The Development and Validation of a Scale to Measure Climate Change Anxiety

DOCTORAL DISSERTATION

Submitted to the Faculty of Graduate Studies

at the University of Prince Edward Island

in partial fulfilment of the requirements

for the degree of

Doctor of Psychology

by

Allegra Netten

Under the supervision of Drs. Jason Doiron and Michael Arfken

University of Prince Edward Island

Charlottetown, PE

August 2022

THESIS/DISSERTATION NON-EXCLUSIVE LICENSE

Family Name: Netten	Given Name, Middle Name (if applicable): Allegra, Stockwood
Full Name of University: University of Prince Edward Island	
Faculty, Department, School: Faculty of Arts, Psychology	
Degree for which thesis/dissertation was presented: Doctor of Psychology (PsyD)	Date Degree Awarded: N/A (anticipated September 2023)
Thesis/dissertation Title: The Development and Validation of a Scale to Measure Climate Change Anxiety	
Date of Birth. It is **optional** to supply your date of birth. If you choose to do so please note that the information will be included in the bibliographic record for your thesis/dissertation.	

In consideration of my University making my thesis/dissertation available to interested persons, I, Allegra Netten, hereby grant a non-exclusive, for the full term of copyright protection, license to the University of Prince Edward Island to :

(a) to archive, preserve, produce, reproduce, publish, communicate, convert into any format, and to make available in print or online by telecommunication to the public for non-commercial purposes;
(b) to sub-license to Library and Archives Canada any of the acts mentioned in paragraph (a).

I undertake to submit my thesis/dissertation, through my University, to Library and Archives Canada. Any abstract submitted with the thesis/dissertation will be considered to form part of the thesis/dissertation.

I represent that my thesis/dissertation is my original work, does not infringe any rights of others, including privacy rights, and that I have the right to make the grant conferred by this non-exclusive license.

If third party copyrighted material was included in my thesis/dissertation for which, under the terms of the *Copyright Act*, written permission from the copyright owners is required I have obtained such permission from the copyright owners to do the acts mentioned in paragraph (a) above for the full term of copyright protection

I retain copyright ownership and moral rights in my thesis/dissertation, and may deal with the copyright in my thesis/dissertation, in any way consistent with rights granted by me to my University in this non-exclusive license.

I further promise to inform any person to whom I may hereafter assign or license my copyright in my thesis/dissertation of the rights granted by me to my University in this non-exclusive license.

Signature	Date 26/10/2022

University of Prince Edward Island

Faculty of Arts

Charlottetown

CERTIFICATION OF DISSERTATION WORK

We, the undersigned, certify that *Allegra Netten*, candidate for the degree of Doctor of Psychology (PsyD) at the University of Prince Edward Island, Canada, has presented a dissertation, in partial fulfillment of the degree requirements, with the following title: *The Development and Validation of a Scale to Measure Climate Change Anxiety*, that the dissertation is acceptable in form and content, and that a satisfactory knowledge of the field covered by the thesis was demonstrated by the candidate through an oral examination held on July 26, 2022.
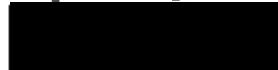
Examiners:

Committee Chair

Jessica V Strong, PhD, ABPP

Supervisor

Jason Doiron, PhD

Co-Supervisor (if applicable)

Michael Arfken, PhD

Supervisory
Committee member

Nino Antadze, PhD

UPEI External examiner

Brent MacDonald, PhD

Date ___July 26, 2022_____

Abstract: Climate change – the rapid changes to Earth's climate system related to anthropogenic influence – has had widespread effects on humans and the natural world (Intergovernmental Panel on Climate Change [IPCC], 2022). Research suggests that psychological effects of climate change are becoming more common as more people become aware of climate change (Searle & Gow, 2010). This includes climate change anxiety, defined as anxiety in response to knowledge of the threat of climate change. To address the growing incidence of climate change anxiety, we must be able to accurately assess the problem. Informed by the psychological literature, the present study involved the development and validation of a scale to measure climate change anxiety at adaptive and maladaptive levels. Exploratory factor analysis revealed a three-factor solution, with subscales measuring clinical significance of anxiety, existential anxiety, and cognitive, future-focused anxiety respectively. The study also explored relationships between climate change anxiety and other constructs, including climate-related knowledge, climate action, and experience with climate change events. The development of this evidence-based scale will allow for the accurate assessment of climate change anxiety which may help to inform treatment of those that experience debilitating levels of climate change anxiety.

Contents

Introduction

Earth's climate system has changed significantly over centuries of human influence and climate change has in turn had widespread effects on humans and the natural world, including mental health consequences (Intergovernmental Panel on Climate Change [IPCC], 2022). Climate change will alter human lives in a variety of ways and with different severity; relocation, inhospitable heat, resource scarcity, and extreme weather events may all affect human livelihoods and quality of life. Research is increasingly documenting various negative effects on mental health due to growing knowledge of the consequences of climate change (Cianconi, Betrò, & Janiri, 2020; IPCC, 2022). As the public becomes increasingly aware of and concerned about climate change, mental health responses to the phenomenon – such as depression and anxiety, as well as more climate-specific responses such as "solastalgia" and "ecological grief" – are becoming more common (Searle & Gow, 2010). Studies suggest that climate change can affect mental health both directly, through extreme events such as heat waves, fires, and floods, and indirectly, through ongoing and future changes in the environment and global relationships (Cianconi, Betrò, & Janiri, 2020; Fritze, Blashki, Burke, & Wiseman, 2008; Searle & Gow, 2010).

Negative experiences with extreme weather events caused by climate change often elicit symptoms of trauma and distress, such as sadness, grief, and despair (Cianconi, Betrò, & Janiri, 2020; Ursano, Morganstein, & Cooper, 2017). In contrast, anticipation of climate change in the future is often met with feelings of worry or anxiety, defined by apprehension of negative outcomes and consequent cautious or avoidant behaviour (Searle & Gow, 2010). Experiences of anxiety can range from mild emotional discomfort to debilitating distress, and responses to anxiety vary in function (Beidel & Frueh, 2018). Climate change anxiety can be simply defined

as anxiety in response to knowledge of the threat of climate change. Individuals from varying

global populations are experiencing some form of climate change anxiety; young people,

marginalized groups, and people with specific personality characteristics or experiences tend to

be at higher risk for climate change anxiety (Clayton, 2020; Clayton, Manning, & Hodge, 2014;

Taylor, 2020). Social factors may also increase vulnerability to climate change anxiety, including

poverty and lack of social support. Finally, people living in coastal regions, small islands, and

rural areas seem to be at higher risk for climate change anxiety (IPCC, 2022).

Across these groups at risk, climate change anxiety – like all anxiety – includes cognitive,

physiological, and behavioural components. Although scholars agree that anxiety generally

consists of these components, theoretical understandings of anxiety and its components vary

widely across psychological frameworks (Pihkala, 2020). Climate change anxiety can be further

understood within the context of more specific psychological theories of anxiety, including

cognitive behavioural theory, psychodynamic theory, and existential theory. Integrating these

theories provides a comprehensive understanding of climate change anxiety that could not be

achieved by any of these theories alone. It is important to acknowledge that most anxiety in

response to climate change is normal, according to cognitive behavioural, psychodynamic, and

existential theories. However, climate change anxiety may also become distressing or begin to

impair functioning such that it is considered clinically significant and may even manifest as an

anxiety disorder (American Psychiatric Association [APA], 2013).

Although increasing research is demonstrating the existence of climate change anxiety,

this concept has not yet been defined in the field of clinical psychology (Clayton & Karazsia,

2020). To my knowledge, no clinical scales exist to measure or assess climate change anxiety

and its consequences. Scales have been developed to measure various types of emotional distress

caused by climate change, including a recently developed climate change anxiety scale which measures non-clinical stress reactions to climate change (Clayton & Karazsia, 2020). Because this scale does not consider clinically significant levels of climate change anxiety, it cannot be used in a clinical assessment or to inform treatment of climate change anxiety. Evidence-based scales measuring clinically significant concerns are required to define these concerns and facilitate treatment (Jensen-Doss, 2015). In this study, I develop a scale which measures climate change anxiety using multiple psychological frameworks and can identify clinically significant anxiety. The resulting development of an evidence-based clinical scale measuring climate change anxiety will allow for the assessment and subsequent treatment of climate change anxiety. This study will enhance clinical understanding of climate change anxiety, with implications for improving clinical outcomes.

Literature Review

Climate Change

Earth's climate system has changed significantly over centuries of anthropogenic influence, and climate change has in turn had widespread effects on humans and the natural world (Intergovernmental Panel on Climate Change [IPCC], 2022). Since the 1950s, the observed changes in the environment have been unprecedented and extreme; the climate has warmed, sea levels have risen, and extreme weather events have increased in frequency (IPCC, 2022). The consequences of climate change have affected the inhabitants of Earth, including humans, significantly and disastrously. For example, 80% of the global human population has been affected by water or food insecurity due to climate change (Cianconi, Betrò, & Janiri, 2020). Geographic regions that are particularly vulnerable to the effects of climate change

include small islands, coastal regions, and arctic regions (Gibson, Barnett, Haslam, & Kaplan, 2020). Unfortunately, the consequences of climate change are continuing to increase in severity, thus increasing the likelihood of pervasive and irreversible effects on the planet and its inhabitants (IPCC, 2022).

It is inevitable that climate change will alter human lifestyles; people across the globe will be affected in a variety of ways and with different severity. Many social adjustments may be required, including relocation or migration due to increasing inhabitability of certain geographic regions (Cianconi, Betrò, & Janiri, 2020). For example, most residents of small pacific islands will be required to abandon their home countries due to rising sea levels and drinking water scarcity (Gibson, Barnett, Haslam, & Kaplan, 2020). Similarly, many areas of the world will become inhospitably hot, causing mass migration to cooler parts of the world (IPCC, 2022). Community restructuring may also be a consequence of extreme weather events such as floods or wildfires (Cianconi, Betrò, & Janiri, 2020). Homes and community buildings may be destroyed, community members may be lost or forced to relocate, and a sense of community safety may be forever reduced. While the entire global population is at increased risk for these types of events due to climate change, coastal regions, small islands, and much of Asia are most vulnerable to floods and storms, while Europe and North America risk wildfires, heatwaves, and drought (IPCC, 2022). Unfortunately, the most vulnerable communities will be disproportionately affected by climate change, including communities in Africa, Asia, Central and South America, small islands and the Arctic.

Resource scarcity, including lack of drinking water, food, and shelter, is another potentially life-altering consequence of climate change (Cianconi, Betrò, & Janiri, 2020). Communities that rely on fishing, hunting, or growing crops may experience food scarcity due to climate change

(Gibson, Barnett, Haslam, & Kaplan, 2020). Indigenous populations and people living in developing countries and rural areas are particularly vulnerable to resource scarcity as a result of climate change (Bohle, Downing, & Watts, 1994; IPCC, 2022). Global indigenous populations are at higher risk for both physical and mental health effects of climate change. This is particularly true for indigenous peoples in North America, especially when considering compounding risk factors such as poverty and lack of resources (Taylor, 2020). Additionally, indigenous groups in North America often inhabit geographic locations that are vulnerable to the effects of climate change, including arctic and coastal regions (Clayton, 2020).

Canadian Inuit communities are already experiencing significant effects of climate change, including reduced sea ice thickness, shifts in storms and weather patterns, warmer temperatures, and changes in wildlife migration and plant growth (Willox, Harper, Edge, Landman, Houle, & Ford, 2013). These changes constitute significant resource scarcity for Inuit populations who often rely on sea ice, wildlife, and plants for survival. Resulting negative physical health consequences in Inuit communities include decreased physical activity and increased diseases, UV exposure, and risk of injury and death (Willox, Harper, Edge, Landman, Houle, & Ford, 2013). These effects have unsurprisingly led to increased mental health impacts, including depression and anxiety (Willox, Harper, Edge, Landman, Houle, & Ford, 2013).

Similarly, farmers, agriculturalists, pastoralists, and others who depend on the land or wildlife for their livelihood are at increased risk of food insecurity due to climate change (Bohle, Downing, & Watts, 1994). Droughts and changing weather patterns have a negative effect on crop yield and livelihood of farmers all over the world (Cianconi, Betrò, & Janiri, 2020). The most vulnerable populations to both food and water scarcity live in rural areas (Bohle, Downing, & Watts, 1994). Geographic regions with low capability to cope with climate change, such as

several African countries, as well as regions with high levels of poverty, tend to be at higher risk for the effects of climate change (IPCC, 2022). Violent conflict in communities can also increase vulnerability to climate change and associated effects such as resource scarcity (IPCC, 2022). It is clear that resource scarcity will be a consequence of climate change that disproportionately affects disadvantaged groups and geographic regions.

These negative consequences of climate change are largely attributable to anthropogenic activities such as fossil fuel use, deforestation, and pollution (Cianconi, Betrò, & Janiri, 2020; IPCC, 2022). However, understanding of the human relationship to climate change varies across individuals and populations globally (Searle & Gow, 2010). While some people do not believe that climate change exists or is caused by humans, others are all too familiar with the causes and consequences of climate change. People living in areas affected by climate change, especially extreme weather events, tend to be more aware of the negative potential consequences of climate change (Gibson, Barnett, Haslam, & Kaplan, 2020). Those who better understand the disastrous outcomes of climate change may experience a wide range of psychological responses to this knowledge (Cianconi, Betrò, & Janiri, 2020). Climate change, whether experienced directly or indirectly, can contribute to negative emotions and mental health, and even to serious psychiatric disorders. Research on the psychological effects of climate change is growing as people are increasingly affected by climate change.

Psychological Effects of Climate Change

The body of research on the psychological effects of climate change is expanding and considers negative emotions as well as more serious mental health concerns. These types of psychological responses are becoming more common, as more people become aware of climate

change through direct and indirect experience (Searle & Gow, 2010). For example, the

increasing knowledge about climate change as an anthropogenic crisis and the extent of the

possible consequences appears to be simultaneous with increasing distress about these

consequences. Additionally, as climate change begins to affect more of the world, through

extreme weather events, heat waves, and resource scarcity, more people are directly experiencing

the impacts of climate change (IPCC, 2022). This increased exposure to the physical effects of

climate change has been associated with more negative psychological effects on the global

population (Cianconi, Betrò, & Janiri, 2020).

In the past two decades, researchers have begun to consider and define different emotional

responses to climate change, including "solastalgia" and "ecological grief" (Cianconi, Betrò, &

Janiri, 2020). This growing body of research suggests that emotional responses to climate change

are common and may have an impact on wellbeing. Unsurprisingly, people who experience the

direct effects of climate change outlined above, including extreme weather events and

displacement, often report strong emotions related to climate change (Cianconi, Betrò, & Janiri,

2020; Cunsolo & Ellis, 2018). Emotions about climate change have been reported by many

people who only have vicarious knowledge of climate change and no direct experience (Searle &

Gow, 2010).

The term "solastalgia" was coined by Australian ecophilosopher Glenn Albrecht in 2005,

meaning "the homesickness you have at home" in relation to the loss of place due to negative

environmental change (Albrecht, 2019, p. 27). The term comes from three words: solace,

desolation, and nostalgia, to explain the feelings of pain and powerlessness caused by external

destruction of one's home (Albrecht, 2019). While nostalgia occurs when away from home,

solastalgia is caused by the destruction or changing of home while still there, thus causing a

desire for the home of the past. Since solastalgia's initial definition, the term has become widely used in discussions of the emotional impacts of climate change.

Another emotion related to climate change is ecological grief – the mourning of losses, past or anticipated, caused by climate change (Cunsolo & Ellis, 2018). Ecological grief can be related to the loss of species, ecosystems, and landscapes, particularly land that is meaningful in some way. Somewhat different, although still a common emotional response to climate change, is grief of people, belongings, or property due to climate change (Cunsolo & Ellis, 2018). For example, extreme weather events have the potential to kill people and destroy homes – inevitably painful experiences for most (Cianconi, Betrò, & Janiri, 2020). Ecological grief and solastalgia both appear to be normal responses to the direct effects of climate change as well as the anticipation of future environmental consequences.

A vast number of other emotions have also been considered in relation to the environment and climate change, including emotions related to surprise, threat, sadness, anxiety, depression, shame, and anger, as well as positive emotions such as hope and motivation (Pihkala, 2022). Recent research defines "climate emotions" as any affective phenomena related to the climate crisis and suggests that these emotions can be caused by personal experiences with climate change and/or general knowledge of climate change (Pihkala, 2022). Climate change can be understood as a moral issue, with many connections to injustice; therefore, moral emotions such as moral outrage are seen as justified responses to the climate emergency (Antadze, 2020; Pihkala, 2022). Additional emotions related to climate change include guilt, anger, worry, confusion, and powerlessness (Cunsolo & Ellis, 2018; Wang, Leviston, Hurlstone, Lawrence, & Walker, 2018).

Considering the variety of emotions experienced about climate change and the severity of climate change consequences, it follows that negative emotional responses may become serious mental health concerns in some people. Research suggests that climate distress is associated with higher rates of psychiatric disorders, including depression and anxiety disorders, stress disorders, and substance use disorders (Cunsolo & Ellis, 2018). Concern about climate change has also been linked to increased suicidal ideation as well as suicide attempts and deaths. These extreme mental health consequences are most common as a direct result from the effects of climate change but can be caused by anticipation of negative consequences as well. Mental health concerns have been associated with increasing temperatures, trauma related to extreme events, and loss of livelihood and culture (IPCC, 2022).

There are significant mental health impacts from extreme weather events, which may occur before, during, or after an extreme weather event (Cianconi, Betrò, & Janiri, 2020; Clayton, Manning, Krygsman, & Speiser, 2017). These psychological responses can range from mild distress and sleep difficulties to severe mental health concerns such as depression, post-traumatic stress disorder (PTSD), and thoughts of suicide (Cianconi, Betrò, & Janiri, 2020; Ursano, Morganstein, & Cooper, 2017). For Indigenous populations, direct environmental events such as deforestation may have a strong emotional impact which increases the likelihood of maladaptive mental health concerns (Cianconi, Betrò, & Janiri, 2020).

