Factor structure of Finnish-translated Climate Anxiety Scale and an examination of correlates in a Finnish convenience sample

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Climate change is one of the biggest crises facing humanity, and its health effects are extensive. According to American Psychology Association, one of the most significant mental health effects of climate change is climate anxiety. Research on climate anxiety is scarce, but it has become a more common research topic in the past decade. To measure climate anxiety reliably, Clayton and Karazsia (2020) created Climate Anxiety Scale (CAS). CAS has been validated in Germany, Italy, Philippines, and French-speaking countries. The aim of the present study was to investigate the factor structure of a Finnish-translated short version of CAS in a Finnish convenience sample. Prevalence of climate anxiety and associations of CAS with demographic factors and coping styles were also investigated.

Data were collected via an online survey, and the final sample consists of 795 completed surveys. The original two-factor structure of CAS did not replicate in a Finnish convenience sample ($n = 795$). Three items were excluded due to weak communalities, and a new, one-factored instrument, CAS-10-FI was created. There were significant gender differences on CAS-10-FI scores. CAS-10-FI scores and age presented a linear negative correlation. No differences on CAS-10-FI scores were found between different income levels, or people who have children and people who do not have children. All three coping styles explained CAS-10-FI scores statistically significantly but rather weakly.

Due to a skewed nonrepresentative sample, generalisability of the results is limited. Thus, more research with a larger and a representative sample is necessary to gain a further understanding on CAS-10-FI, climate anxiety in general and its associations to demographic factors and coping mechanisms.

Keywords: climate anxiety, climate change anxiety, eco-anxiety, anxiety, climate anxiety scale, coping style, coping mechanism

Contents

1   Introduction

Climate change evokes more conversation than ever. Researchers agree that climate change is unambiguously caused by humans (Anderegg et al., 2010) and according to the latest report by International Panel of Climate Change (IPCC)(2021) its effects can already be seen around the world. Increase in temperature has led to declines in glaciers, permafrost, frost days and snow cover. In Europe, hot weather extremes are more common and intense than ever and regardless of future levels of global warming, these changes will continue to expand (e.g., Guiot & Corona, 2010; Rahmstorf & Coumou, 2011). According to IPCC (2021) global warming of 2°C is a critical threshold for ecosystems and humanity and limiting temperature rise to 1.5°C would make adapting to the changes in the environment less difficult. Despite scientists having established many ways to mitigate climate change, studies show that humans do not do enough to limit temperature rise to 1.5°C (Hagen et al., 2016), regardless of the strong support to national climate policy in population (e.g., Ministry of Environment of Finland, 2019; Lee et al., 2015).

The indecisiveness and inefficiency of climate politics has led to protests, climate strikes, and establishment of activist groups around the world. In Finland, an activist group, Extinction Rebellion Finland, has declared a state of climate emergency (Extinction Rebellion Finland, 2022). The activists have repeatedly conquered streets to protest inefficiency of climate politics, demanding proper attitude and action towards climate change. Especially young people, such as Fridays for future activist Greta Thunberg, have expressed their worry over climate change.

According to American Psychological Association (APA, 2018) one of the most significant mental health problems caused by climate change is climate anxiety. Climate anxiety has been investigated in the past years to an increasing extent (e.g., Clayton & Karazsia, 2020; Hickman et al., 2021; Innocenti et al., 2021; Mouguiama-Daouda et al., 2022; Wullenkord et al., 2021), but the studies have major differences on definitions of climate anxiety and methodology. Thus, only limited conclusions can be made about prevalence and symptoms of climate anxiety, or its impacts on behaviour. To measure climate anxiety reliably, Clayton and Karazsia (2020) developed Climate Anxiety Scale (CAS). CAS has been validated in Germany (Wullenkord et al., 2021), Italy (Innocenti et al., 2021), Philippines (Simon et al., 2022) and French-speaking countries (Mouguiama-

Daouda et al., 2022). Ojala (2013) has investigated what coping mechanisms people use to cope with the emotions evoked by climate change, but the associations between climate anxiety and different coping styles have not yet been investigated.

In this study we investigate whether a Finnish-translated version of CAS has the same factor structure in a Finnish convenience sample as in the original sample (Clayton & Karazsia, 2020). In addition, prevalence of climate anxiety and its associations with demographic factors will be investigated. Differences on CAS scores between different genders, income levels and people who have children and people who do not have children, and the association of climate anxiety and age will be investigated. Furthermore, the association between CAS scores and three coping styles, emotion-focused, problem-focused, and avoidant coping, will be investigated.

