Seeley, 2012); helplessness and depression (Albrecht, 2011) strain on social relationships (Simpson, Weissbecker, and Sephton, 2011); loss of personal identity and decline of problem solving skills (Dittmar, 2012); and occupational identity loss (Stain et al, 2011). While certain effects of climate change can be beneficial, particularly, in the short-term, current and future effects of climate change pose considerable risks to people's psychological well-being and physical health (EPA, 2010). Overall, widespread scientific agreement divulges that the world's climate is changing at a fast pace. Some of these changes will likely include more variable weather, heat waves, heavy precipitation events, flooding, droughts, more intense storms, sea level rise, and air pollution (Mora, 2013) and each of these impacts could negatively affect public health. The purpose of this study is to examine college student's perception of how climate change impacts human psychological well-being. Four causes of climate change, addressed by the Center for Disease Control: raising temperature, more extreme weather, increasing CO<sub>2</sub>, and rising sea level (CDC, 2015) were used as eliciting sources for psychological stressors. Two psychological

symptoms, namely anxiety and depression, were assessed to determine the magnitude of psychological well-being of participants.

## Methodology

### Participants

Participant of this study consisted of ( $N = 120$ ) undergraduate and graduate students from Jackson State University in Jackson, Mississippi. These participants were randomly assigned to groups. The first group included 50 undergraduate and graduate students (50% undergraduate students and 50% graduate students) who were exposed to a 10 minute visual presentation about various forms of climate change disaster images. The second group included 50 undergraduate and graduate students (50% undergraduate students and 50% graduate students) who were not exposed to any presentation of climate disaster related images. The participants were 70% female and 30% male ranging in age from 19 to 58 ( $M = 38.5$ ). Climate change images consisted of floods, hurricanes, drought, displaced people due to climate change, and rise of sea level.

### Measures and procedures

Flourishing stress-related symptoms were indexed by a 33-item measure of four causes of climate change based on the CDC (2015) classification. Namely, rising temperature, more extreme weather, increasing CO<sub>2</sub>, and rising sea level as eliciting sources for psychological stressors. Items tapping psychological distress measure anxiety, control over physiological needs, and internal locus of control over needs for safety and security. Diagnostic criteria for identifying the presence of stress-related symptoms were deployed in most of the items. The participants cast their responses based on three levels of 1 (*Not all*), 2 (*Maybe*), and 3 (*Undoubtedly*) to indicate the extent to which they felt the impact of climate change.

Participants in group one were exposed to a 10 minute visual presentation (slide show) about various forms of climate change disaster images. These images consisted of catastrophic changes in many forms such as heat waves, prolonged droughts, more powerful storms, rise of sea level, and polluted air. Additionally, some statistical data were included in this visual presentation. The second group was not exposed to any of these images. All the participants were furnished with informed consent that included information and about the process of this experiment.

### Research Hypotheses

1. There is no statistically significant main effect of the four impacts of climate change on provoking anxiety.
2. There is no statistically significant main effect of the two modes of exposure on provoking anxiety.
3. There is no statistically significant main effect of three source threats on provoking anxiety.
4. There are no statistically significant interaction effects of the impact of climate change and source of threats.
5. There are no statistically significant interaction effects of the impacts of climate change and mode of exposure.

6. There are no statistically significant interaction effects of the source of threats mode of exposure.
7. There is no statistically significant interaction effects of the source of threats, mode of exposure, or impacts of climate change

### Research Design and Statistics

A 4x2x3 factorial design (Mukerjee & Mu, 2006), was used to test the significance of 4 main effects- forms of climate change impact, 3 threats as source of anxiety, and 2 modes of exposure; and interaction effects of exposure. This design provides access to the main and interaction effects of three independent variables namely (a) four impacts of climate change classification (rising temperature, rising sea levels, increasing CO<sub>2</sub>, and more extreme weather); (b) two modes of exposures (audio visual exposure and no exposure); and (c) three threats as the source of anxiety (threat to physiological needs, threat to safety and security needs, and threat to human relationship). Randomization was used to assign subjects to different exposures. Self-selection of sessions was substituted for random assignment of subjects to groups. The groups were then assigned at random to 2 conditions. The dependent variable was the score on a measure of anxiety.