In addition to the psychological responses to threats to survival, many people experience emotional responses to indirect consequences of climate change (Cianconi, Betrò, & Janiri, 2020). As the global population becomes increasingly aware of and concerned about climate change, people have increasingly demonstrated negative emotional responses to this knowledge of climate change (Searle & Gow, 2010). There is increasing research demonstrating that simply

knowing that climate change exists, and will have negative effects on the planet, can cause

symptoms of depression, anxiety, and stress, among other mental health concerns (Searle &

Gow, 2010.) These psychological responses to future consequences of climate change are

distinct from the mental health consequences of current environmental impacts such as extreme

weather events (Gow & Leahy, 2005; Searle & Gow, 2010).

The most common anticipatory or indirect psychological response to climate change is

worry - defined as anticipation of negative consequences and related distress (Searle & Gow,

2010). Specifically, climate change-related worry is generally understood as a series of negative

thoughts, manifesting through attempts to engage in mental problem-solving on the climate crisis

and its consequences (Stewart, 2021). This worry about climate change can vary in severity and

frequency, and can become excessive or problematic (Fritze, Blashki, Burke, & Wiseman, 2008;

Stewart, 2021). Worrying about climate change varies across individuals and across countries,

depending on the level of exposure to and understanding of climate change (Gregersen, Doran,

Böhm, Tvinnereim, & Poortinga, 2020). People may be more likely to worry about climate

change if they believe in the negative effects of climate change, work in the climate change field,

or have experienced the effects of climate change directly or indirectly (Fritze et al., 2008;

Gregersen et al., 2020). Children and adolescents are also more likely to worry about climate

change than adults (Fritze et al., 2008). Research suggests that individuals who worry more

about climate change are likely focusing on possible negative consequences of climate change

and are more likely to support climate mitigation policies (Gregersen et al., 2020).

Evidently, there exists a wide range of possible psychological responses to climate change,

which depend to some extent on whether one has experienced the effects of climate change

directly or indirectly. Direct effects of climate change, including natural disasters and extreme

weather events, are expected to have psychological impacts (Cianconi, Betrò, & Janiri, 2020).

However, the psychological effects caused by the anticipation of future consequences of climate

change constitute distinct and unique concerns (Searle & Gow, 2010). Perhaps most concerning

is the possibility of climate change anxiety, a serious extension of worry.

Climate Change Anxiety

Worry is generally considered to be one component of anxiety – an emotional reaction to

the possibility of threat (Barlow, 2002; Stewart, 2021). Anxiety and fear are two different types

of reactions to dangerous stimuli. Fear can be defined as an "alarm reaction" in response to

immediate danger, while anxiety involves apprehension about possible future danger (Barlow,

2002). Fear serves an adaptive purpose in protecting against immediate danger through fighting

or fleeing the threat. Anxiety, in contrast, is a reaction to a future, rather than immediate, threat,

but shares many of the same cognitive, physiological, and behavioural components of fear

(Barlow, 2002). The cognitive construct of worry and the somatic construct of fear are combined

to make up anxiety (Stewart, 2021). Climate change is typically thought of as a future event with

negative consequences and may thus elicit feelings of anxiety. Climate change anxiety can be

simply defined as anxiety in response to knowledge of the threat of climate change. Climate

change anxiety appears to be distinct from other climate emotions in many ways, as it is

characterized by feelings of ambivalence, powerlessness, and helplessness (Pihkala, 2022).

However, more research is needed to understand how climate change anxiety is a distinct

climate-related psychological experience.

Climate change will likely affect the entire global population, but anxiety related to the

consequences of climate change is not a universal experience. In general, increased knowledge

of or exposure to climate change is associated with increased anxiety or distress about the

consequences of climate change (Helm, Pollitt, Barnett, Curran, & Craig, 2018; Searle & Gow,

2010). However, certain groups of people seem to be more vulnerable to experiencing anxiety

about climate change. Studies with farmers, pacific islanders, and individuals with low

socioeconomic status have demonstrated high levels of climate-related anxiety in these groups

(Cianconi, Betrò, & Janiri, 2020; Gibson, Barnett, Haslam, & Kaplan, 2020; Howard, Ahmed,

Lachapelle, & Schure, 2020). Demographically, young people, marginalized groups, and people

with specific personality characteristics or experiences tend to be at higher risk for climate

change anxiety (Clayton, 2020; Clayton, Manning, & Hodge, 2014; Taylor, 2020). Climate

change seems to have a greater emotional impact on youth compared with older adults; this may

be due to the higher likelihood that young people will live to experience the consequences of

climate change (Taylor, 2020).

Social factors may also increase vulnerability to climate change anxiety, including poverty

and lack of social support. Residents of developing countries and communities with fewer

resources are particularly vulnerable to the psychological effects of climate change (Clayton,

Manning, & Hodge, 2014; Taylor, 2020). Lower social cohesion or connectedness as well as

social inequity can put a community at greater risk for the psychological impacts of climate

change (Clayton, Manning, & Hodge, 2014). This may be related to the aforementioned social

risk factors for climate change including community restructuring, loss, and relocation

(Cianconi, Betrò, & Janiri, 2020). For example, people forced to migrate are more vulnerable to

anxiety and other emotional difficulties (Taylor, 2020). Additionally, communities at higher risk

for extreme weather events and other physical consequences of climate change, including

droughts and rising sea levels, are more likely to experience anxiety about climate change (Chen,

Bagrodia, Pfeffer, Meli, & Bonanno, 2020; Gibson, Barnett, Haslam, & Kaplan, 2020; Taylor, 2020).

In line with previously discussed research on geographic regions vulnerable to the effects of climate change, people living in coastal regions, small islands, and rural areas seem to be at higher risk for climate change anxiety. Studies suggest that island residents experience high levels of anxiety and distress related to climate change (Gibson, Barnett, Haslam, & Kaplan, 2020). Research on the experience of climate change in Tuvalu, a small pacific island being significantly affected by climate change, found that Tuvaluans reported significant distress and anxiety about the consequences of climate change (Gibson, Barnett, Haslam, & Kaplan, 2020). This climate change anxiety was often significant enough to interfere with functioning and participation in daily activities. Similarly, research suggests that farmers tend to feel moderately or very anxious about the effects of climate change on agriculture (Howard, Ahmed, Lachapelle, & Schure, 2020). This climate change anxiety was associated with increased perceptions of climate risk and harm, especially to crop yield and farmers' livelihood.

Finally, some psychologists suggest that certain personality characteristics are associated with increased risk for climate change anxiety (ex. Clayton, 2020). People who have a stronger connection to the environment or land seem to be more emotionally concerned about the effects of climate change (Taylor, 2020). For example, indigenous populations tend to experience high levels of emotional distress related to climate change, likely due to a strong environmental bond (Clayton, 2020). The land is often of extreme spiritual and emotional importance to indigenous communities in North America (Willox, Harper, Edge, Landman, Houle, & Ford, 2013). Other personal characteristics that may predispose people to experience climate change anxiety include neuroticism, anxiety sensitivity, and intolerance of uncertainty, which are accepted as risk factors

for anxiety in several contexts (Barlow, 2002; Taylor, 2020).

Across these groups at risk, climate change anxiety – like all anxiety – includes cognitive, physiological, and behavioural components. Cognitive components of anxiety include negative mood, worry about the future, hypervigilance to threats, and feelings of uncertainty, unpredictability, and uncontrollability (Dugas & Ladouceur, 1998). Physiological components include physical tension and overarousal with symptoms such as increased heart rate, perspiration, restlessness, and shallow breathing (Barlow, 2002; Morse, 1998). Finally, behavioural responses to climate change anxiety may include avoidant or cautious behaviour as well as pro-environmental action. Although scholars agree that anxiety generally consists of these components, theoretical understandings of anxiety and its components vary widely across psychological frameworks (Pihkala, 2020). Climate change anxiety can be further understood within the context of more specific psychological theories of anxiety, including cognitive behavioural theory, psychodynamic theory, and existential theory. These theories and their relevance to climate change are discussed in detail below.

Theories of Anxiety

Cognitive Behavioural.

Cognitive behavioural theory postulates that cognitive processes significantly influence emotional and behavioural responses to situations (Gonzalez-Prendes & Resko, 2012). Cognitive processes are defined as thoughts in the form of meanings, judgements, appraisals, and assumptions. These cognitions combine with emotions, physical sensations, and behaviours, and become intertwined (Knaus, 2008). As such, cognitive behavioural theory understands anxiety as comprised of these cognitive, emotional, physical, and behavioural processes in response to

threatening situations (Boschen & Oei, 2008). Cognitive behavioural theory is a predominant theory of anxiety that has been used to understand the symptoms and maintaining factors of anxiety – as such, it will be useful in informing a conceptualization of climate change anxiety.

Anxiety, within a cognitive behavioural framework, is caused by the perception of threat rather than the situation itself (Boschen & Oei, 2008). Although the cognitive behavioural framework for anxiety is most useful for near future or current threats, the perception of a distant threat can be understood cognitively as well. Cognitive behavioural theory understands climate change anxiety as a consequence of a person's cognitions (beliefs, judgements, and assumptions) and emotions about climate change (Helm, Pollitt, Barnett, Curran & Craig, 2018). Anxious thoughts and feelings about climate change may result from personal experience with climate change, such as extreme weather events, or from vicarious knowledge.

Key cognitive features of anxiety include worry, uncertainty, uncontrollability, and unpredictability; uncontrollable and unpredictable situations create more fear and anxiety than other situations (Mineka & Oehlberg, 2008). Intolerance of uncertainty, defined as difficulty enduring a lack of knowledge about the future, is associated with worry and anxiety in both clinical and non-clinical populations (Buhr & Dugas, 2002; Dugas, Gosselin, & Ladouceur, 2001). People who are intolerant of uncertainty worry that a negative event might occur, even when there is little known information. Buhr and Dugas (2002) suggest that individuals with lower tolerance for uncertainty will be highly anxious because much of life is uncertain or ambiguous. In the case of climate change, the future is uncertain, and the consequences of climate change will be extremely negative and sometimes irreversible (IPCC, 2022). It follows that this level of uncertainty and uncontrollability could lead to increased anxiety about climate change.

Further research on the fear of the unknown suggests that not knowing is a core component of anxiety, including pathological anxiety (Carleton, 2016). Fear of the unknown, although similar to intolerance of uncertainty, is a distinct concept characterized by fear or anxiety due to an absence of information about the future (Carleton, 2016). A more immediate unknown will often cause fear, while an extended absence of information about future events can elicit anxiety. Unknown circumstances reduce the ability to predict and control the future, which facilitates more anxiety (Havranek et al., 2016). While intolerance of uncertainty describes a dispositional trait that varies across humans, fear of the unknown is a universal predictor of anxiety (Carleton, 2016). This suggests that the absence of information about climate change and its consequences could elicit fear and anxiety in anyone, regardless of disposition or personal characteristics.

When considering the environment, a perceived lack of control over what will happen often leads to anxiety and other forms of distress (Reser & Swim, 2011). Specifically, environmental stressors caused by climate change can cause people to feel uncertain about the future and unable to control the world in which they live. Climate change and its various consequences are profoundly uncertain, difficult to predict, and almost impossible to control; many people report experiencing feelings of uncertainty and anxious apprehension regarding the effects of climate change (Cianconi, Betrò, & Janiri, 2020; Pihkala, 2020). For example, it is extremely hard to know how disastrous the consequences of climate change will be for any given population. Furthermore, there is uncertainty regarding behaviour to mitigate climate change; people often do not know how to engage in pro-environmental behaviour and may worry about social norms or expectations regarding climate action (Pihkala, 2020).

Related to these concepts of uncertainty and unknowns is the cognitive construct of future anxiety which outlines feelings of anxiety about the (more distant) future. Future anxiety is

defined as a "state of apprehension, uncertainty, fear, worry and concern of unfavorable changes in a more remote personal future" (Zaleski, 1996, p. 165). It is characterized by negative cognitive and emotional processes regarding bad future outcomes. Zaleski (1996) emphasizes that these cognitive and emotional processes are within awareness. This cognitive awareness, as well as the future event being remote, distinguishes future anxiety from regular anxiety about events in the present or near future.

Interest in future anxiety grew from social and political problems, including "ecological pollution", war, and non-curable diseases (Zaleski, 1996). In the past decade, future anxiety has been considered in terms of terrorism, migration, and climate change (Zaleski et al., 2019). Zaleski (1996) suggests that anxiety will always be the first reaction to distant potential dangers, functioning as an alarm system and motivating acts of preparation. Future anxiety is more likely to occur when negative future events are more likely. Climate change can certainly be understood as a likely, distant danger for which anxiety is acting as an alarm system. In fact, climate change is often discussed as relating to future generations and the distant future, with worry about future children being frequently reported (Kverndokk, 2020; Schneider-Mayerson & Leong, 2020). It is possible, then, that climate change anxiety may be a situation-specific type of future anxiety.

In addition to the specific cognitive constructs of intolerance of uncertainty and future anxiety, climate change anxiety can be considered through the lens of cognitive dissonance theory. Cognitive dissonance theory suggests that people feel uncomfortable, or a sense of dissonance, when they hold multiple pieces of information that are inconsistent or contradictory (Harmon-Jones & Harmon-Jones, 2007). Some research suggests that cognitive dissonance is often experienced along with anxiety specific to the dissonant situation (Menasco & Hawkins,

1978). This simultaneous experience of dissonance and anxiety tends to lead people to adjust

their attitudes and beliefs in order to reduce the sense of inconsistency (Harmon-Jones &

Harmon-Jones, 2007). In the case of climate change, knowledge about the human impact on

climate change may be dissonant with other attitudes about humans or the self; this dissonance

can lead to climate change anxiety or climate change denial (Frantz & Mayer, 2009). An explicit

association between cognitive dissonance and climate change anxiety has not been made within

the cognitive behavioural literature; however, this cognitive lens can be applied to the

psychodynamic understanding of climate change anxiety discussed below.

Cognitive behavioural theory typically focuses on reactions to immediate threats; however,

certain cognitive concepts can be used to understand climate change anxiety as a response to

future threat. Within a cognitive behavioural framework, climate change anxiety is understood as

a combination of negative cognitions and emotions about the consequences of climate change.

Climate change anxiety may be related to the cognitive concepts of intolerance of uncertainty

and fear of the unknown, as well as cognitive dissonance - all common experiences in the

context of climate change. Additionally, climate change is often perceived as being in the remote

future, so climate change anxiety may be considered one type of future anxiety. However, some

aspects of climate change anxiety cannot be understood within a cognitive behavioural

framework, suggesting that other psychological theories, including psychodynamic and

existential, may provide additional insight into climate change anxiety.

Psychodynamic.

Psychodynamic theory originated with Sigmund Freud, who emphasized the internal

dynamics of unconscious processes (Luborsky & Barrett, 2006). Psychodynamic theorists

suggest that processes outside of awareness (within the unconscious) can influence conscious thoughts, feelings, and behaviours – the same components considered important within cognitive behavioural theory. Freud believed that anxiety played a principal role in psychopathology, and he developed several theories of anxiety and described mechanisms used to defend against anxiety (defense mechanisms; Hooley, Butcher, Nock, & Mineka, 2017). Psychodynamic theories of anxiety have changed with the field over time, but anxiety is generally seen as resulting from repressed feelings and denial of life changes (Pihkala, 2020). Psychodynamic theorists suggest that internal conflict leads to anxiety which causes defense against anxiety (Cabaniss, Cherry, Douglas, Graver, & Schwartz, 2013). These theories tend to differ significantly from cognitive behavioural theories, with their focus on the unconscious.

Freud developed two theories of anxiety: the toxic theory and the signal theory (Leichsenring & Salzer, 2014). In Freud's original conceptualization of the toxic theory, anxiety results from repressed libido (Leichsenring & Salzer, 2014). However, the toxic theory has come to be more generally understood to suggest that repressed tension or conflictual feelings can build up and lead to anxiety (Zerbe, 1990). While the toxic theory suggests that anxiety is the consequence of repression, Freud's later signal theory suggests that repression is the consequence of anxiety (Zerbe, 1990). Specifically, Freud hypothesized that defense mechanisms are used to reduce anxiety by repressing or denying the perceived threat (Leichsenring & Salzer, 2014). Freud also suggested that anxiety could act as an adaptive signal to activate defenses so that threatening experiences do not become traumatic (Zerbe, 1990). In this way, psychodynamic and cognitive behavioural theories both suggest that anxiety functions as an alarm signal to prepare for future threats (Zaleski, 1996).

Freud and later psychodynamic theorists believed that anxiety is often caused by a state of

helplessness which arises when we realize the world is not in our control (Zerbe, 1990). This aligns with cognitive behavioural theories suggesting that uncontrollability and helplessness are key components of anxiety (Mineka & Oehlberg, 2008). Additional psychodynamic theories suggest that anxiety arises from the anticipated disapproval of others and a sense of personal failure as well as the fear of death (Zerbe, 1990). These psychodynamic theories of anxiety can be applied to climate change, as the knowledge of climate change may make people feel helpless, threatened, or afraid of death (Fritze et al., 2008). Since the turn of the 21st century, psychodynamic theories of climate change anxiety have become more prominent, suggesting that anxiety in response to climate change is to be expected when considering psychodynamic theory (Pihkala, 2020).

Psychodynamic therapist Sally Weintrobe (2013) discussed climate change anxiety in the context of Melanie Klein's distinction between depressive anxiety and narcissistic anxiety. Depressive anxiety results from fears related to survival and death, while narcissistic anxiety results from guilt about climate change and discomfort with change. Weintrobe suggests that climate change anxiety, when depressive, is rooted in fear of loss, neglect, and death. Within the context of climate change, individuals have many reasons to fear for their survival and the health of the planet – increasing numbers of people are dying, coping with natural disasters and resource scarcity, and being required to leave their homes (Cianconi, Betrò, & Janiri, 2020; IPCC, 2022). The future is no longer predictable and safe, and the earth can no longer be depended on to satiate every human need and desire. Anxiety thus arises from this uncertainty about survival and the knowledge that leadership may not be taking sufficient action to prevent this unsafe future. While this psychodynamic conceptualization of anxiety shares the cognitive behavioural theme of uncertainty, there is a uniquely psychodynamic focus on drives and

emotions, including fear related to survival. This depressive anxiety can facilitate the use of defense mechanisms to feel more optimistic about the future, such as denial of the negative consequences (Weintrobe, 2013).