1.1 Climate Change

Climate change is one of the biggest crises facing humanity (IPCC, 2021). Climate change has mainly been caused by human activities since the 1800s (e.g., Santer et al., 2003). For instance, using fossil fuels like coal, oil, and gas, has led to long-term changes in temperatures and weather conditions (e.g., Rodhe, 1990). Using fossil fuels produces greenhouse gas emissions, for example carbon dioxide, which leads to the weather system storing more energy (IPCC, 2021). Consequently, the earth absorbs more radiation from the sun, which leads to rising temperature. Many daily human activities, such as using gasoline for driving a car, travelling by plane, or using coal for heating a house, produce greenhouse gas emissions. The last decade (2011−2020) was the warmest recorded, but the temperature rise is not the only consequence of climate change (IPCC, 2021). Other consequences include extreme weather conditions, such as droughts, fires, melting polar ice, rising sea levels, floods, and severe storms (Hoeg-Guldberg & Bruno 2010; IPCC, 2021). Rapid changes in the environment caused by climate change affect negatively on a variety of organisms around the world, and some species have become extinct due to not having enough time to adapt (e.g., Kannan & James, 2009). The consequences of climate change can already be seen around the world and significant changes in human behaviour are necessary to avoid further crises (IPCC, 2021; WHO, 2021).

1.2 Climate Change and Health

The World Health Organization (WHO, 2021) states that climate change is one of the biggest health threats facing humanity and predicting the full extent of its health effects is difficult. According to IPCC (2021) to avert millions of climate change-related deaths, temperature rise must be limited to 1.5°C.

Climate change has potential to affect health in several ways (Costello et al., 2009). Direct threats to physical health include extreme weather situations leading to injuries, deaths and diseases (WHO, 2021). Rising temperature can increase prevalence of diarrheal and vector-borne diseases (IPCC, 2021; McMichael 2003). Combination of rising temperature and high air humidity can cause heat exhaustion, heat stroke and even death (Anderson & Bell, 2011; Kovats & Hajat, 2008; Mitchell et al., 2016; Sinha et al., 2022; WHO, 2021). WHO (2021) predicts the number of climate change caused deaths to rise by 250 000 between 2030 and 2050. Climate change also affects health indirectly by threatening living conditions, such as air quality (Doherty et al., 2017) or food systems (Tirado et al., 2010). WHO (2021) states that climate change "has the potential to undermine decades of progress in global health."

Mental health effects of climate change have been investigated significantly less than physical health effects. Nonetheless, climate change also has direct and indirect impacts on mental health (Berry et al., 2010; Fritze et al., 2008). Climate change affects mental health directly and indirectly through three pathways. According to Kjellstrom (2009), direct mental health effects are caused by traumatic experiences related to natural disasters. Prolonged stress is a normative reaction to traumatic, life-threatening events, such as natural disasters (Silove & Steel, 2006), and exposure to natural disasters and extreme weather conditions have been found to have potential to cause post-traumatic stress disorder (Galea et al., 2005; Salcioglu et al. 2007), mental health hospitalization (Obradovich et al., 2018) and even suicide (Ahern et al. 2005; Carleton, 2017; Maes et al. 1994; Ramphal, 2018). According to Berry and colleagues (2010) climate change can also impact mental health indirectly through two different pathways. First, by affecting physical health (Miller et al. 2009; Prince et al. 2007) and second, by affecting environment (Berry et al, 2008) or economic and social wellbeing of community (Kjellstrom et al., 2009). For example, heat waves caused by climate change have been found to cause cognitive impairment (Norloei et al., 2017), increased suicide risk

(Thompson et al., 2018), and prolonged droughts in Australia were found to cause depression (Ferré et al., 2019; Marshall et al., 2007) and anxiety (Ferré et al., 2019). Climate change also changes and damages environment, which can lead to reduced sense of belonging and connectedness to the environment (e.g., Higginbotham et al., 2006).

Most of these mental health effects of climate change mostly affect people who have been directly exposed to the consequences of climate change, such as flood. However, as Pihkala (2019) states, many people in the Western cultures have only been exposed to indirect consequences of climate change. According to Doherty (2015) indirect exposure to climate change can also cause mental health symptoms. Therefore, he suggests reconsidering old models of exposure might be necessary to understand the mental health effects of climate change better.