### Results

This study was designed to determine the effects of fours forms of climate change and two modes of exposure on production of three sources of threat related to provoking anxiety. Mean and standardizations were found for all three sources of threat and four forms of climate change. The seven null hypotheses that were formulated were tested for significance by 4x2x3 weighted means factorial analysis of variance for equal cell. Data in Table 1 shows differences among the means of the four forms of climate change. As illustrated in table 1, descriptive statistics indicates that more extreme weather causes the most impact on stress level and anxiety, and rising sea level has the least impact. The report of More Extreme *Weather* ( $M = 4.36, DS = 1.02$ ) were significantly higher than Rising Sea Level ( $M = 2.07, SD = 1.11$ ).

**Table 1:** Mean and Standardization for Forms of Climate Change.

Forms of Climate Change	Mean	Standardization
Rising Temperature	3.41	1.06
Rising Sea Level	2.07	1.11
More Extreme Weather	4.36	1.02
Increasing CO <sub>2</sub>	3.76	1.13



Table 2 demonstrated that the anxiety due to climate change is rooted in threats to physiological and safety and security needs ( $M = 4.63, SD = 1.06$  and  $M = 4.06, SD = 1.17$ ) more than threats to human relationships ( $M = 2.89, SD = 1.12$ ).

**Table 2:** Mean and Standardization for threat as a source of anxiety via modes of exposure.

Threats as source of anxiety	Means (WAV/WN)	Standardizations (WAV/WN)
Physiological	4.63/3.07	1.06/1.51
Safety and Security	4.06/2.88	1.17/1.02
Human relationship	2.89/3.05	1.12/1.33

The observation based on table 2 suggests the transpose of several crucial themes based on the perception of college students participating in this experiment. This table explains the impact of climate change on provoking anxiety is rooted in threats via two modes of exposures. This data suggest that physiological threats and safety and security threats (*Means 4.63/3.07 and 4.06/2.88*) are more perceived by students, independent from modes of exposure.

**Table 3:** Analysis of Variance Summery table for 4X2X3 Factorial Design.

Source of Variance	df	SS	MS	F
Impact of Climate Chang (C)	3	2567.14	855.71	21.93*
Sources of Threat (T)	2	934.53	467.17	11.97*
Mode of Exposure (E)	1	37.41	37.41	0.96
CT	6	1391.65	231.45	5.93*
CE	3	80.06	26.69	0.69
TE	2	887.96	443.98	11.37*
TCE	6	1109.08	184.84	4.74
S/TCE	96	3746.49	39.02	

\* $P < 0.01$

Table 3 provides a breakdown of the main effects and interaction effects of three threats as a source of anxiety, four impacts of climate change, and two modes of exposures. The null hypothesis number two indicates that the mode of exposure did have any impact and the hypothesis failed to reject. However, the main effects of impacts of climate change  $F(3, 96) = 21.93, p < 0.1$  and the main effect of sources of threat  $F(2, 96) = 11.97$  indicates that hypothesis 1 and 3 are rejected. Therefore, all four forms of climate change have significant potential to provoke anxiety and this anxiety is significantly provoked by threats to physiological needs, safety and security needs, and human relationship. Furthermore, the interaction of climate change and source of threats  $F(6, 96) = 5.96, p < 0.1$  and the interaction effect of climate change and modes of exposure  $F(2, 96) = 11.37, p < 0.1$  were both significant. As a result, the null hypothesis of 4 and 6 are rejected. Additionally, the data from the interaction effect of climate change, source of threats, and mode of exposure, indicates that null hypothesis 7 is not rejected  $F(6, 96) = 4.74, P < 0.1$ .

## Conclusion and Summary

The mounting evidence for the bearing of global climate change and its psychological impacts on humans has been the focus of many researchers. This rapidly unfolding environmental change is deeply associated with acute and chronic psychological impact (Yardley, 2007). Addressing psychological well-being and the role of climate change was the bedrock of this study. Since this study is designed to test the impact of various climate change in provoking anxiety as the threat to well-being, three themes emerged. Theme 1: Climate change does not impact human relationship as much as it impacts physiological and safety and security needs in regard to provocation of anxiety. Theme 2: The greatest source of anxiety in this geographical area is due to impact of severe weather threats and the increasing level of CO<sub>2</sub>. Theme 3: Anxiety due to climate change is likely to have significant negative effects on humans regardless of being expose to audio visual presentation, experiencing it, or just thinking about it. This article addresses several vital issues related to challenges the human race is facing for the future of our planet and all its living residents. As chess is a logical game and moves can be predicated, we would be wise to plan our next moves carefully.

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