In contrast to depressive anxiety's focus on the future, narcissistic anxiety relates more to humanity's involvement in climate change. The realization that climate change has been caused primarily by humans causes immense guilt and shame, about oneself and about the human species as a whole (Weintrobe, 2013). This guilt may be exacerbated by desires to maintain a materialist lifestyle that is harmful to the environment, so that consumerism is pitted against the negative effects of that consumerism on the planet. This tension may lead to defense mechanisms that allow individuals to continue consumerist habits free of guilt or shame (Weintrobe, 2013). Similarly, many people may feel uncomfortable with the lifestyle changes, such as decreased consumerism, required to mitigate the guilt. Within psychodynamic theory, it is thought that individuals' identities and desires are often displaced onto material goods, and the loss of those material goods can cause anxiety (Nixon & Gabriel, 2016).

Weintrobe suggests that narcissistic climate change anxiety results from two realizations: realizing one's impact on the environment and realizing that they would have to change their lifestyle in order to reduce the guilt and negative environmental effects. This aligns with the previously described cognitive behavioural concept of cognitive dissonance, such that individuals may struggle to hold the knowledge that their lifestyle affects the environment along with the preference to maintain their lifestyle. These contradictory beliefs may cause cognitive dissonance and anxiety, thus causing people to attempt to reduce the inconsistency between the two (Harmon-Jones & Harmon-Jones, 2007). Just as cognitive dissonance theory suggests that climate change dissonance can lead to anxiety and denial, psychodynamic theorists argue that

this discomfort will cause people to develop anxiety and consequent defense mechanisms, including denial (Frantz & Mayer, 2009; Weintrobe, 2013).

Psychodynamic theorists suggest that, although climate change anxiety is normal, defense mechanisms – strategies used to manage anxiety – may become maladaptive or pathological (Lingiardi & McWilliams, 2017; Weintrobe, 2013). Essentially, the anxiety from thinking about climate change becomes too difficult to bear, and people protect themselves against this anxiety in a variety of ways: denying the existence of climate change, keeping worries about climate change unconscious, focusing on positive rather than negative thoughts about climate change, seeing climate change in a positive light, and/or projecting the problem of climate change onto others. Defense mechanisms are a unique psychodynamic contribution to the understanding of climate change anxiety.

The two most common defense mechanisms considered in the context of climate change anxiety are denial of the threat and repression of the anxiety (Pikhala, 2020). Some psychodynamic theorists separate denial into two specific defense mechanisms: negation, which denies the truth, and disavowal, which distorts the truth (Haseley, 2019; Weintrobe, 2013). Negation is characterized by complete denial that something is true – stating that something is not true or cannot be true, when it is likely to be true. Disavowal, in contrast, involves changing or distorting reality in order to reduce feelings of anxiety, and can lead to significant confusion (Haseley, 2019). Weintrobe (2013) argues that society's depiction of climate change encourages disavowal by providing inaccurate information to the public. While denial involves the suppression of knowledge about climate change, repression involves suppression of the anxiety about climate change. Repression is characterized by pushing unpleasant feelings out of conscious awareness, so they seem to be forgotten (Cabaniss, 2013). In the context of climate

change, individuals who feel anxious may repress the anxiety in order to continue living

functional lives.

Further relevant defense mechanisms to climate change anxiety include mental splitting,

idealization, and projection (Bellamy, 2019; Weintrobe, 2013). Mental splitting occurs when one

has both positive and negative feelings about something, and experiences tension within

themselves (Cabaniss, 2013). This tension is managed by separating, or splitting, the positive and

negative feelings in order to focus on the positive. The defense mechanism of mental splitting

can be seen as a psychodynamic way of understanding the cognitive behavioural concept of

cognitive dissonance and psychological attempts to reduce that dissonance (Cabaniss, 2013;

Harmon-Jones & Harmon-Jones, 2007). In the case of climate change, one may feel good about

their consumerist or materialist lifestyle while simultaneously feeling guilt about the

consequences of that lifestyle on the planet (Weintrobe, 2013). This could cause intense feelings

of anxiety, resolved by mental splitting to keep the guilt separate from more positive feelings.

Similarly, idealization involves the attribution of overly positive feelings towards

something complex (Cabaniss, 2013). Climate change is a complex problem with many negative

consequences that can cause anxiety; focusing on the possible positive consequences of climate

change – such as warmer weather and increased crop productivity in some areas – can be used to

relieve that anxiety (Weintrobe, 2013; Yang et al., 2015). Finally, projection is characterized by

blaming other people or forces for negative experiences (Cabaniss, 2013). Understanding the

negative consequences of climate change may be made less anxiety-provoking by perceiving the

consequences as separate from the self and caused by external forces (Weintrobe, 2013).

Psychodynamic theories of climate change anxiety are becoming more prevalent. Climate

change anxiety can be seen psychodynamically as being caused by repressed feelings about climate change, the fear of death, a sense of helplessness, and feelings of guilt. Climate change anxiety, like all anxieties, can be defended against with defense mechanisms that make people feel better. These defense mechanisms can actually contribute to the maintenance of anxiety, so they are considered integral to the psychodynamic theory of anxiety. The most common defense mechanisms used to cope with climate change anxiety include denial, repression, and mental splitting. Interestingly, psychodynamic theories of climate change anxiety overlap significantly with cognitive behavioural theories – both consider uncertainty and dissonance as key factors in the development or maintenance of anxiety. Still, climate change is a global philosophical issue in addition to being a psychological one, so existential theories of anxiety may apply more directly to climate change than cognitive behavioural or psychodynamic theories.

Existential.

Existential theory, sometimes considered a branch of psychodynamic theory, emphasizes individuals' attempts to understand and cope with the inherent imperfections in the world and humanity (Fernando, 2007). Existential theorists focus on how individuals make meaning in life and cope with the inevitability of death. Existential anxiety is a key concept within existential theory and can be defined as "a deep concern over whether we are living meaningful and fulfilling lives" (Hooley, Butcher, Nock, & Mineka, 2017, p.82). Climate change anxiety has been increasingly considered from an existential perspective. Climate change can be seen as two types of existential threat which then cause existential anxiety (van Kessel, 2020). First, climate change is a direct threat of death; knowledge of climate change and its consequences often facilitates thoughts of death, thus provoking anxiety. Second, an indirect worldview threat can occur when one's view of the world is unable to protect against death anxiety; this can be caused

by interactions that increase understanding of the human influence on climate change (van Kessel, 2020).

Existential psychiatrist Irvin Yalom (1980) defined four ultimate existential conflicts which can cause anxiety. First, the awareness of death as inevitable conflicts with the desire to live. This conflict, defined by the fear of death, is considered a primal source of anxiety within both existential and psychodynamic theories. Second, the desire for freedom and independence is in conflict with the desire for ground and structure. Third, the awareness of absolute isolation conflicts with the wish for connection and community. The fear of being alone and loss of community are key contributors to anxiety. Finally, the awareness that the universe has no meaning conflicts with the desire for meaning and purpose in life. Within existential theory, these four ultimate conflicts lead to anxiety, which is then responded to with other psychological reactions, including defense mechanisms (Yalom, 1980). This is slightly different from the psychodynamic theory in which inner drives lead to anxiety, which then lead to defense mechanisms. However, both Freud and Yalom suggested that these conflicts can cause people to feel helpless and powerless, which further exacerbates anxiety.

Climate change calls into question philosophical understandings of how life works, and how humans should relate to one another and the world (Myers, 2014). Climate change thus poses an existential threat by challenging individual and societal existence; this leads to existential anxiety across many themes. In fact, existential theorists suggest that climate change is particularly conducive to anxiety, due to its all-encompassing nature (ex. Myers, 2014; Ojala, 2016). Climate change will affect agriculture, migration, geography, community, individual futures, and many other areas of life (Cianconi, Betrò, & Janiri, 2020; IPCC, 2022). These consequences, on such a large scale, seem to inevitably lead to existential anxiety; they highlight

the ultimate existential concerns of death, freedom, isolation, and meaninglessness (Yalom, 1980). Existential anxiety has been discussed by many theorists, but Paul Tillich and Ernesto Spinelli's theories have been studied most in the context of climate change.

Paul Tillich suggested that existential anxiety is comprised of three broad domains, made up of six specific existential concerns (Scott & Weems, 2013; Weems, Costa, Dehon, & Berman, 2004). The first domain consists of fate and death: fate anxiety involves concerns about one's role in the world and uncertainty about the future, while death anxiety is related to the end of one's existence in the world (Scott & Weems, 2013). The second domain consists of emptiness and meaninglessness: emptiness anxiety results from feeling that one's beliefs no longer have meaning, while meaninglessness anxiety involves the loss of meaning in life. The third and final domain consists of guilt and condemnation: guilt anxiety involves concern that one's behaviour has not met their moral standards and condemnation anxiety results from the feeling that one's life has not met universal standards. While most of these domains are uniquely existential, psychodynamic theorists have long considered the fear of death as a source of anxiety (Zerbe, 1990). Additionally, many of these domains highlight uncertainty, which is associated with hopelessness and anxiety in both cognitive behavioural and psychodynamic theories. Existential anxiety, like anxiety within cognitive behavioural and psychodynamic theories, also includes a somatic component, often triggered by the above existential domains (Morse, 1998).

Tillich's three domains of existential anxiety map on to three parts of the individual: the ontic part (fate and death anxiety), the spiritual part (emptiness and meaninglessness anxiety), and the moral part (guilt and condemnation anxiety) (Ojala, 2016). Maria Ojala (2016), a psychologist researching emotional reactions to climate change, suggests that climate change evokes existential anxiety by threatening "the whole individual." Climate change threatens the

ontic part of the individual in its potential for death and destruction of humanity and the planet (Ojala, 2016). Awareness of the potential consequences of climate change requires envisioning the "terminal crisis of human civilization", thus activating anxiety about the fate of humanity and personal death (Budziszewska & Jonsson, 2021, p. 5). This may present as feelings of hopelessness in the face of the uncertainty of our planet and species (Ojala, 2011).

Climate change challenges the spiritual part of the individual by raising questions about the purpose of active citizenship in the face of such a complex societal problem (Ojala, 2016). The meaningfulness of life may be questioned, and individuals may feel that their beliefs and values are no longer important. Climate change threatens human legacies, including children and communities, and undermines the value of human action (Budziszewska & Jonsson, 2021). Finally, climate change threatens the moral part of the individual in considering how our lifestyles have an influence on the future of the planet (Ojala, 2016). The realization that humans have caused climate change, along with the extinction of several species and natural landscapes, may cause feelings of extreme guilt (Budziszewska & Jonsson, 2021). This threatens both individual self-worth and the collective morality of humanity. Overall, climate change may elicit uncertainty and hopelessness about the future, fear of death, concerns about the meaning of life, and guilt about personal or human behaviours and the effect on the planet. As such, it is likely that this theory of existential anxiety – with uniquely existential components and some overlap with cognitive behavioural and psychodynamic theories – may be an appropriate model for climate change anxiety.

Existential psychotherapist Ernesto Spinelli described the three foundational principles of existential anxiety, existential relatedness, and existential uncertainty (Spinelli, 2015, as cited by Budziszewska & Jonsson, 2021). Here, existential anxiety is characterized by feelings of

incompleteness related to uncertainty about existence, offering more support for the cross-theory theme of uncertainty's involvement in climate change anxiety (Budziszewska & Jonsson, 2021). In this context, anxiety can be distressing – as in clinically significant anxiety – and liberating, allowing one to feel completely alive and aware of the realities of existence. Spinelli's theory of existential anxiety shares many similarities with Yalom and Tillich's theories; all three consider themes of meaning and meaninglessness, choice and freedom, authenticity and inauthenticity, isolation and relatedness, death anxiety, future anticipation, and responsibility (Spinelli, 2015, as cited by Budziszewska & Jonsson, 2021). These three theories are uniquely existential but pull from psychodynamic theory and help to demonstrate the similarities between existential and cognitive behavioural theories.

Budziszewska and Jonsson (2021) conducted interviews about climate change anxiety and found support for all of Spinelli's themes of existential anxiety. Climate change anxiety, often triggered by new information about climate change, includes feelings of helplessness in the face of death (Budziszewska & Jonsson, 2021). A sense of overwhelm and meaninglessness was also reported in the context of climate change anxiety, as people felt the consequences of climate change would actively remove meaning from life. Additionally, climate change was associated with feelings of social isolation and lack of relatedness with others and the world. Participants reported feeling alone in their anxiety, as others deny and ignore climate change and its consequences. This research further supports the characterization of climate change anxiety as a form of existential anxiety, with overlapping themes from cognitive behavioural and psychodynamic theories (Budziszewska & Jonsson, 2021).

These accounts of existential anxiety in response to climate change are unsurprising given the extent of the threat and the prevalence of anxiety. The sociologist Anthony Giddens

suggested that anxiety is endemic in the 21st century, as our "ontological security" is threatened (Myers, 2014). Giddens' existential theory of ontological security suggests that feelings of *insecurity* in one's identity and autonomy can influence behaviour and reduce wellbeing (Pihkala, 2020). This existential theory, with roots in psychodynamic theory, suggests that insecure individuals experience the world as perpetually threatening and overwhelming (Rossdale, 2015). As such, ontological insecurity can lead to existential anxiety as well as other emotional difficulties and defensive reactions (Pihkala, 2020). Climate change can cause feelings of ontological insecurity which may contribute to the feelings of meaninglessness in existential anxiety.

Importantly, ontological insecurity can be seen as a signal that something needs to change (Myers, 2014). Although existential anxiety is seen as a normal response to the world, and to climate change, failure to deal constructively with existential anxiety can lead to maladaptive behaviour. Rollo May – one of the first writers to introduce existentialism to North America in his seminal work *The Meaning of Anxiety* (1950, 1977) – controversially described anxiety as a normal, functional response to being human. May acknowledged, however, that anxiety could become disproportionate to threat or elicit distress and unhealthy responses (May, 1977). This existential perspective that anxiety exists on a spectrum from adaptive to maladaptive is shared among cognitive behavioural and psychodynamic theorists as well.

Climate change is considered an existential threat, thus existential theories are perhaps the most applicable to climate change anxiety. Existential anxiety, characterized by worries about death, meaning, morals, and connectedness, has been used to explain climate change anxiety in several contexts including the threat to humanity's survival and challenge to human morals and values. Climate change can also be seen as a threat to ontological security, so that people feel

unsure of their identities or place in the world. Uncertainty and fear of death are themes raised by existential theories which align with both cognitive behavioural and psychodynamic theories of anxiety.

Cognitive behavioural, psychodynamic, and existential theories of anxiety all contribute unique frameworks to understanding climate change anxiety. The literature on climate change anxiety is growing but is still limited, and integration across these theories does not appear to exist. Climate change anxiety can be understood using a variety of cognitive behavioural theories, including intolerance of uncertainty, future anxiety, and cognitive dissonance theory. Cognitive behavioural theory contributes a focus on cognitions, including worry, as key components of the cross-theory climate change anxiety conceptualization. However, cognitive behavioural theories are missing a deeper examination of the internal experience of anxiety. In contrast, psychodynamic and existential theories consider profound and meaningful components of anxiety, while ignoring some of the surface-level symptoms such as worry thoughts.

Psychodynamic theory uniquely contributes a focus on the unconscious and on defense mechanisms. Existential theory contributes several themes to the cross-theory understanding of climate change anxiety, including meaninglessness, hopelessness, and value loss. While all three of these theories contribute to the understanding of climate change anxiety, there are some key areas of overlap. This cross-theory conceptualization of climate change anxiety includes a focus on the future, uncertainty, powerlessness, helplessness, guilt, and somatic symptoms – key themes from cognitive behavioural, psychodynamic, and existential theories. As such, integrating these three theories in the conceptualization of climate change anxiety may provide a comprehensive understanding that could not be achieved by any of these theories alone.

Across all these theories, climate change anxiety is composed of physiological, cognitive, emotional, and behavioural components. Climate change anxiety is seen as a unique type of anxiety which can vary in severity. It is important to acknowledge that most anxiety in response to climate change is normal, according to cognitive behavioural, psychodynamic, and existential theories. Climate change is unpredictable and uncontrollable, it elicits feelings of guilt and shame, and it is an inevitable threat to human survival – expected precipitants for anxiety across these theories. However, climate change anxiety may also become severe such that it is no longer considered normal or adaptive.

Adaptive and Maladaptive Anxiety

Cognitive behavioural, psychodynamic, and existential theorists agree that anxiety is an adaptive response in most cases but can become maladaptive in certain circumstances. Low levels of anxiety can help individuals plan and prepare for threats and may even enhance learning and performance in threatening situations (Barlow, 2002). However, anxiety that becomes chronic or severe can be maladaptive and may result in an anxiety disorder. In order for an anxiety disorder to be clinically significant according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), the anxiety must "cause significant distress or impairment in social, occupational, or other important areas of functioning" (APA, 2013, p.189). Anxiety disorders involve anxiety that is unreasonable or irrational in proportion to any real threat, and several anxiety disorders have been defined based on the type of threat or anxiety response (APA, 2013).

Because climate change is a real and significant threat, climate change anxiety may often be considered a proportional response to the threat, rather than a clinically significant one.

However, climate change anxiety is often experienced as significantly distressing and this should not be dismissed. Additionally, climate change anxiety can affect behaviour and interfere with functioning. The DSM-5 describes various causes and consequences of psychological pathology, but it does not include any reference to climate change (APA, 2013; Cianconi, Betrò, & Janiri, 2020). This is a significant omission considering the growing literature reviewing several types of psychological distress related to climate change.

Through both direct and indirect experiences with climate change, some individuals may become intensely anxious such that it leads to significant distress or interferes with functioning (Fritze et al., 2008). Climate change anxiety is often experienced as overwhelming and can become clinically significant (Haseley, 2019). Additionally, climate change anxiety may influence relationships and the decision to procreate, with many people choosing not to have children because of climate change (Schneider-Mayerson & Leong, 2020). However, pathological climate change anxiety should be distinguished from normal climate change anxiety (Pihkala, 2020). Caution should be exercised when considering whether climate change anxiety is clinically significant; the expected level of anxiety about climate change may be higher than for other precipitants of anxiety disorders (Clayton, 2020). As such, it is important to identify whether climate change anxiety causes significant distress and interferes with functioning in order to distinguish between adaptive and maladaptive levels of climate change anxiety.

Official measures of climate change-related mental health disorders are not presently available within clinical psychology (Cianconi, Betrò, & Janiri, 2020). To my knowledge, no tool exists to distinguish between normal and clinically significant levels of climate change anxiety. However, anxiety has been measured in a variety of ways across cognitive behavioural, psychodynamic, and existential theories. These different methods of measurement may be useful

to inform the measurement of climate change anxiety using an integrative theoretical framework.