1.3 Climate Anxiety

1.3.1 Definition of Climate Anxiety

Research on emotions related to climate change has become more common research topic in the last decade, but researchers have not yet agreed on common terminology. Especially Pihkala (2020) has tried to solve this conceptual confusion by reviewing studies about eco-anxiety. He suggests that climate anxiety is a specific subtype of a wider phenomenon, eco-anxiety, which according to Clayton and colleagues (2017) is a chronic feeling of fear of environmental destruction. Albrecht (2012), on the other hand, defines eco-anxiety as "a generalized sense that the ecological foundations of existence are in the process of collapse."

The phenomenon of negative emotions related to climate change has also been called by terms; climate change distress (Searle & Gow, 2010), climate change concern (McBride et al., 2021; Ojala, 2013) climate change anxiety (Clayton & Karazsia, 2020; Heeren et al., 2021; Innocenti et al., 2021; Mouguiama-Daouda et al., 2022) and climate anxiety (Clayton, 2020; Clayton & Karazsia, 2020; Hickman et al., 2021; Wullenkord et al., 2021). The terminology will not be editorialized in this study, but defining the phenomenon investigated is important. Therefore, in this study the term climate anxiety will be used to represent a score of an instrument that measures climate anxiety, Climate Anxiety Scale (Clayton & Karazsia, 2020).

Due to lack of research, conceptual confusion, and differences in methodology as well as views on symptoms of climate anxiety differ. However, there are a few suggestions. Doherty (2015) suggests that symptoms could include insomnia and sleeping disorders, mood changes, overstimulation, and decreased energy levels. Castelloe (2018), on the other hand, suggests symptoms could include panic attacks, insomnia, and obsessive thinking. Clayton and Karazsia (2020) suggest, that symptoms of climate anxiety could include emotional, cognitive, and functional impairment. Clayton (2020) also argues that distress caused by climate change may worsen other daily stressors, leading to negative mental health impacts, such as anxiety disorders, depression, and substance use.

1.3.2 Climate Anxiety Scale

Climate Anxiety Scale (CAS) developed by Clayton & Karazsia (2020) is a self-evaluation questionnaire consisting of four factors and 22 items (presented in Table 1). The four factors are cognitive-emotional impairment, functional impairment, experience of climate change and behavioural engagement. In this study the Finnish-translated version of the whole instrument is referred to as CAS-22-FI. The actual climate anxiety instrument itself consists only of the first two factors: cognitive-emotional impairment and functional impairment. It has 13 items, and its Finnish-translated version is referred to as CAS-13-FI in this study. Each item presents a claim about behaviour or subjective experience related to climate anxiety, and each item is answered by self-evaluation on a scale from 1 to 5. Each number of the scale reflects how often the claim of the item is true (1 = never, 2 = rarely, 3 = sometimes, 4 = often, and 5 = almost always).

Table 1

Items of the original instrument CAS-22 (Clayton & Karazsia, 2020). Items 1–8 measure cognitive-emotional impairment, items 9–13 measure functional impairment, items 14–16 measure experience of climate change, and items 17–22 measure behavioural engagement. Items 1–13 form the climate anxiety instrument CAS-13.

Item
1. Thinking about climate change makes it difficult for me to concentrate.
2. Thinking about climate change makes it difficult for me to sleep.
3. I have nightmares about climate change.
4. I find myself crying because of climate change.
5. I think, "why can't I handle climate change better?"
6. I go away by myself and think about why I feel this way about climate change.
7. I write down my thoughts about climate change and analyze them.
8. I think, "why do I react to climate change this way?"
9. My concerns about climate change make it hard for me to have fun with my family or friends.
10. I have problems balancing my concerns about sustainability with the needs of my family.
11. My concerns about climate change interfere with my ability to get work or school assignments done.
12. My concerns about climate change undermine my ability to work to my potential.
13. My friends say I think about climate change too much.
14. I have been directly affected by climate change.
15. I know someone who has been directly affected by climate change.
16. I have noticed a change in a place that is important to me due to climate change.
17. I wish I behaved more sustainably.
18. I recycle.
19. I turn off lights.
20. I try to reduce my behaviors that contribute to climate change.
21. I feel guilty if I waste energy.
22. I believe I can do something to help address the problem of climate change.