Measurement and Assessment

Psychologists have been attempting to measure anxiety since the mid-20th century, encountering a variety of difficulties along the way. In order to measure a construct such as anxiety, that construct must be operationalized or clearly defined (Buss, Wiener, Durkee, & Baer, 1955). Anxiety has held several different definitions over the years and a universal definition has yet to be achieved – as demonstrated by the differences between the cognitive behavioural, psychodynamic, and existential theories of anxiety outlined above. However, most theorists agree that anxiety can manifest through cognitive, physiological, and behavioural experiences, as measured through self-report or external observation (Buss, Wiener, Durkee, & Baer, 1955; Cattell, 1963; Morse, 1998).

In an attempt to operationalize anxiety, many tools have been developed in the past century which measure anxiety in different ways. Although it is often assumed that anxiety scales all define anxiety in the same way, this is not the case (Keedwell & Snaith, 1996). Depending on the psychological theory, anxiety has several components by which it may differ across scales. For example, some scales might measure generalized anxiety while others measure situation-specific anxiety, and some scales focus on the physiological components of anxiety while others emphasize cognitive or emotional components (Keedwell & Snaith, 1996). A few anxiety scales attempt to measure all components or facets of anxiety; however, most individuals do not experience every component when anxious.

Because not all components of anxiety are simultaneously experienced by most individuals, anxiety scales should not require endorsement of all components in order to meet

criteria for anxiety. However, content validity is highest when a scale accurately measures all

aspects of anxiety as outlined by theory (Keedwell & Snaith, 1996). Subscales which represent

the facets or factors within anxiety may allow for high content validity without requiring that

individuals must endorse all subscales. Furthermore, differentiating between different

manifestations of anxiety may be clinically useful in both assessment and treatment of anxious

individuals. A review of how different anxiety scales have assessed anxiety follows.

As previously mentioned, the DSM-5 considers anxiety to be clinically significant if it

causes significant distress or interferes with functioning (APA, 2013). The Structured Clinical

Interview for the DSM-5 (SCID-5; First, Williams, Karg, & Spitzer, 2016) is a psychodiagnostic

tool used to assess for most psychiatric disorders listed in the DSM-5. It includes sections on

anxiety disorders, most of which are situation-specific or include unique symptoms (APA, 2013).

However, the section on Generalized Anxiety Disorder (GAD) measures a more generalizable

idea of anxiety, which is likely most relevant to climate change anxiety. Questions are used to

assess cognitive, physical, emotional, and behavioural symptoms of anxiety, such as "have you

been feeling anxious and worried for a lot of the time?" and "has this anxiety affected your

ability to take care of things at home?" (First, Williams, Karg, & Spitzer, 2016). Importantly, the

questions from the SCID-5 assess whether the anxiety causes significant distress or impairment

of functioning, and therefore measure clinically significant anxiety.

Similarly, the Beck Anxiety Inventory (BAI; Beck & Steer, 1993) is used to assess for

clinically significant anxiety. This scale was developed using a cognitive behavioural

framework, and therefore emphasizes the three-component model of anxiety: thoughts, physical

sensations, and behaviours (Beck, 2021; Beck & Steer, 1993). The BAI is a self-report

questionnaire which lists common symptoms of anxiety, such as "numbness or tingling" and

"fear of worst happening." It seems likely that climate change anxiety includes cognitive behavioural components, as measured by the BAI.

The State Trait Anxiety Inventory (STAI: Spielberger, 1983, 2015) has also been used to assess for clinically significant anxiety. The unique contribution of this scale is its differentiation between state and trait anxiety, concepts first outlined by Cattell and expanded upon by Spielberger (1966). The state-trait theory of anxiety suggests that state anxiety results from certain experiences and knowledge, while trait anxiety is more stable and innate in certain people (Grös, Antony, Simms, & McCabe, 2007; Spielberger, 1966). State anxiety is a temporary consequence of internal (ex. thoughts or memories) or external (ex. hearing the news or experiencing something scary) circumstances (Spielberger, 1983, 2015). In contrast, trait anxiety is enduring and exists within the individual regardless of context. Interestingly, Spielberger suggested that one may be more predisposed for higher levels of trait anxiety if they have frequently experienced state anxiety (Grös, Antony, Simms, & McCabe, 2007; Spielberger, 1966). The STAI is a self-report questionnaire with two subscales for state and trait anxiety, respectively measuring how respondents feel in the moment and how they generally feel (Spielberger, 1983, 2015). As climate change is an external stressor which can cause situation-specific anxiety, it is possible that climate change anxiety could include components of state anxiety.

Measures have been developed based on other cognitive behavioural frameworks, including intolerance of uncertainty and future anxiety. Intolerance of uncertainty, as previously discussed, can be defined as difficulty enduring ambiguity about the future, is highly associated with anxiety, and may be particularly relevant to climate change anxiety (Buhr & Dugas, 2002). The Intolerance of Uncertainty Scale (IUS; Buhr & Dugas, 2002) is a self-report questionnaire

that measures this construct and can predict generalized anxiety. Example items from the IUS include "uncertainty keeps me from living a full life" and "the ambiguities in life stress me" (Buhr & Dugas, 2002). Additionally, climate change anxiety may be a type of future anxiety, as it is related to the more distant future. Measures of future anxiety may thus be useful in measuring climate change anxiety. Two scales, a long and short form, have been developed to measure future anxiety: The Future Anxiety Scale (FAS; Zaleski, 1996) and the Dark Future Scale (Zaleski et al., 2019). The FAS includes general items such as "I am afraid to plan for the future" and items specific to non-climate change situations, including sudden accidents, serious illness, and apocalypse. The Dark Future Scale consists of more general items such as "I am afraid that in the future my life will change for the worse" (Zaleski et al., 2019).

In contrast to the abundance of tools that use a cognitive behavioural framework, there are not many psychodynamically oriented tools to measure anxiety. The Psychodynamic Diagnostic Manual, 2nd Edition (PDM-2; Lingiardi & McWilliams, 2017) and accompanying psychodiagnostic chart (PDC-2) outline personality syndromes, mental functioning, and symptom patterns related to psychopathology from a psychodynamic perspective. The PDM-2 describes cognitive and somatic symptoms of anxiety, including poor concentration, poor memory, fear, tension, sweaty palms, and breathing difficulties (Lingiardi & McWilliams, 2017). To my knowledge, there is no anxiety scale associated with the PDM-2.

Climate change anxiety has been considered consistently from an existential psychology perspective. The Existential Anxiety Questionnaire (EAQ; Weems, Costa, Dehon, & Berman, 2004) was developed to measure Paul Tillich's theory of existential anxiety and has provided support for these existential concerns as causes of existential anxiety. The EAQ has been used to support the existence of existential climate change anxiety caused by environmental disaster

(Scott & Weems, 2013). It includes items such as "I often feel anxious because I am worried that life might have no meaning" and "I never think about emptiness" (reverse scored). These cognitive behavioural, psychodynamic, and existential ways of assessing anxiety may all be relevant in the measurement of climate change anxiety.

At the time of this writing, only one climate change anxiety scale appears to exist, which measures stress reactions to climate change (Clayton & Karazsia, 2020). This scale found that climate change anxiety was common and was comprised of four factors: cognitive-emotional impairment, functional impairment, behavioural engagement, and experience. However, this scale considers anxiety from an adaptive perspective and does not effectively distinguish clinically significant anxiety from adaptive anxiety. Additionally, the scale is based only on cognitive behavioural theory, using items such as "thinking about climate change makes it difficult for me to concentrate" and "I find myself crying because of climate change" (Clayton & Karazsia, 2020). Similarly, the Climate Change Worry Scale was created to measure the worry cognitions experienced in relation to personal experience with climate change (Stewart, 2021). This scale measures worry, which is only one component of anxiety. Psychodynamic and existential theories of anxiety add depth to the understanding of climate change anxiety beyond what is measured in these scales.

Based on the reviewed literature, it seems that climate change anxiety can be understood in different ways by cognitive behavioural, psychodynamic, and existential psychological theories. Additionally, climate change anxiety may exist on a spectrum from adaptive to maladaptive, based on criteria of clinical significance outlined in the DSM-5. As such, a scale measuring climate change anxiety should consider these psychological theories and frameworks in order to measure anxiety comprehensively.

Because the previously developed scales do not consider clinically significant levels of climate change anxiety, they cannot be used in a clinical assessment or to inform treatment of climate change anxiety. Evidence-based scales measuring clinically significant concerns are required to define these concerns and facilitate treatment (Jensen-Doss, 2015). To my knowledge, no tool exists to distinguish between adaptive and maladaptive levels of climate change anxiety. In this study, I will attempt to develop a scale which measures climate change anxiety using multiple psychological frameworks and can assess clinical significance of climate change anxiety. The resulting development of an evidence-based clinical scale measuring climate change anxiety will allow for the assessment and subsequent treatment of climate change anxiety. This study will enhance clinical understanding of climate change anxiety, with implications for improving clinical outcomes.

Method

Item Generation

The first step in scale development is over-generation of items related to the construct being measured (DeVellis, 2016). It is important to begin with a large pool of items, which can then be cut down by eliminating redundant or problematic items; the initial item pool should be three to four times the size of the final scale length (DeVellis, 2016). Scale items should be firmly grounded in the existing literature on the subject (Hinkin, 1998). As such, I generated an initial pool of 218 items based on review of the psychological theories of anxiety described above – cognitive behavioural theory, psychodynamic theory, and existential theory. Items were also adapted from existing measures of anxiety, including the Structured Clinical Interview for the DSM-5 (SCID-5; First, Williams, Karg, & Spitzer, 2016), the Existential Anxiety

Questionnaire (EAQ; Weems, Costa, Dehon, & Berman, 2004), and the Intolerance of Uncertainty Scale (IUS; Buhr & Dugas, 2002). Items were generated as declarative statements that participants agree or disagree with, as measured by a 5-point Likert scale from "strongly disagree" to "strongly agree."

After the initial item pool was generated, items were modified or eliminated based on redundance. Two expert raters assessed the remaining 83 items for practicality, understandability, redundance, and any possible negative reactions from participants. The final, approved 45 items made up the initial Cross-Theory Climate Change Anxiety Scale (see Figure A1). Development and validation samples completed this scale, along with several other scales, as described below.

Participants

The recommended number of participants for scale development varies greatly; some researchers suggest that 200 or 300 participants would be sufficient (ex. Clayton & Karazsia, 2020; DeVellis, 2016) while others recommend 800 participants for ideal statistical analyses (ex. Taylor, Grant, Frosi, & White, 2018). The current study had 608 survey responses. Participants completed the survey online through a platform called Free Online Surveys. Participants were recruited online from 350 Canada, online climate change groups, social media, and the University of Toronto and University of Prince Edward Island. Online groups included Green Party of Canada networks, *Leaders Net GPPEI, Climate Elder Millennials, Canada and the People's Climate March, Extinction Rebellion PEI,* and *Climate Change Education Canada.* Participants had the option to be entered into a lottery to win one of 100 $40.00CAD gift cards. All participants completed the same survey, although the total sample was divided into two groups for statistical analyses as described below.

Participants had to be at least 18 years of age, fluent in the English language (by self-report) and residing in Canada. Inclusion of participant data was screened based on attention checks (two instructed-response items (ex. "Select 'strongly agree' for this item")), patterns of static responding, and participant indication of a desire to withdraw from the study. Additionally, participants who did not complete any of the items intended to measure climate change anxiety were excluded as their data would not be useful for statistical analyses. After excluding participants based on these criteria, the total number of viable responses for statistical analyses was 428. Responses were randomly split into two groups for statistical analyses: 328 responses were used for factor and reliability analyses (sample 1) and 100 responses were used for validity, reliability, and correlational analyses (sample 2).

Measures

The primary measure administered was the 45-item initial Cross-Theory Climate Change Anxiety Scale (see Figure A1). A measure of social desirability (The Social Desirability Scale-17; Stöber, 1999) was administered to determine whether survey responses were biased by desirable responding. Additional measures of anxiety (The State-Trait Anxiety Inventory for Adults; Spielberger, 1968, 1977) and depression (The Center for Epidemiologic Studies Depression Scale; Radloff, 1977) were included for validation analyses. A measure of climate change knowledge (The Climate-Related Knowledge Scale; Tobler, Visschers, & Siegrist, 2012) was administered to explore its relationship with climate change anxiety. Two instructed response items were also included to check for attention. Finally, I generated 8 items to measure attitudes and experiences with climate change (see Figure A2) and 9 items to measure demographic information (see Figure A3). A total of 156 items were included in the survey.

The Social Desirability Scale-17 (SDS-17).

The Social Desirability Scale-17 (SDS-17; Stöber, 1999) is a short form version of the Marlowe-Crowne Social Desirability Scale. The SDS-17 is intended to measure social desirability bias in participant responses, which occurs when participants respond inaccurately due to social norms or expectations. The items are statements which participants must indicate if they describe them personally, using "True" or "False" responses. Example items include "I sometimes litter" and "I always eat a healthy diet." Based on recommendations from Stöber, one item was removed, for a total of 16 items (Stöber, 2001). Items 1, 5, 6, 10, 14, and 16 are reverse scored. A lower total score suggests lower social desirability. The SDS-17 has demonstrated satisfactory reliability, with a Cronbach's alpha of α=.72 and a test-retest correlation of .82 across four weeks (Stöber, 2001). Additionally, the SDS-17 has demonstrated sufficient convergent validity with the original Marlowe-Crowne Scale, with a correlation of .74.

State-Trait Anxiety Inventory for Adults (STAIAD).

The State-Trait Anxiety Inventory for Adults (STAIAD; Spielberger, 1968, 1977) is a self-report scale designed to measure anxiety across two subscales: the state anxiety subscale measures levels of anxiety "right now, at this moment" while the trait anxiety subscale measures the level of anxiety that people "generally feel" (Spielberger, 1983, 2015). In the Short Form of the STAIDAD, each subscale consists of 10 statements which participants must indicate how well they describe themselves. The state anxiety subscale uses a four-point Likert scale with responses "not at all", "somewhat", "moderately so", and "very much so." The trait anxiety subscale uses a four-point Likert scale with responses "almost never", "sometimes", "often", and "almost always." Items 1, 3, 8, 10, 12, 17, and 19 are reverse scored. An example item from the state subscale is "I feel calm" and an example item from the trait subscale is "I am a steady

person." Scores for each subscale can range from 10 to 40, with higher scores indicating higher levels of anxious symptomatology (Spielberger, 1983, 2015).

The state anxiety subscale does not demonstrate significant test-retest reliability across time, as it is intended to measure anxiety only for the present moment. The trait anxiety subscale has demonstrated satisfactory test-retest reliability, with coefficients ranging from .65 to .86 (Spielberger, 1983, 2015). Both subscales have demonstrated satisfactory internal consistency, with Cronbach's alpha coefficients ranging from .89 to .96. The Short Form of the STAIAD correlates significantly with the full-length form, with correlation coefficients ranging from .93 to .96 (Spielberger, 1983, 2015).

Center for Epidemiologic Studies Depression Scale (CES-D).

The Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977) is a self-report scale designed to measure depressive symptoms in the general population. It has 20 items which are rated on a four-point scale from "Rarely or none of the time (less than 1 day)" to "Most or all of the time (5-7 days)". Items 4, 8, 12, and 16 are reverse scored. Example items include "I felt depressed" and "I thought my life had been a failure." The possible total score ranges from 0 to 60, with higher scores indicating more depressive symptomatology. The CES-D has demonstrated high reliability and internal consistency, with coefficient alphas ranging from .84 to .90 in general and clinical populations (Radloff, 1977).

Climate-Related Knowledge Scale.

The Climate-Related Knowledge Scale measures knowledge about climate change across four domains: physical knowledge about CO_2 and the greenhouse effect, knowledge about climate change and its causes, knowledge about the expected consequences of climate change,

and knowledge related to actions that affect climate change (Tobler, Visschers, & Siegrist, 2012). It has 36 items split across four subscales, mapping to the above domains. Items are statements which participants must indicate as "True" or "False." 17 of the items are false or incorrect, while the remaining 19 items are accurate statements about climate change. Example items include "Water vapor is a greenhouse gas" and "Reducing the temperature of a gas-heated room by 1 degree Celsius decreases CO_2 emissions." A higher score suggests more knowledge about climate change. At development, the four subscales had moderate reliability, with the first three subscales' Mokken reliability ranging from $\rho=0.65$ to 0.70, and the action-related subscale had a Cronbach's alpha reliability of .61 (Tobler, Visschers, & Siegrist, 2012).

Demographics.

Participants provided demographic information (see Figure A3), including gender, age, ethnic background, education and vocation, and geographical location with particular attention to locations affected highly by climate change such as islands and coastal areas. Participants also indicated any personal exposure to effects of climate change.

Statistical Analyses

Several statistical analyses were used to analyze participant data for the purposes of scale development and to ensure reliability and validity of the scale. Statistical analyses were conducted using Jamovi statistical software, and included exploratory factor analysis, Cronbach's alpha reliability analysis, and non-parametric tests of variance and correlation analyses to test for validity and relationships between climate change anxiety and other constructs. Before conducting these analyses, data was tested for abnormalities and cleaned so that it met the assumptions of parametric data.

Results

Descriptive Information

The sample's (N=428) demographic characteristics were as follows: Female (66.7%), male (29.6%), nonbinary or gender non-conforming (3.1%), other gender (0.7%). The mean age of participants was 28.7 years (SD=12.1) with a minimum age of 18 and a maximum age of 89. The distribution of race was White/Caucasian (84.1%), Black (1.64%), Asian (7.48%), Canadian Indigenous/First Nations (2.80%), Pacific Islander (0.70%), Middle Eastern (1.17%), Latino/South American (0.70%), Mixed Race (0.93%), and other (0.70%). The mean years of education was 15.3 (SD=3.2). The sample varied highly in occupation, with 38.5% students, 4% unemployed/retired, and the remaining 57.5% employed in various occupations. 71.5% of participants lived in urban areas. The most common province was Prince Edward Island (36.8%) and most participants lived in coastal (27.57%) or island (40.89%) geographical locations. Almost all participants had experienced some effects of climate change, with the most common being severe storm (40.19%) and heatwave/heat dome (40.42%). See Table A1 for detailed demographic information.

Sample 1

Exploratory Factor Analysis.

Factor analysis can be used to determine the latent variables underlying the items of a scale (DeVellis, 2016). Additionally, factor analysis condenses the items to fit under relevant factors (subscales) and determines the meaning of these factors as they account for item variation (DeVellis, 2016). Exploratory factor analysis (EFA) was conducted to determine if there are subscales within the items and to eliminate unnecessary items. A confirmatory factor analysis

was not conducted, because there does not exist a unifying theory of climate change anxiety to be tested. However, I expected that subscales may be defined by specific theories of anxiety used to generate items, including cognitive behavioural, psychodynamic, and existential theories, as well as items measuring clinical significance of anxiety.

The results of Bartlett's test of sphericity (Bartlett, 1954) indicated that the correlation matrix was not random, $\chi 2(990) = 8,332$, $p < .001$, and the KMO statistic (Kaiser, 1974) was .95, well above the minimum standard for conducting factor analysis. Therefore, it was determined that the correlation matrix was appropriate for factor analysis. Levels of skewness and kurtosis were investigated, and all levels of skewness and kurtosis fell within acceptable levels (-2 to +2). The correlation matrix was examined for inter-item correlations that were not significant or too highly correlated. Recommended practice is to eliminate items that do not correlate with any other variables and items that correlate too highly ($r > .8$) with other variables (Field, 2018). Two items (6 and 38) did not correlate significantly with several other items and occasionally correlated negatively, suggesting that these items should be eliminated.

For the EFA, principal axis was used, as the recommended extraction method to determine the common factor model (Field, 2018; Watkins, 2018). To determine which factors to retain, several methods can be used, including scree plots, Parallel Analysis, and Kaiser's criterion for evaluating eigenvalues. Recommended practice is to examine the factor solutions generated by several methods and carefully judge each possible solution to find the best fit (Watkins, 2018; Worthington & Whittaker, 2006). Two EFAs were run, using Parallel Analysis and Kaiser's criterion (eigenvalues greater than 1); scree plots were examined for both solutions. An oblique oblimin rotation method was used, as the recommended practice within psychology, to allow factor intercorrelations to emerge (Watkins, 2018). Finally, factor loadings below 0.3 were

hidden by Jamovi, as only factor loadings with an absolute value greater than 0.3 or 0.4 should be interpreted (Field, 2018; Watkins, 2018). To be considered strong enough for interpretation, factor loadings should be statistically significant, in addition to being large enough to be practically useful (>|0.3|). For a sample size of 328, all factor loadings greater than 0.29 were statistically significant at the 0.01 alpha level.

EFA results were interpreted using simple structure criteria (Thurstone, 1947) and additional criteria outlined by Watkins (2018): In an acceptable EFA solution, each factor should be saliently loaded by at least three variables (overdetermined), there should be no complex or cross-loadings, each factor should demonstrate internal consistency, and each factor should be theoretically meaningful. Parallel Analysis suggested that four factors should be retained, but the fourth factor was only loaded by four items, with 3 being smaller than |0.4|. As such, the fourth factor was not overdetermined, and a four-factor structure did not appear to be a good fit for the data. Kaiser's criterion suggested that three factors should be retained. This three-factor structure was overdetermined and demonstrated internal consistency and theoretical meaningfulness across factors. However, there were complex and cross-loadings, therefore the solution was not acceptable.

Several EFAs, using Kaiser's criterion, were run with different items eliminated, based on cross-loadings or complex loadings, non-significant inter-item correlations, too high inter-item correlations, and factor loadings below |0.4|. A 35-item solution was generated after eliminating items from the EFA using Kaiser's criterion. This EFA suggested that three factors should be retained. The solution was overdetermined, demonstrated internal consistency and theoretical meaningfulness across factors, and had no complex or cross-loadings, thus meeting criteria for an acceptable factor solution. The first factor had 14 items, the second factor had 13 items, and

the third factor had 8 items (see Table A2 & Figure A4). Factor 1 accounted for 20.3% of the variance, factor 2 accounted for 20.1% of the variance, and factor 3 accounted for 12.2% of the variance (see Table A3). The inter-factor correlations suggest that factors 1 and 2, and factors 2 and 3 correlate more highly than factors 1 and 3 (see Table A4). These non-zero inter-factor correlations suggest that an oblique oblimin rotation method was appropriate for this data.

Each factor appeared to be theoretically meaningful, with factor 1 representing clinically significant anxiety, factor 2 representing existential anxiety, and factor 3 representing cognitive and future-focused anxiety. To obtain total and factor (subscale) scores for the Cross-Theory Climate Change Anxiety Scale, the item scores should be summed. Higher scores indicate higher levels of climate change anxiety, with climate change anxiety being measured on a continuum. The maximum total anxiety score is 175, with maximum scores of 70 for factor/subscale 1, 65 for factor/subscale 2, and 40 for factor/subscale 3.

Reliability Analyses.

Reliability analyses were conducted to determine if the items reliably measure the same construct. The Cronbach's alpha test was used to assess internal consistency of the Cross-Theory Climate Change Anxiety Scale and subscales. The total scale ($\alpha=0.96$) and each of the three subscales ($\alpha_1=0.93$, $\alpha_2=0.94$, $\alpha_3=0.89$) demonstrated sufficient internal consistency, suggesting that the total scale and subscales reliably measure the same construct.

Sample 2

Descriptive Information.

All variables used in Sample 2 analyses were tested and data was cleaned to ensure all variables met the assumptions of parametric data. Data was trimmed to eliminate significant

outliers (data points greater than 1.5 times the interquartile range at the 25th and 75th percentiles). Levels of skewness and kurtosis were investigated, and all levels of skewness and kurtosis fell within acceptable levels (- 2) to (+2). Based on analysis of Q-Q plots and the Shapiro-Wilk test, the total scores for the SDS-17 (W = .98, p = .06), the CRKS (W = .98, p = .10), the STAI (W = .99, p = .53), the STAI-T (W = .98, p = .06), the STAI-S (W = .99, p = .34), and the CES-D (W = .99, p = .48) met the assumption of normality. The total score for the developed Cross-Theory Climate Change Anxiety Scale also met the assumption of normality, W = .98, p = .11. The central limit theorem suggests that for sample sizes larger than 30, normality can always be assumed. After cleaning, all variables had appropriate measures of central tendency and variability, further suggesting normal distribution (see Table A5).

Validity Analyses.

Validity analyses assessed the validity of the newly developed Cross-Theory Climate Change Anxiety Scale. Validity analyses used the second part of the sample and the STAIAD and CES-D, intended to assess for convergent and discriminant validity, respectively. There is no standard value to clearly demonstrate convergent and discriminant validity; in fact, DeVellis (2016) indicated that there is no consistent number than defines construct validity. However, a general rule of thumb seems to be that correlation values of 0.70 or greater with construct-similar scales indicate sufficient convergent validity (Sall, 2020).

Scores on the Cross-Theory Climate Change Anxiety Scale and the STAIAD were significantly correlated, r = .39, p < .001. This weak and significant correlation suggests that scores on the Cross-Theory Climate Change Anxiety Scale are somewhat convergent with scores on a measure of anxiety. Looking at the subscales of the STAIAD, Cross-Theory Climate Change Anxiety Scale total scores were significantly and moderately correlated with the state

subscale (STAI-S), r = .57, p < .001 and not significantly correlated with the trait subscale

(STAI-T), r = .18, p = .08. This suggests that scores on the Cross-Theory Climate Change

Anxiety Scale are convergent with scores of state anxiety and not very convergent with scores of

trait anxiety. Scores on the Cross-Theory Climate Change Anxiety Scale and the CES-D were

significantly correlated, r = .33, p < .001. This weak, but significant, correlation suggests that

scores on the Cross-Theory Climate Change Anxiety Scale are somewhat convergent with, rather

than discriminant from, scores on a measure of depression. CES-D total scores were strongly and

significantly correlated with the STAIAD (r = .68, p < .001), the STAI-S (r = .55, p <.001), and

the STAI-T (r = .72, p < .001). These correlations suggest that the CES-D scale may be a better

measure of convergent validity than discriminant validity. Overall, these correlations suggest

moderate convergent validity but cannot confirm discriminant validity.

Reliability Analyses.

A second set of reliability analyses further determined the internal consistency of the scale

and subscales. The total scale (α=0.95) and each of the three subscales (α_1=0.92, α_2=0.93,

α_3=0.91) demonstrated sufficient internal consistency, with very similar alpha levels as in sample

1. This provides further support that the total scale and subscales reliably measure the same

construct.

Social Desirability.

To test if responses to the Cross-Theory Climate Change Anxiety Scale were biased by

desirable responding, a Pearson's correlation was conducted with the Cross-Theory Climate

Change Anxiety Scale and the SDS-17 total scores. Scores on the Cross-Theory Climate Change

Anxiety Scale and the SDS-17 were not significantly correlated, r = -.16, p = .11. This suggests

that social desirability is not a concern in responses to the climate change anxiety items. Furthermore, correlations between other scales were not significantly attenuated when SDS-17 scores are partialled out, indicating that responses are not biased by desirable responding (Stöber, 2001).

Exploratory Relationships.

To explore potential relationships between climate change anxiety and other constructs, a number of (Pearson's and Spearman's) correlations and Kruskall-Wallis tests were conducted. A Pearson's correlation found that total scores on the Cross-Theory Climate Change Anxiety Scale and the CRKS were not significantly correlated, $r_t = .16$, $p = .12$. The CRKS total score was not significant correlated with factors 1 ($r_1 = -.09$, $p = .40$) or 2 ($r_2 = .13$, $p = .20$), but was significantly, positively correlated with factor 3 ($r_3 = .45$, $p < .001$). Climate change anxiety total scores were significantly correlated with number of climate-related effects experienced, such that participants who had experienced more climate-related effects also had higher levels of climate change anxiety, $r = .35$, $p < .001$. Climate change anxiety total and factor scores were not significantly correlated with age ($r_t = -.04$, $p = .70$; $r_1 = .03$, $p = .81$; $r_2 = -.06$, $p = .56$; $r_3 = -.07$, $p = .47$) or years of education ($r_t = .01$, $p = .96$; $r_1 = .04$, $p = .69$; $r_2 = -.001$, $p = .99$; $r_3 = -.05$, $p = .66$) (see Table A6). A biserial correlation assessed the relationship between climate change anxiety and rural or urban home. Rural/urban home was not significantly correlated with the total Cross-Theory Climate Change Anxiety Scale score ($r_t = -.05$, $p = .62$) or the first two factors ($r_1 = .09$, $p = .37$; $r_2 = -.04$, $p = .70$). However, it was significantly, negatively correlated with the third factor, $r_3 = -.25$, $p = .01$.

Spearman's correlation analyses were conducted with items generated to measure attitudes and experiences with climate change. Total Cross-Theory Climate Change Anxiety Scale scores

were significantly, positively correlated with items 2 ("Climate change has had a negative effect on my life"; $\rho = .39$, $p < .001$), 4 ("I check the news regularly for information about climate change"; $\rho = .29$, $p = .004$), 5 ("Our leaders are not taking enough action to lessen the effects of climate change"; $\rho = .29$, $p = .003$), 6 ("I do things to reduce my impact on climate change"; $\rho = .20$, $p = .045$), 7 ("Because of climate change, I eat fewer animal products"; $\rho = .49$, $p < .001$), and 8 ("I participate in activism (ex. Protests, signing petitions) to fight climate change"; $\rho = .26$, $p = .010$). Additionally, Cross-Theory Climate Change Anxiety Scale subscale scores were significantly correlated with some of these items (see Table A7). Of note, the third subscale had strong, positive, and significant correlations with items 1 ("Climate change is real"; $\rho = .55$, $p < .001$), 2 ("Climate change has had a negative effect on my life"; $\rho = .51$, $p < .001$), and 5 ("Our leaders are not taking enough action to lessen the effects of climate change"; $\rho = .68$, $p < .001$).

The mean Cross-Theory Climate Change Anxiety Scale total scores (MCCCAS) were explored across five categorical demographic variables: gender, race, occupation, province and territory, and geographical location. Due to low data values across categories, no parametric significance tests could be used. Across gender, the MCCCAS was highest for nonbinary participants ($M = 135$), followed by other gender ($M = 120$), then men ($M = 103$), and lowest for women ($M = 101$) (see Table A8). A One-Way Kruskall-Wallis rank sum test suggested that the mean differences across gender were significant ($x^2 = 10.7$, $p = .01$). Dwass-Steel-Critchlow-Fligner pairwise comparisons suggest that the nonbinary MCCCAS was significantly higher than the MCCCAS for men ($W = 4.14$, $p = .02$) and women ($W = 3.90$, $p = .03$), with no other significant pairwise comparisons.

Across race, the MCCCAS was highest for the sole Pacific Islander ($M = 107$) and lowest among Asian participants ($M = 81$) (see Table A9). A One-Way Kruskall-Wallis rank sum test

suggested that the mean differences across race were not significant ($x^2 = 8.12$, p = .23). Across occupation, the MCCCAS was highest for three occupations: Building and Grounds Cleaning and Maintenance, Office and Administrative Support, and other (government program officer) (M = 126). The lowest MCCCAS occurred for the sole participant in Business and Financial Operations (M = 80) (see Table A10). A One-Way Kruskall-Wallis rank sum test suggested that the mean differences across occupation were not significant ($x^2 = 18.6$, p = .55).

Across province and territory, the MCCCAS was highest among residents of Newfoundland and Labrador (M = 115) and lowest among residents of the Yukon (M = 84) (see Table A11). A One-Way Kruskall-Wallis rank sum test suggested that the mean differences across province and territory were not significant ($x^2 = 9.34$, p = .67). Across geographical location, the MCCCAS was highest for the sole participant who identified their geographical location as both Arctic and other (M = 111), followed by participants living in coastal regions (M = 108.4). The lowest MCCCAS occurred for the participant living in the Arctic (with no other geographical locations endorsed) (M = 89), with the second lowest MCCCAS occurring amongst participants living inland (M = 100) (see Table A12). A One-Way Kruskall-Wallis rank sum test suggested that the mean differences across geographical location were not significant ($x^2 = 6.26$, p = .62). Overall, there were no meaningful relationships between Cross-Theory Climate Change Anxiety Scale scores and demographic variables other than gender.

Discussion

This research has resulted in the development of a new scale to measure climate change anxiety, integrating several psychological frameworks: The Cross-Theory Climate Change Anxiety Scale. Furthermore, the new scale allows practitioners to identify when climate change

anxiety is clinically significant, thus distinguishing between adaptive and maladaptive anxiety. The Exploratory Factor Analysis process found a 35-item scale that can be used to measure climate change anxiety, with three subscales (see Figure A4 and Appendix B). The subscales measure clinical significance of climate change anxiety, existential components of climate change anxiety, and cognitive and future-focused components of climate change anxiety, respectively.

Subscales

The first subscale consists of items assessing the clinical significance of climate change anxiety when present. Research across psychological theories (including cognitive behavioural, psychodynamic, and existential) suggests that climate change anxiety is often adaptive and even helpful, but that it can become unhelpful and pathological (Beidel & Frueh, 2018; Boschen & Oei, 2008; Lingiardi & McWilliams, 2017; May, 1977; Weintrobe, 2013; Zerbe, 1990). From the clinical psychology perspective, climate change anxiety may become clinically significant or pathological when it causes significant distress or impairs functioning in social, occupational, or other domains of life (APA, 2013). Items from this subscale assess whether climate change anxiety causes significant distress, if it is difficult to manage, and if it interferes with life. As such, this subscale may be used to assess the clinical significance of climate change anxiety. Many of the items assume the presence of climate change anxiety, so this subscale may be most useful when administered to those who endorse climate change anxiety.

The second subscale consists of items which relate to existential anxiety. Existential anxiety generally involves concern about the meaningfulness of life, values, and relationships; all themes highlighted in this factor (Budziszewska & Jonsson, 2021; Yalom, 1980). Climate

change and existential anxiety have been linked in the literature, with studies suggesting that climate change, as a threat to life and meaning, is likely to cause existential anxiety (Myers, 2014; Ojala, 2016). Climate change can be considered an existential threat as it may cause death and devastation across the world (IPCC, 2022). These consequences of climate change may eliminate meaning from life, thus causing feelings of overwhelm, hopelessness, and powerlessness (Budziszewska & Jonsson, 2021). Individuals experiencing climate change anxiety may feel as though their beliefs and values are no longer important (Ojala, 2016). These existential factors appear to be important components of climate change anxiety as measured by this scale.

While many of the items in this subscale are directly related to existential theory, the subscale also includes three items measuring physiological symptoms of anxiety – restlessness, tension, and increased heart rate. Across theories, psychologists agree that anxiety includes physiological components in addition to cognitive, emotional, and behavioural ones. Existential anxiety can be separated into psychological and somatic components; while existential themes are generally psychological, they tend to be accompanied by physiological responses (Morse, 1998). These physiological items support a general cross-theory inclusion of the somatic component of existential anxiety. Similarly, themes of death and uncertainty exist across cognitive behavioural and psychodynamic theories in addition to existential ones, providing further support for the integration of psychological theories in defining climate change anxiety (Weintrobe, 2013; Zerbe, 1990). Overall, this primarily existential subscale suggests that climate change anxiety includes existential components and may even be considered a type of existential anxiety.

The third subscale consists of items assessing cognitive components of climate change anxiety, largely related to the future. Cognitive components of climate change anxiety include worry and fear, thinking that the future is uncertain, and thinking that bad things will happen in the future (Dugas & Ladouceur, 1998; Fritze, Blashki, Burke, & Wiseman, 2008; Searle & Gow, 2010). This subscale seems to map on to the worry component of anxiety, rather than the somatic or existential components. Future research may examine how this subscale relates to the Climate Change Worry Scale (Stewart, 2021). Uncertainty tends to be associated with worry and anxiety, and climate change involves significant uncertainty around future consequences (Buhr & Dugas, 2002; Dugas, Gosselin, & Ladouceur, 2001). Although unclear, it is likely that the consequences of climate change will be negative, thus leading to increased thoughts about bad things happening in the future (Cianconi, Betrò, & Janiri, 2020; Pihkala, 2020). Future anxiety, a cognitive type of anxiety specific to the distant future, is characterized by negative cognitive and emotional processes about negative future outcomes (Zaleski, 1996). Future anxiety occurs in situations when negative outcomes are more likely; as such, it follows that climate change anxiety shares similar processes to future anxiety.

In addition to cognitive, future-focused items, the third subscale includes one item about guilt related to the anthropogenic contributions to climate change. Guilt can be understood as a cognitive component of anxiety. Guilt about the human impact on climate change may be in conflict with one's view of themselves or other humans; this conflict can be understood as a type of cognitive dissonance which may contribute to climate change anxiety (Frantz & Mayer, 2009). Guilt about climate change is also part of a psychodynamic understanding of climate change anxiety, often leading to defense mechanisms (Weintrobe, 2013). In line with both cognitive dissonance theory and psychodynamic theory, guilt about climate change can cause

significant emotional distress, including anxiety. Overall, this third subscale suggests that climate change anxiety involves cognitive and future-focused components and provides further support for a cross-theory conceptualization of climate change anxiety.

Climate change anxiety appears to be comprised of several theoretical components, even within each subscale. Climate change anxiety, perhaps like all anxiety, includes cognitive and worry components, existential and psychodynamic components, and somatic components. This scale and its subscales demonstrate how cognitive behavioural, psychodynamic, and existential theories of anxiety all intersect to inform the conceptualization of climate change anxiety. This scale pulls together items measuring symptoms of climate change anxiety as indicated by all three of these theories. While some items are unique to one theory, many elements of climate change anxiety seem to be understandable across two or three of these theories, including uncertainty, fear of death, and cognitive dissonance. The psychodynamic and existential components of anxiety are integral to the way this scale measures climate change anxiety, combining with cognitive behavioural components to create a profound and meaningful understanding of anxiety. Overall, the Cross-Theory Climate Change Anxiety Scale is built upon a rich integration of psychological theories, demonstrating the overlap and balance provided by cognitive behavioural, psychodynamic, and existential theories within a biopsychosocial model of clinical psychology. The intersection of theories within the Cross-Theory Climate Change Anxiety Scale may have theoretical implications for other types of anxiety; future research should consider how psychological theories can be combined to define and understand anxiety.

Scoring, Interpretation, and Scale Use

To obtain total and subscale scores for the Cross-Theory Climate Change Anxiety Scale, the item scores (ranging from 1 to 5) should be summed. When interpreting total and subscale scores, higher scores are associated with higher levels of climate change anxiety. Specifically for the clinical subscale, higher scores are indicative of more severe or clinically significant levels of climate change anxiety. When administering the climate change anxiety scale, I recommend consideration of the total score and all three subscale scores for best understanding of a given individual's climate change anxiety. In addition to score interpretation, it may be useful to consider responses to specific items, as each subscale represents multiple components of anxiety. For example, particular attention may be paid to the somatic items in subscale 2 or the guilt item in subscale 3.

Many scales used to measure psychological constructs such as anxiety employ threshold or cut-off scores to demarcate levels of the construct (ex. Low-Medium-High, Minimal-Mild-Moderate-Severe, etc.). It is possible that the use of cut-off scores for the total Cross-Theory Climate Change Anxiety Scale and the clinical subscale may offer useful categorical information about the severity of climate change anxiety. However, there is ongoing disagreement within clinical psychology as to the categorical or dimensional nature of psychological constructs and disorders (Clark, Muthén, Kaprio, D'Onofrio, Viken, & Rose, 2013; Widiger & Mullins-Sweatt, 2007). Within a categorical model, a psychological construct such as anxiety can be represented by categories indicating whether a person experiences anxiety or not – individuals must fall in to one category or the other. The categorical model has been predominant within clinical psychology, particularly for the use of diagnostic categories in determining if someone has a certain psychiatric disorder or not (Clark, Muthén, Kaprio, D'Onofrio, Viken, & Rose, 2013).

Indeed, the DSM-5 continues to use a categorical model of diagnosis, requiring that a certain number of symptoms are met past a threshold in order to make a diagnosis (APA, 2013).

In contrast, the dimensional model places psychological constructs on a continuum, with each individual displaying varying levels of a construct such as anxiety. Within this model, constructs and disorders can be represented by scores which provide a more nuanced understanding of the individual's experience. For example, an individual's level of anxiety can be interpreted as higher or lower on a spectrum, rather than being categorized as present or absent. Since the publication of the DSM-5 (APA, 2013), the limitations of the categorical model have been recognized. Many constructs are being increasingly understood as dimensional, with some research suggesting that most constructs in clinical psychology are dimensional (Haslam, Holland, & Kuppens, 2012). Existing research on climate change anxiety suggests that it exists on a spectrum of severity, with some researchers cautioning against creating diagnostic categories for climate change anxiety (Clayton, 2020; Pihkala, 2020). Consistent with research suggesting that anxiety can be measured on a continuum, I conceptualize climate change anxiety as a dimensional construct.

Despite the movement towards dimensional models of psychological constructs such as climate change anxiety, categories continue to serve several practical purposes within clinical psychology. The categorical model is often a better fit for meeting diagnostic and reporting requirements within clinical psychology (Clark, Muthén, Kaprio, D'Onofrio, Viken, & Rose, 2013). Similarly, diagnostic categories can facilitate communication and aid in both psychological assessment and intervention (Kamphuis & Noordhof, 2009). Some clinical psychologists aim to compromise between categorical and dimensional models and have developed utility-based categories within a dimensional classification system. For example, the

use of flexible cut-off scores (ex. Low-Medium-High) to classify the level of climate change anxiety may be useful in determining treatment needs. For the purpose of this study, I treat climate change anxiety as a dimensional construct; however, further taxometric research would be required to conclusively determine if climate change anxiety should be measured categorically or dimensionally. In the future, it may be useful to examine the benefits of flexible, non-diagnostic cut-off scores within the Cross-Theory Climate Change Anxiety Scale.

Because anxiety is often an adaptive response to the climate change emergency, it is important to be able to identify when climate change anxiety becomes significant and may require psychological intervention. An individual with higher levels of climate change anxiety (higher scores on the Cross-Theory Climate Change Anxiety Scale) may benefit more from intervention than an individual with lower levels. One of the most important factors when considering intervention is clinical significance: how much does the climate change anxiety affect the individual's life and wellbeing? Scores on the clinical subscale are informative of the level of distress and impairment that climate change anxiety is causing for any given individual. Higher levels of clinical significance, as measured by the first subscale, may indicate a greater need for intervention. Overall, total scores on the Cross-Theory Climate Change Anxiety Scale and scores on the clinical subscale should be informative in determining whether someone would benefit from intervention. However, the Cross-Theory Climate Change Anxiety Scale is not diagnostic, and other factors, such as social context and psychological vulnerabilities, should be considered when determining intervention needs.

While interpretation of the first subscale can provide information about the clinical significance of climate change anxiety and the need for intervention, scores on the second and third subscales can provide information about the types of interventions that may be helpful for a

given individual. Comparing scores on the second and third subscales may provide information about whether climate change anxiety is experienced more existentially or cognitively for any given individual. Higher existential scores may suggest that an individual would benefit more from existential intervention approaches, such as emotion processing and helping clients come to terms with existential inevitabilities such as death (Yalom, Josselson, & May, 2019). Existential therapy may focus on internal existential conflicts and the defense mechanisms used to manage existential anxiety (Yalom, 1980). Higher cognitive and future-focused scores may suggest that cognitive and behavioural intervention approaches would be more useful, such as behavioural activation, cognitive restructuring, and emotion regulation (Beck, 2021). Based on the Cross-Theory Climate Change Anxiety Scale items and subscales, it seems likely that most climate change anxiety interventions should address somatic, existential, and cognitive components of anxiety, with overlap across theories and approaches to target symptoms such as uncertainty, worry, and cognitive dissonance.

The Cross-Theory Climate Change Anxiety Scale has implications beyond clinical assessment and intervention. This scale may be useful in epidemiological research, with the increasing interest in the psychological effects of climate change. The Intergovernmental Panel on Climate Change (IPCC) continues to produce reports on the global impacts of climate change, along with information on adaptation and vulnerability. These reports, and others like it, consider the mental health impacts of climate change including anxiety (ex. IPCC, 2022). Climate epidemiology allows for a better understanding of the current and potential future health impacts of climate change (Anderson, Barnes, Bell, & Dominici, 2019). Climate epidemiologists examine the health impacts across geographical location, race, age, and other factors, thus providing key information about risk and prevention (IPCC, 2022). Importantly, epidemiological

research has significant impacts on policies and measures related to climate change mitigation and adaptation (Anderson, Barnes, Bell, & Dominici, 2019). The Cross-Theory Climate Change Anxiety Scale could serve as a useful measurement tool in epidemiological research and reporting, providing useful information on climate change anxiety to scientists, policymakers, and the public.

Finally, the Cross-Theory Climate Change Anxiety Scale may be useful for climate change activists and others working in the climate field. People working in the climate change field, such as activists and scientists, are knowledgeable about the negative consequences of climate change and seem more likely to experience negative emotions about climate change (Hoggett & Randall, 2018). Within these climate change fields, it may be important to identify and address various climate change emotions, including climate change anxiety (Pihkala, 2022). In fact, climate change anxiety may be directly related to climate action, including activism or pursuing a scientific career in climate change (Clayton, 2020). It will be important for future research to examine how climate change anxiety is related to behaviour and involvement in climate change fields; the Cross-Theory Climate Change Anxiety Scale may be useful in developing this understanding and promoting healthy pro-environmental behaviour. For example, research may examine how different levels of anxiety relate to behaviour and whether there is an optimal level of climate change anxiety to motivate climate action. Overall, the Cross-Theory Climate Change Anxiety Scale has significant implications for clinical psychology practice, epidemiology and other research, and climate change advocacy.

Relationships with Anxiety and Depression

Correlational analyses between the climate change anxiety scale and the State Trait Anxiety Inventory demonstrated that climate change anxiety was more highly associated with state anxiety than with trait anxiety. This suggests that climate change anxiety may be a type of state anxiety specific to climate-related situations, which is characterized by tension, apprehension, and worry (Spielberger, 1983, 2015). State anxiety tends to be transitory, often recurring in the presence of specific stimuli. In the case of climate change anxiety, reminders of the climate change emergency – such as thoughts, memories, experiences, or news articles – may evoke state-based climate change anxiety.

In contrast to state anxiety, trait anxiety tends to be enduring and stable within a given individual, more related to individual predisposition than external circumstances (Spielberger, 1983, 2015). While climate change anxiety has been theorized to be related to certain personal characteristics such as neuroticism, anxiety sensitivity, and intolerance of uncertainty (Clayton, 2020; Taylor, 2020), it seems most strongly connected to an understanding of the negative consequences of the climate change emergency (Searle & Gow, 2010). It follows, then, that climate change anxiety is a type of state anxiety rather than trait anxiety. This suggests that anyone can experience climate change anxiety when confronted with the realities of climate change, further supporting the need for research on climate change anxiety.

Correlational analyses also demonstrated that climate change anxiety was moderately associated with depressive symptoms. This may be due to the strong relationship between anxiety and depression indicated in the psychological literature and in the significant positive correlation between the total STAI and CES-D scores in this study. These analyses could also

suggest that climate change anxiety overlaps with depression; perhaps individuals experiencing climate change anxiety are also experiencing depressive symptoms. The climate change emergency is having a variety of psychological effects on individuals, including solastalgia, ecological grief, and other forms of distress (Albrecht, 2019; Cunsolo & Ellis, 2018; Wang, Leviston, Hurlstone, Lawrence, & Walker, 2018). It would not be surprising for symptoms of anxiety and depression to co-occur in individuals experiencing climate-related distress. Future research may investigate the relationship between climate change anxiety and other climate-related psychological constructs, and how interrelated symptoms may be addressed.

Exploratory Relationships

Exploratory analyses assessed the relationships between climate change anxiety and several other constructs, providing avenues for future research. These analyses were simply exploratory in nature and should not be interpreted as definitive evidence of relationships.

Research suggests that various factors contribute to the mental health impact of climate change anxiety. In particular, those who are more likely to be affected by climate change – such as residents of small islands, coastal regions, and arctic regions – appear to be at higher risk for negative psychological responses, including anxiety (Cianconi, Betrò, & Janiri, 2020; Gibson, Barnett, Haslam, & Kaplan, 2020). Exploratory analyses suggested that participants who had experienced effects of climate change may have higher levels of climate change anxiety. This provides tentative support for recent research suggesting that individuals at risk for the effects of climate change experience more climate change anxiety (Chen, Bagrodia, Pfeffer, Meli, & Bonanno, 2020; Gibson, Barnett, Haslam, & Kaplan, 2020; Taylor, 2020). This finding is unsurprising, given established psychological theory that higher perceived risk of threat and

higher experience of threat are both associated with higher anxiety.

Exploratory analyses also suggested that individuals with higher levels of climate change anxiety may take more action to mitigate climate change, including eating fewer animal products and participating in activism. This finding may support research suggesting that individuals who worry more about climate change are more likely to support climate mitigation policies (Gregersen et al., 2020). Further research on this topic could provide insight into the behaviours of individuals with climate change anxiety. It seems possible that a relationship exists between climate change anxiety and pro-environmental action; future research may consider the existence of an optimal level of climate change anxiety to motivate such action.

Research suggests that younger people seem to have more negative psychological responses to the threat of climate change (Clayton, Manning, & Hodge, 2014; Clayton, 2020; Taylor, 2020). This inverse relationship between age and climate distress may be related to the higher likelihood that younger people will face the negative consequences of climate change in the future. However, exploratory analyses did not find a relationship between age and climate change anxiety as measured by the Cross-Theory Climate Change Anxiety Scale. This may be indicative of increasing climate change anxiety across the lifespan or may be due to the low mean age of participants in this study. Further research on climate change anxiety and age may be important to clarify their relationship.

The exploratory analyses did find a significant relationship between gender and climate change anxiety, suggesting that nonbinary and gender non-conforming individuals may experience higher levels of climate change anxiety than individuals of other genders. Very little research exists on gender and climate change anxiety, and non-binary genders are often not

considered. Existing research has demonstrated that women may be more vulnerable to the effects of climate change and experience more climate change anxiety than men (Chan, Pong, & Tam, 2019; Clayton & Karazsia, 2020). However, this research suggests that gender differences in environmental concern may be related to other sociocultural variables (Chan, Pong, & Tam, 2019). Further research is needed to better understand the relationship between gender and climate change anxiety; this research should consider genders outside of the binary and take sociocultural contexts into account.

Exploratory analyses did not show a relationship between climate change anxiety and years of education, suggesting that climate change anxiety may not differ across education level. Previous research has demonstrated variable results, with no clear consensus as to the relationship between education and climate change anxiety or distress (Clayton & Karazsia, 2020; Wullenkord, Tröger, Hamann, Loy, & Reese, 2021). Similarly, the exploratory analyses suggested that climate change anxiety may not differ across race, occupation, province and territory, or geographical location. Finally, exploratory analyses found no significant relationship between total climate change anxiety and living in rural locations, with one subscale having a weak relationship suggesting that cognitive and future-focused climate change anxiety was higher for individuals living in a rural environment. The general lack of significant relationships between climate change anxiety and demographic variables is somewhat surprising, considering research implying that indigenous populations, farmers, and people living in rural, coastal, or island locations are at higher risk for climate change anxiety (Bohle, Downing, & Watts, 1994; Cianconi, Betrò, & Janiri, 2020; Gibson, Barnett, Haslam, & Kaplan, 2020; Howard, Ahmed, Lachapelle, & Schure, 2020; IPCC, 2022). However, these analyses were only exploratory and were statistically limited; future research should examine how climate change anxiety might

differ across various demographic variables.

Limitations and Future Directions

This research has led to the development and initial validation of a scale to measure climate change anxiety, but it is not without limitations. First, it is important to note that, as an initial development study, the Cross-Theory Climate Change Anxiety Scale was not validated across a variety of settings and populations. Moving forward, other researchers should consider this scale and validate it widely. The scale was only validated with a Canadian population and may not generalize to residents of other countries. Climate change anxiety may present differently across cultures and geographical locations, so this scale should be used with caution outside of Canada. I would encourage further development of this scale for use in other cultures around the world. Similarly, demographic variability was somewhat limited in this research. The majority of participants identified as White/Caucasian and all participants were 18 years of age or older, with no youth and few older adults. Many participants were also recruited from climate change groups, so the scale should be further validated for groups with less knowledge of climate change. Future directions for research may include the validation of this scale with youth and older adults, the examination of climate change anxiety across culture or race, and the use of the scale to test research suggesting a negative relationship between climate change anxiety and age (Clayton, Manning, & Hodge, 2014; Clayton, 2020; Taylor, 2020).

In addition to demographic limitations, there were some statistical limitations to this research. I was unable to establish sufficient discriminant validity of the Cross-Theory Climate Change Anxiety Scale. A measure of depression (the CES-D) was chosen to assess for discriminant validity, but upon further examination of the literature, it became clear that

depression was likely to be associated with anxiety and would therefore not be an appropriate measure of discriminant validity. While some research suggests that discriminant validity is ambiguously defined and measured (ex. Rönkkö & Cho, 2022), I suggest that future research examine the discriminant validity of this scale. Additionally, further research is needed to validate the Cross-Theory Climate Change Anxiety Scale across populations.

Similarly, this study was limited in its ability to taxometrically examine the climate change anxiety construct as measured by the scale. The scale was treated as dimensional for all statistical analyses, but threshold scores may be practically useful for categorical measurement. For example, clinical assessment with this scale may be more effective if clinicians can categorize climate change anxiety (ex. mild-medium-severe). Categorical measurement may also be useful for epidemiological research. Taxometric analyses may be used to look at the latent variable of climate change anxiety and determine whether the construct varies by categories or along a continuum, and thus whether it should be measured categorically or dimensionally (Haslam, Holland, & Kuppens, 2012). Additionally, future studies should employ clinical samples to further determine how this scale can be used to identify clinically significant climate change anxiety. Future research should consider the most effective way to administer and interpret the climate change anxiety scale. For example, it may be more effective to administer the clinical subscale only after assessing an individual's score on the second and third subscales.

The exploratory analyses used in this study were limited by a small sample size and the use of exploratory, correlational, and non-parametric analyses. Future research should examine climate change anxiety's relationships with other constructs, including demographic variables such as age and gender, as well as other constructs such as climate-related knowledge, experience with the effects of climate change, and geographical location. Climate change anxiety

is an emerging topic with growing interest and relevance to various fields, including clinical psychology. There is an abundance of possible avenues for future research using the Cross-Theory Climate Change Anxiety Scale to better understand climate change anxiety and its relationships. This scale can be used to follow up on research examining the climate factors, social factors, and individual factors related to climate change anxiety (ex. Clayton, Manning, & Hodge, 2014; Helm, Pollitt, Barnett, Curran, & Craig, 2018; Searle & Gow, 2010; Taylor, 2020). More research in these directions would allow us to develop a better understanding of climate change anxiety and its correlates.

Finally, an important direction for future research is the treatment of climate change anxiety. I recommend that the Cross-Theory Climate Change Anxiety Scale be used to assess climate change anxiety and provide information about the specific symptoms experienced by any given individual. Endorsement of different symptoms across subscales may suggest the need for different types of treatment to address those symptoms. Future research should examine how this scale can be used to inform treatment planning. Additionally, the Cross-Theory Climate Change Anxiety Scale could be helpful in differentiating climate change anxiety from other climate emotions, understanding the global mental health impacts of climate change, and promoting climate-related behaviour change. Future research should use the Cross-Theory Climate Change Anxiety Scale to better understand climate change anxiety within clinical psychology, emotion research, epidemiology, policy making, and advocacy.

Research about climate change anxiety is becoming increasingly prevalent, with growing interest across fields. The development and validation of the Cross-Theory Climate Change Anxiety Scale contributes to a new way of understanding and measuring climate change anxiety. Additionally, this research explored some of the ways climate change anxiety might relate to

other factors, thus generating many new research questions. How does climate change anxiety relate to demographic variables and what social or cultural factors might contribute to climate change anxiety? How might climate change anxiety be related to geographical location, understanding of climate change, or experience with the effects of climate change? Is it helpful for people to better understand climate change or does this inevitably cause anxiety? How can climate change anxiety be motivating, such that people take more pro-environmental action or start to engage in activism? Is there an optimal level of climate change anxiety that motivates climate action without causing too much distress? What does this mean for how we teach about climate change and our approach to climate change activism? How can we effectively treat climate change anxiety? The current study acts as a jumping off point for future research on climate change anxiety, with many new and exciting directions.

Conclusion

This study involved the development of the Cross-Theory Climate Change Anxiety Scale – a clinical scale intended to measure climate change anxiety based on the integration of a variety of psychological theories. The Cross-Theory Climate Change Anxiety Scale has three subscales, measuring clinically significant climate change anxiety, existential climate change anxiety, and cognitive and future-focused climate change anxiety. As such, this scale is intended to be able to identify when climate change anxiety is clinically significant and when an individual may benefit from psychological intervention. This scale can be used to gain understanding of individuals' symptoms of climate change anxiety and may have implications for improving clinical outcomes, as well as practical implications for epidemiology, policy, and advocacy. Exploratory analyses suggested that climate change anxiety may be higher for individuals who have experienced the effects of climate change and among those who engage in

pro-environmental action. The development of the Cross-Theory Climate Change Anxiety Scale opens up several avenues for future research examining the nuances of climate change anxiety, the variety of behavioural responses to climate change anxiety, and its relationships with other constructs.

References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*. American Psychiatric Pub.

Anderson, G. B., Barnes, E. A., Bell, M. L., & Dominici, F. (2019). The future of climate epidemiology: opportunities for advancing health research in the context of climate change. *American journal of epidemiology*, *188*(5), 866-872.

Barlow, D. H. (2002). *Anxiety and its disorders: The nature and treatment of anxiety and panic*. Guilford press.

Beck, J. S. (2021). *Cognitive Behavior Therapy: Basics and Beyond* (3rd ed.). The Guilford Press.

Beck, A.T., Epstein, N., Brown, G., & Steer, R.A. (1988). An inventory for measuring clinical anxiety: Psychometric properties. Journal of Consulting and Clinical Psychology, 56, 893-897.

Beidel, D. C. & Frueh, B. C. (2018). Adult Psychopathology and Diagnosis - Eighth Edition. New York: Wiley.

Bellamy A. Trauma, fragmentation and narrative: Sandor Ferenczi's relevance for psychoanalytical perspectives on our response to climate change and environmental destruction. *Int J Appl Psychoanal Studies*. 2019;16:100–108. https://doi.org/10.1002/aps.1618

Bohle, H. G., Downing, T. E., & Watts, M. J. (1994). Climate change and social vulnerability: toward a sociology and geography of food insecurity. *Global environmental change*, *4*(1),

37-48.

Boschen, M. J., & Oei, T. P. (2008). A cognitive behavioral case formulation framework for

treatment planning in anxiety disorders. *Depression and Anxiety*, *25*(10), 811-823.

Cabaniss, D. L., Cherry, S., Douglas, C. J., Graver, R. L., & Schwartz, A. R. (2013).

Psychodynamic formulation. *J Clin Psychiatry*, *75*(12), e1446.

Chan, H. W., Pong, V., & Tam, K. P. (2019). Cross-national variation of gender differences in

environmental concern: Testing the sociocultural hindrance hypothesis. *Environment and

Behavior*, *51*(1), 81-108.

Chen, S., Bagrodia, R., Pfeffer, C. C., Meli, L., & Bonanno, G. A. (2020). Anxiety and resilience

in the face of natural disasters associated with climate change: a review and

methodological critique. *Journal of Anxiety Disorders*, 102297.

Cianconi, P., Betrò, S., & Janiri, L. (2020). The impact of climate change on mental health: a

systematic descriptive review. *Frontiers in psychiatry*, *11*.

Clark, S. L., Muthén, B., Kaprio, J., D'Onofrio, B. M., Viken, R., & Rose, R. J. (2013). Models

and strategies for factor mixture analysis: An example concerning the structure

underlying psychological disorders. *Structural equation modeling: a multidisciplinary

journal*, *20*(4), 681-703.

Clayton, S. (2020). Climate anxiety: Psychological responses to climate change. *Journal of

Anxiety Disorders*, *74*, 102263.

Clayton, S., & Karazsia, B. T. (2020). Development and validation of a measure of climate

change anxiety. *Journal of Environmental Psychology, 69*.

doi:10.1016/j.jenvp.2020.101434

Clayton, S., Manning, C. M., & Hodge C. (2014). Beyond storms & droughts: The psychological impacts of climate change. Washington, DC: American Psychological Association and ecoAmerica.

Clayton, S., Manning, C., Krygsman, K., & Speiser, M. (2017). Mental health and our changing climate: Impacts, implications, and guidance. *Washington, DC: American Psychological Association and ecoAmerica,*

Cunsolo, A., & Ellis, N. R. (2018). Ecological grief as a mental health response to climate change-related loss. *Nature Climate Change, 8*(4), 275.

DeVellis, R. F. (2016). *Scale development: Theory and applications* (Vol. 26). Sage publications.

Dugas, M. J., & Ladouceur, R. (1998). Analysis and treatment of generalized anxiety disorder. In V. E. Caballo (Ed.), *International handbook of cognitive and behavioural treatments for psychological disorders* (pp. 197-225). Oxford: Elsevier Science Ltd. doi:https://doi-org.proxy.library.upei.ca/10.1016/B978-008043433-9/50009-2

Fernando, D. (2007). Existential theory and solution-focused strategies: Integration and application. *Journal of Mental Health Counseling*, *29*(3), 226-241.

First MB, Williams JBW, Karg RS, Spitzer RL: Structured Clinical Interview for DSM-5 Disorders, Clinician Version (SCID-5-CV). Arlington, VA, American Psychiatric Association, 2016

Fritze, J. G., Blashki, G. A., Burke, S., & Wiseman, J. (2008). Hope, despair and transformation:

Climate change and the promotion of mental health and wellbeing. *International Journal of Mental Health Systems, 2*(1), 13. doi:10.1186/1752-4458-2-13

Gibson, K. E., Barnett, J., Haslam, N., & Kaplan, I. (2020). The mental health impacts of climate change: Findings from a Pacific Island atoll nation. *Journal of Anxiety Disorders*, *73*, 102237.

Gow, J., & Leahy, T. (2005). Apocalypse probably: Agency and environmental risk in the Hunter region. *Journal of Sociology*, *41*(2), 117-141.

Gregersen, T., Doran, R., Böhm, G., Tvinnereim, E., & Poortinga, W. (2020). Political orientation moderates the relationship between climate change beliefs and worry about climate change. *Frontiers in Psychology, 11* doi:10.3389/fpsyg.2020.01573

Grös, D. F., Antony, M. M., Simms, L. J., & McCabe, R. E. (2007). Psychometric properties of the state-trait inventory for cognitive and somatic anxiety (STICSA): Comparison to the state-trait anxiety inventory (STAI). *Psychological assessment*, *19*(4), 369.

Haseley, D. (2019). Climate change: Clinical considerations. *International Journal of Applied Psychoanalytic Studies, 16*(2), 109-115. doi:10.1002/aps.1617

Haslam, N., Holland, E., & Kuppens, P. (2012). Categories versus dimensions in personality and psychopathology: a quantitative review of taxometric research. *Psychological medicine*, *42*(5), 903-920.

Havranek, M. M., Bolliger, B., Roos, S., Pryce, C. R., Quednow, B. B., & Seifritz, E. (2016). Uncontrollable and unpredictable stress interacts with subclinical depression and anxiety scores in determining anxiety response. *Stress: The International Journal on the Biology*

of Stress, 19(1), 53-62. doi:10.3109/10253890.2015.1117449

Helm, S. V., Pollitt, A., Barnett, M. A., Curran, M. A., & Craig, Z. R. (2018). Differentiating

environmental concern in the context of psychological adaption to climate

change. *Global Environmental Change*, *48*, 158-167.

Hinkin, T. R. (1998). A brief tutorial on the development of measures for use in survey

questionnaires. *Organizational research methods*, *1*(1), 104-121.

Hoggett, P., & Randall, R. (2018). Engaging with climate change: Comparing the cultures of

science and activism. *Environmental Values*, *27*(3), 223-243.

Hooley, J., Butcher, J., Nock, M., & Mineka, S. (2017). *Abnormal Psychology* (17th ed.).

Boston, Ohio: Pearson Education.

Howard, M., Ahmed, S., Lachapelle, P., & Schure, M. B. (2020). Farmer and rancher

perceptions of climate change and their relationships with mental health. *Journal of Rural

Mental Health, 44*(2), 87-95. doi:10.1037/rmh0000131

IPCC. (2022). Climate Change 2022: Impacts, adaptation and vulnerability. *Working Group II

Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate

Change.* IPCC, Geneva, Switzerland.

Jensen-Doss, A. (2015). Practical, evidence-based clinical decision making: Introduction to the

special series. *Cognitive and Behavioral Practice, 22*(1), 1-4.

doi:https://doi.org/10.1016/j.cbpra.2014.08.001

Kamphuis, J. H., & Noordhof, A. (2009). On categorical diagnoses in DSM-V: Cutting

dimensions at useful points? *Psychological Assessment*, *21*(3), 294–301.

https://doi.org/10.1037/a0016697

Kverndokk, K. (2020). Talking about your generation: "Our children" as a trope in climate

change discourse. *Ethnologia Europaea 50*(1), 145–158.

Lazarus, R.S., & Folkman, S. (1984). Stress, appraisal, and coping. New York: Springer

Publishing Company.

Luborsky, L., & Barrett, M. S. (2006). The history and empirical status of key psychoanalytic

concepts. *Annu. Rev. Clin. Psychol.*, *2*, 1-19.

May, R. (1977). *The meaning of anxiety*. WW Norton & Company.

Meyer, T. J., Miller, M. L., Metzger, R. L., & Borkovec, T. D. (1990). Development and

validation of the Penn State Worry Questionnaire. *Behaviour Research and

Therapy, 28*(6), 487-495.

Mineka, S., & Oehlberg, K. (2008). The relevance of recent developments in classical

conditioning to understanding the etiology and maintenance of anxiety disorders. *Acta

psychologica*, *127*(3), 567-580.

Morse, D. R. (1998). Confronting existential anxiety: The ultimate stressor. *Stress

medicine*, *14*(2), 109-119.

Ojala, M. (2005). Adolescents' worries about environmental risks: subjective well-being, values,

and existential dimensions. Journal of Youth Studies, 8, 3, 331-348.

Ojala, M. (2008). Recycling and ambivalence: Quantitative and qualitative analyses of household recycling among young adults. Environment and Behavior, 40(6), 777–797.

Ojala, M. (2011). Hope and climate change: The importance of hope for pro-environmental engagement among young people. Environmental Education Research. On Line first. doi:10.1080/13504622.2011.637157.

Ojala, M. (2012). Regulating worry, promoting hope: How do children, adolescents, and young adults cope with climate change?. *International Journal of Environmental and Science Education, 7*(4), 537-561.

Park, C. L., & Folkman, S. (1997). Meaning in the context of stress and coping, Review of General Psychology, 1(2), 115-144.

Pihkala, P. (2020). Anxiety and the ecological crisis: An analysis of eco-anxiety and climate anxiety. *Sustainability, 12*(19), 7836.

Pihkala, P. (2022). Toward a Taxonomy of Climate Emotions. *Frontiers in Climate*, 199.

Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied psychological measurement*, *1*(3), 385-401.

Rönkkö, M., & Cho, E. (2022). An updated guideline for assessing discriminant validity. *Organizational Research Methods*, *25*(1), 6-14.

Rossdale, C. (2015). Enclosing critique: the limits of ontological security. *International political sociology*, *9*(4), 369-386.

Sall, E. G. (2020). *Development of a Political Viewpoints Scale*. North Carolina State University.

Schneider-Mayerson, M., & Leong, K. L. (2020). Eco-reproductive concerns in the age of
      climate change. *Climatic Change*, *163*(2), 1007-1023.

Searle, K., & Gow, K. (2010). Do concerns about climate change lead to distress? *International
      Journal of Climate Change Strategies and Management, 2*(4), 362-379.
      doi:10.1108/17568691011089891

Spielberger, C. D. (1966). Theory and research on anxiety. *Anxiety and behavior*, *1*(3).

Spielberger, C. D. (1983). *State-Trait Anxiety Inventory for Adults; Sampler Set; Manual,
      Instrument and Scoring Guide*. Consulting Psychologists Press.

Spielberger, C.D., Gorssuch, R.L., Lushene, P.R., Vagg, P.R., & Jacobs, G.A. (1983,
      2015). S*tate-Trait Anxiety Inventory for Adults ™ Manual*. Mind Garden, Inc.

Stewart, A. E. (2021). Psychometric properties of the climate change worry scale. *International
      Journal of Environmental Research and Public Health*, *18*(2), 494.

Taylor, D. L., Grant, D. M., Frosio, K. E., Kraft, J. D., & White, E. J. (2018). Psychometric
      properties of the Response to Anxiety Questionnaire. *Journal of Psychopathology and
      Behavioral Assessment*, *40*(3), 550-562.

Taylor, S. (2020). Anxiety disorders, climate change, and the challenges ahead: Introduction to
      the special issue. *Journal of Anxiety Disorders*, *76*, 102313.

Tobler, C., Visschers, V. H., & Siegrist, M. (2012). Consumers' knowledge about climate
      change. *Climatic change*, *114*(2), 189-209.

Ursano, R. J., Morganstein, J. C., & Cooper, R. (2017). APA resource document resource
      document on mental health and climate change.

Weems, C. F., Costa, N. M., Dehon, C., & Berman, S. L. (2004). Paul Tillich's theory of

existential anxiety: A preliminary conceptual and empirical examination. *Anxiety, Stress

& Coping*, *17*(4), 383-399.

Weintrobe, S. (2013). The difficult problem of anxiety in thinking about climate

change. *Engaging with climate change: Psychoanalytic and interdisciplinary

perspectives*, 33-47.

Widiger, T. A., & Mullins-Sweatt, S. (2007). Mental disorders as discrete clinical conditions:

Dimensional versus categorical classification.

Willox, A. C., Harper, S. L., Edge, V. L., Landman, K., Houle, K., & Ford, J. D. (2013). The

land enriches the soul: On climatic and environmental change, affect, and emotional

health and well-being in Rigolet, Nunatsiavut, Canada. *Emotion, Space and Society*, *6*,

14-24.

Wullenkord, M. C., Tröger, J., Hamann, K. R., Loy, L. S., & Reese, G. (2021). Anxiety and

climate change: a validation of the Climate Anxiety Scale in a German-speaking quota

sample and an investigation of psychological correlates. *Climatic Change*, *168*(3), 1-23.

Yalom, I. D. (1980). *Existential psychotherapy*. Basic Books.

Yalom, I. D., Josselson, R., & May, R. (2019). Existential Psychotherapy. In D. Wedding & R. J.

Corsini (Eds.), *Current psychotherapies* (11th ed., pp. 273–307). Cengage.

Appendix A

Tables and Figures

Figure A1

Initial Cross-Theory Climate Change Anxiety Scale Items (Before EFA)

1. I think too much about climate change.
2. The effects of climate change are out of my control.
3. I try to avoid thinking or talking about climate change and its effects.
4. I try to ignore my feelings about climate change.
5. Climate change will cause me to lose people or things that are important to me.
6. Human action is useless in the face of climate change.
7. Thinking about climate change makes it hard to think about anything else.
8. My mind can't be relaxed if I don't know what will happen because of climate change.
9. My future is uncertain because of climate change.
10. I am afraid that climate change will cause a catastrophe to occur.
11. Climate change means that my life will be worse in the future.
12. I am terrified by the thought of the effects of climate change.
13. I am worried that climate change will negatively impact my (current or future) children.
14. My climate change anxiety prevents me from getting things done.
15. Climate change anxiety causes problems in my relationships.
16. Climate change anxiety negatively affects my ability to take care of things at home.
17. Climate change anxiety negatively affects my work/schoolwork.
18. Climate change anxiety prevents me from taking care of myself (ex. Hygiene, eating, etc.)
19. My climate change anxiety causes me significant distress.
20. My climate change anxiety is overwhelming.
21. I avoid doing certain things because of my climate change anxiety.
22. I worry about climate change more days than not.
23. I know I should not worry about climate change, but I just cannot help it.
24. Once I start worrying about climate change, I cannot stop.
25. Because of my anxiety about climate change, I do not want to have children.
When I think about climate change…
26. …I feel worried.
27. …I feel afraid.
28. …It is hard for me to sleep well.
29. …I feel anxious.
30. …I feel hopeless.
31. …I feel powerless.
32. …I worry about the future.
33. …My body feels tense.

34. …My heart races.
35. …I am afraid that I will not survive.
36. …I worry that others will judge me on whether I take pro-environmental action or not.
37. …I feel guilty about the human impact on climate change.
38. …I try to see climate change in a positive way. (R)
39. …I question the meaning of life.
40. …My other values (ex. family, work, education, etc.) no longer seem important.
41. …I feel overwhelmed.
42. …I feel that I cannot live a meaningful life.
43. …I feel restless.
44. …I am afraid to plan for the future.
45. …I worry that I won't be able to achieve my goals in the future

Figure A2

Items to Measure Attitudes and Experiences with Climate Change

1. Climate change is real.
2. Climate change has had negative effects on my life.
3. I know a lot about climate change.
4. I check the news regularly for information about climate change.
5. Our leaders are not taking enough action to lessen the effects of climate change.
6. I do things to reduce my impact on climate change.
7. Because of climate change, I eat fewer animal products.
8. I participate in activism (ex. Protests, signing petitions) to fight climate change.

Figure A3

Demographic Items

1. What is your age?
2. How do you identify your gender? (4 options)
   - Man
   - Woman
   - Nonbinary or Gender Non-Conforming
   - Other
3. How do you identify your race? (9 options)
   - White/Caucasian
   - Black
   - Asian
   - Canadian Indigenous/First Nations
   - Pacific Islander
   - Middle Eastern
   - Latino/South American
   - Mixed Race
   - Other

4. How many years of education do you have?

5. How do you define your occupation? (25 options)

- Unemployed/Retired
- Student
- Installation, Maintenance, and Repair
- Computer and Mathematical
- Arts, Design, Entertainment, Sports, and Media
- Sales and Related Occupations
- Personal Care and Service
- Protective Service
- Architecture and Engineering
- Food Preparation and Serving Related Occupations
- Management
- Community and Social Service
- Legal
- Building and Grounds Cleaning and Maintenance
- Education, Training, and Library
- Production
- Life, Physical, and Social Science
- Construction and Extraction
- Healthcare Support
- Office and Administrative Support
- Business and Financial Operations
- Farming, Fishing, and Forestry
- Healthcare Practitioners
- Transportation and Materials Moving
- Other

6. Do you live in a rural or urban area? (3 options)

- Rural
- Urban
- Other

7. In which province or territory do you live? (13 options)

- Yukon
- Northwest Territories
- Nunavut
- British Columbia
- Alberta
- Saskatchewan
- Manitoba
- Ontario
- Quebec
- New Brunswick
- Nova Scotia
- Prince Edward Island
- Newfoundland and Labrador

8. How would you define the geographical area in which you live? (6 options; can select multiple)

- Coastal
- Island
- Plains
- Inland
- Arctic
- Other

9. Have you experienced any of the following effects of climate change? (12 options; can select multiple)

- Wildfire (including smoke exposure)
- Drought
- Flood
- Heatwave/Heat Dome
- Insufficient Food
- Insufficient Water
- Relocation/Migration
- Poor Air Quality
- Severe Storm
- Damaged/Destroyed Home
- Other
- None

Table A1

Descriptive Information for Demographic Variables (Samples 1 & 2)

	Age	Education
N	428	413
Missing	0	15
Mean	28.7	15.3
Median	26.0	15.0
Standard Deviation	12.1	3.23
Minimum	18	1.00
Maximum	89	30.0

Gender	N	% of Total
Man	126	29.6
Woman	284	66.7
Nonbinary or Gender Non-Conforming	13	3.1
Other	3	0.7

Race	N	% of Total
White/Caucasian	360	84.1
Black	7	1.64
Asian	32	7.48
Canadian Indigenous/First Nations	12	2.80
Pacific Islander	3	0.70
Middle Eastern	5	1.17
Latino/South American	3	0.70
Mixed Race	4	0.93
Other	3	0.70

Occupation	N	% of Total
Unemployed	16	3.8
Student	163	38.5
Installation, Maintenance, and Repair	7	1.7
Computer and Mathematical	32	7.6
Arts, Design, Entertainment, Sports, and Media	19	4.5
Sales and Related Occupations	18	4.3
Personal Care and Service	16	3.8
Protective Service	3	0.7
Architecture and Engineering	10	2.4
Food Preparation and Serving Related Occupations	12	2.8
Management	26	6.1
Community and Social Service	14	3.3
Legal	3	0.7
Building and Grounds Cleaning and Maintenance	5	1.2
Education, Training, and Library	16	3.8
Production	3	0.7

	N	% of Total
Life, Physical, and Social Science	13	3.1
Construction and Extraction	1	0.2
Healthcare Support	7	1.7
Office and Administrative Support	6	1.4
Business and Financial Operations	7	1.7
Farming, Fishing, and Forestry	5	1.2
Healthcare Practitioners	5	1.2
Transportation and Materials Moving	1	0.2
Other	15	3.5

Province or Territory	N	% of Total
Yukon	13	3.1
Northwest Territories	30	7.2
Nunavut	16	3.8
British Columbia	65	15.6
Alberta	21	5.0
Saskatchewan	11	2.6
Manitoba	7	1.7
Ontario	59	14.2
Quebec	10	2.4
New Brunswick	14	3.4
Nova Scotia	10	2.4
Prince Edward Island	153	36.8
Newfoundland and Labrador	7	1.7

Table A2

Factor Loadings for 3-Factor Solution (Sample 1)

	Factor			
Item	1	2	3	Uniqueness
17	0.846			0.344
14	0.775			0.396
18	0.759			0.342
16	0.749			0.348
8	0.732			0.384
24	0.717			0.397
7	0.686			0.412
20	0.680			0.297
15	0.664			0.448
19	0.628			0.407

| Item | Factor | | | Uniqueness |
	1	2	3	
1	0.547			0.777
23	0.506			0.751
21	0.492			0.568
4	0.412			0.733
34		0.856		0.319
45		0.768		0.326
42		0.740		0.341
39		0.732		0.522
30		0.730		0.399
44		0.729		0.374
41		0.692		0.338
43		0.614		0.405
33		0.596		0.441
31		0.553		0.538
35		0.522		0.515
40		0.499		0.512
25		0.494		0.603
26			0.816	0.338
32			0.811	0.297
10			0.692	0.531
13			0.692	0.441
9			0.596	0.527
37			0.594	0.581
27			0.540	0.420
11			0.531	0.548

Note. 'Principal axis factoring' extraction method was used in combination with an 'oblimin'

rotation.

Figure A4

Developed Cross-Theory Climate Change Anxiety Scale with Subscales (Sample 1)

Subscale 1: Clinical Significance of Climate Change Anxiety
1. I think too much about climate change.
2. I try to ignore my feelings about climate change.
3. My climate change anxiety prevents me from getting things done.
4. Climate change anxiety causes problems in my relationships.
5. My climate change anxiety causes me significant distress.
6. Thinking about climate change makes it hard to think about anything else.
7. Climate change anxiety prevents me from taking care of myself (ex. Hygiene, eating, etc.)
8. Climate change anxiety negatively affects my work/schoolwork.
9. My mind can't be relaxed if I don't know what will happen because of climate change.
10. Once I start worrying about climate change, I cannot stop.
11. Climate change anxiety negatively affects my ability to take care of things at home.
12. My climate change anxiety is overwhelming.
13. I avoid doing certain things because of my climate change anxiety.
14. I know I should not worry about climate change, but I just cannot help it.
Subscale 2: Existential Climate Change Anxiety
1. Because of my anxiety about climate change, I do not want to have children.
When I think about climate change…
2.   …My body feels tense.
3.   …I am afraid that I will not survive.
4.   …I question the meaning of life.
5.   …I feel hopeless.
6.   …My heart races.
7.   …My other values (ex. family, work, education, etc.) no longer seem important.
8.   …I feel overwhelmed.
9.   …I am afraid to plan for the future.
10.   …I feel powerless.
11.   …I worry that I won't be able to achieve my goals in the future.
12.   …I feel restless.
13.   …I feel that I cannot live a meaningful life.
Subscale 3: Cognitive and Future-Focused Climate Change Anxiety
1. My future is uncertain because of climate change.
2. I am afraid that climate change will cause a catastrophe to occur.
3. Climate change means that my life will be worse in the future.
4. I am worried that climate change will negatively affect my (current or future) children.
When I think about climate change…
5.   …I feel worried.
6.   …I feel afraid.
7.   …I worry about the future.
8.   …I feel guilty about the human impact on climate change.

Table A3

Factor Summary for 3-Factor Solution (Sample 1)

Factor	% of Variance	Cumulative %
1	20.3	20.3
2	20.1	40.4
3	12.2	52.6

Table A4

Inter-Factor Correlations for 3-Factor Solution (Sample 1)

	1	2	3
1	—	0.664	0.112
2		—	0.453
3			—

Table A5

Descriptive Information for Exploratory Variables (Sample 2)

	CRKS	STAI-T	STAI-S	STAI	SDS	CES-D	CCA
N	97	96	97	94	99	99	99
Missing	2	3	2	5	0	0	0
Mean	21.4	24.9	23.8	48.3	9.44	25.3	103
Median	21	24.0	24	48.0	10	25	105
Standard deviation	2.72	4.74	5.29	8.23	1.77	9.83	22.5
Variance	7.40	22.4	28.0	67.8	3.13	96.7	508
Range	12	22	24	37	8	44	110
Minimum	15	15	12	31	5	5	45.0
Maximum	27	37	36	68	13	49	155

Table A6

Correlation Matrix: Exploratory Pearson's Correlations (Sample 2)

	CCCAS[a] Total	Factor 1	Factor 2	Factor 3	Age	Education	CRKS Total	# of climate-related effects
CCCAS[a] Total	-							
Factor 1	.802***	-						
Factor 2	.946***	.649***	-					
Factor 3	.662***	.169	.619***	-				
Age	-.039	.025	-.059	-.074	-			
Education	.005	.041	-.001	-.045	.327**	-		
CRKS Total	.158	-.086	.132	.454***	.015	.002	-	
# of climate-related effects	.350***	.157	.327***	.427***	.130	.042	.276**	-

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

[a] CCCAS = Cross-Theory Climate Change Anxiety Scale.

Table A7

Correlation Matrix: Exploratory Spearman's Correlations (Sample 2)

	CCCAS Total	Factor 1	Factor 2	Factor 3	Item 1	Item 2
CCCAS Total	-					
Factor 1	.751***	-				
Factor 2	.954***	.606***	-			
Factor 3	.632***	.125	.606***	-		
Item 1	.002	-.391***	.033	.547***	-	
Item 2	.389***	.134	.379***	.507***	.438***	-
Item 3	.171	.247*	.131	.041	-.123	.252*
Item 4	.288**	.375***	.186	.162	-.062	.299**
Item 5	.293**	-.163	.331***	.673***	.645***	.485***
Item 6	.202*	.064	.177	.345***	.378***	.445***
Item 7	.490***	.315**	.486***	.434***	.032	.333***
Item 8	.259**	.136	.233*	.287**	.162	.247*

	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8
Item 3	-					

Item 4	.321**	-				
Item 5	.043	-.037	-			
Item 6	.171	.326**	.349***	-		
Item 7	.266**	.393***	.284**	.361***	-	
Item 8	.395***	.272**	.316**	.411***	.449***	-

Note. * p < .05, ** p < .01, *** p < .001.

See Figure 2 for items 1-8 to measure attitudes and experiences with climate change.

Table A8

Cross-Theory Climate Change Anxiety Scale Total Scores Across Gender (Sample 2)

	Gender	N	Mean	Median	SD
CCCAS Total	Man	24	103	107	18.0
	Woman	68	101	104	23.3
	Nonbinary or Gender Non-Conforming	4	135	129	13.5
	Other	3	120	117	10.8

Table A9

Cross-Theory Climate Change Anxiety Scale Total Scores Across Race (Sample 2)

	Race	N	Mean	Median	SD
CCCAS Total	White/Caucasian	80	105.8	108.0	22.2
	Black	1	98.0	98	-
	Asian	6	81.0	83.0	25.5
	Canadian Indigenous/First Nations	3	103.0	111	21.2
	Pacific Islander	1	107.0	107	-
	Mixed Race	5	101.6	101	21.1

Table A10

Cross-Theory Climate Change Anxiety Scale Total Scores Across Occupation (Sample 2)

	Occupation	N	Mean	Median	SD
CCCAS Total	Unemployed	3	83.0	87	13.45
	Food Preparation and Serving Related Occupations	3	103.0	107	8.72
	Management	8	105.1	111	14.10
	Community and Social Service	4	106.3	103	14.86
	Building and Grounds Cleaning and Maintenance	1	126.0	126	-
	Education, Training, and Library	5	122.8	127	10.11
	Life, Physical, and Social Science	5	93.2	103	28.18
	Healthcare Support	2	103.5	104	45.96
	Student	42	103.5	105	26.31
	Office and Administrative Support	1	126.0	126	-
	Business and Financial Operations	1	80.0	80	-
	Healthcare Practitioners	1	88.0	88	-
	Installation, Maintenance, and Repair	1	84.0	84	-
	Computer and Mathematical	5	97.2	94	18.70
	Arts, Design, Entertainment, Sports, and Media	7	106.6	112	22.85
	Sales and Related Occupations	3	91.7	101	17.93
	Personal Care and Service	1	106.0	106	-
	Protective Service	1	105.0	105	-
	Architecture and Engineering	3	108.7	108	19.01
	Government program officer	1	126.0	126	-
	Public servant.	1	97.0	97	-

Table A11

Cross-Theory Climate Change Anxiety Scale Total Scores Across Province and Territory (Sample 2)

	Province or Territory	N	Mean	Median	SD
CCCAS Total	Yukon	3	84.0	84	21.000
	Northwest Territories	5	94.4	90	13.831
	Nunavut	3	108.3	108	19.502
	British Columbia	16	114.3	115.5	19.909
	Alberta	5	109.0	109	3.240
	Saskatchewan	3	104.3	104	0.577
	Manitoba	1	112.0	112	-
	Ontario	11	99.2	101	22.054
	Quebec	2	89.5	89.5	30.406
	New Brunswick	6	107.2	106.5	16.798
	Nova Scotia	1	105.0	105	-
	Prince Edward Island	39	101.1	101	27.359
	Newfoundland and Labrador	2	115.0	115.0	21.213

Table A12

Climate Change Anxiety Total Scores Across Geographical Location (Sample 2)

	Geography	N	Mean	Median	SD
CCCAS Total	Island & Coastal	11	104.8	94	26.6
	Coastal & Inland	1	103.0	103	-
	Arctic & Other	1	111.0	111	-
	Coastal	17	108.4	113	19.6
	Island	32	103.1	105	28.3
	Plains	9	107.4	107	12.6
	Inland	26	100.0	104	17.3
	Arctic	1	89.0	89	-

Appendix B

The Cross-Theory Climate Change Anxiety Scale

The following questions will be related to climate change. Climate change can be defined as the collective effects on global or regional climate patterns related to increased carbon dioxide and other "greenhouse gases" in the atmosphere. These increases are produced by the use of fossil fuels, as well as other human activities. Some examples of the impacts of climate change include extreme weather events such as floods and wildfires, reduced availability of food and water, and significant changes in temperature.

Please rate the extent to which you agree or disagree with the following statements, by circling one number for each item using the following scale:

1	2	3	4	5
Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

1.	My future is uncertain because of climate change.	1	2	3	4	5
2.	My climate change anxiety causes me significant distress.	1	2	3	4	5
3.	Thinking about climate change makes it hard to think about anything else.	1	2	3	4	5
4.	I am afraid that climate change will cause a catastrophe to occur.	1	2	3	4	5
5.	Climate change anxiety negatively affects my work/schoolwork.	1	2	3	4	5
6.	I think too much about climate change.	1	2	3	4	5
7.	I try to ignore my feelings about climate change.	1	2	3	4	5
8.	My mind can't be relaxed if I don't know what will happen because of climate change.	1	2	3	4	5
9.	Once I start worrying about climate change, I cannot stop.	1	2	3	4	5
10.	Because of my anxiety about climate change, I do not want to have children.	1	2	3	4	5
11.	I avoid doing certain things because of my climate change anxiety.	1	2	3	4	5
12.	I know I should not worry about climate change, but I just cannot help it.	1	2	3	4	5
13.	Climate change means that my life will be worse in the future.	1	2	3	4	5
14.	My climate change anxiety prevents me from getting things done.	1	2	3	4	5

15.	Climate change anxiety causes problems in my relationships.	1	2	3	4	5
16.	I am worried that climate change will negatively affect my (current or future) children.	1	2	3	4	5
17.	Climate change anxiety prevents me from taking care of myself (ex. Hygiene, eating, etc.)	1	2	3	4	5
18.	Climate change anxiety negatively affects my ability to take care of things at home.	1	2	3	4	5
19.	My climate change anxiety is overwhelming.	1	2	3	4	5
When I think about climate change…						
20.	…My body feels tense.	1	2	3	4	5
21.	…I am afraid that I will not survive.	1	2	3	4	5
22.	…My heart races.	1	2	3	4	5
23.	…My other values (ex. family, work, education, etc.) no longer seem important.	1	2	3	4	5
24.	…I feel overwhelmed.	1	2	3	4	5
25.	…I question the meaning of life.	1	2	3	4	5
26.	…I feel hopeless.	1	2	3	4	5
27.	…I feel worried.	1	2	3	4	5
28.	…I feel afraid.	1	2	3	4	5
29.	…I am afraid to plan for the future.	1	2	3	4	5
30.	…I feel powerless.	1	2	3	4	5
31.	…I worry that I won't be able to achieve my goals in the future.	1	2	3	4	5
32.	…I feel restless.	1	2	3	4	5
33.	…I feel that I cannot live a meaningful life.	1	2	3	4	5
34.	…I worry about the future.	1	2	3	4	5
35.	…I feel guilty about the human impact on climate change.	1	2	3	4	5

*Scoring: To obtain total scores, sum all item scores (no reverse-scored items). Subscale 1 consists of items 2, 3, 5, 6, 7, 8, 9, 11, 12, 14, 15, 17, 18, & 19. Subscale 2 consists of items 10, 20, 21, 22, 23, 24, 25, 26, 29, 30, 31, 32, & 33. Subscale 3 consists of items 1, 4, 13, 16, 27, 28, 34, & 35.