A few instruments measuring climate anxiety have been created before CAS (e.g., Searle & Gow, 2010), but Clayton and Karazsia (2020) argue, that CAS is the first instrument to investigate the connection between climate anxiety and its possible negative effects on wellbeing. The aim was to create an instrument able to separate healthy and unhealthy climate change related worry and investigate, whether climate anxiety could be a clinically significant phenomenon. Therefore, items measuring relevant clinical symptoms, rumination and functional impairment, were formed. The items were developed by reading blogs about the emotional consequences of climate anxiety, and existing psychological measures were utilized to form the final items. To measure the extent of thinking about climate change, rumination items were formed, based on the Ruminative Responses Scale (Treynor et al., 2003). These items formed the cognitive-emotional impairment factor in Clayton and Karazsia's (2020) study. To investigate

whether climate change related emotions impair people's daily functioning, functional impairment items were developed based on the Weiss Functional Impairment Rating Scale (Weiss, 2000). These items formed the functional impairment factor in Clayton and Karazsia's (2020) study. To measure engaging in pro-environmental behaviour, behavioural items were created utilizing the Drive for Muscularity scale (McCreary & Sasse, 2000). These items formed the behavioural engagement factor (Clayton & Karazsia, 2020). In addition, Clayton and Karazsia (2020) created three items measuring personal experiences of climate change to form the experience of climate change factor. According to Clayton & Karazsia (2020) CAS enables distinguishing maladaptive reaction to climate change from adaptive reaction. They argue that high scores of behavioural engagement and even cognitive-emotional impairment represent an adaptive reaction to climate change. Functional impairment, on the other hand, is claimed to represent a maladaptive, and possibly a clinically significant reaction (Clayton & Karazsia, 2020).

Translated versions of CAS-13 have been validated in a representative sample of Germans (Wullenkord et al., 2021), in a convenience sample of Italians (Innocenti et al., 2021), a convenience sample of Filipino adolescents (Simon et al., 2021), and a multinational convenience sample of French-speaking people (Mouguiama-Daouda et al., 2022). The original two-factor structure of CAS-13 was replicated in a French-speaking sample and a Philippine sample (Mouguiama-Daouda et al., 2022; Simon et al., 2021). However, one-factor structure demonstrated a better fit in German and Italian samples (Innocenti et al., 2021; Wullenkord et al., 2021). In the German study (Wullenkord et al., 2021) one item, "I go away by myself and think about why I feel this way about climate change.", was removed due to weak psychometric properties.

1.3.3 Psychometric Validation

Field (2013) defines validity as measuring what is intended to be measured. Validation of an instrument means determining how accurately it measures the phenomenon it is designed to measure (APA, 2022a). APA (2022b) divides validity into three main types, criterion validity, construct validity and content validity.

Criterion validity means the instrument's ability to predict outcomes of another conceptually relevant instruments. It can be divided into three subtypes: predictive validity, concurrent validity, and retrospective validity (APA, 2022c). All three refer to

the instrument's ability to estimate scores in other relevant measurements; predictive validity with a measure conducted in the future, concurrent validity with a measure conducted at the same time, and retrospective validity with a measure conducted in the past. Considering criterion validity, as Clayton and Karazsia (2020) claim that CAS distinguishes maladaptive and adaptive climate anxiety, CAS should be able to predict clinical outcomes.

Construct validity means that the instrument represents the phenomenon that it is intended to measure (APA, 2022d). It can be divided into convergent validity, representing associations to measures it is intended to be associated with, and discriminant validity, representing the instrument not being associated with measures it is not intended to be associated with. Considering construct validity, CAS should, for example, correlate with general anxiety, but not with experience of climate change.

Content validity means that the instrument covers all dimensions of the phenomenon it is intended to measure while not covering something irrelevant (APA, 2022e). Considering content validity, CAS should measure all dimensions of climate anxiety, and nothing irrelevant. According to the theory of Clayton and Karazsia (2020), climate anxiety could consist of two factors: cognitive-emotional and functional impairment. Were it true, CAS should measure both.

Investigation of validity of CAS in relation to other conceptually similar measures or clinical outcomes is limited, as CAS is the only scale measuring climate anxiety, and our knowledge of the respondents is limited to the knowledge provided by this questionnaire. Therefore, we focus on investigating the factor structure of CAS in a sample representing a different culture and language than it was originally developed in. Additionally, CAS will be compared to a general anxiety measure, a short version of The State and Trait Anxiety (STAI-6) (Spielberg, 1983). Thus, the results should provide information on validity of CAS. However, as climate anxiety, and CAS in particular, is a relatively new research subject, investigating all types of validity comprehensively is out of scope of the present study.

1.3.4 Prior Research

In Finland, a variety of media sources have conducted surveys about climate anxiety in recent years (e.g., Autere, 2018; Hallamaa, 2018; Immonen, 2018). Results suggest that

climate anxiety is a common phenomenon especially among young population (Autere, 2018; Immonen, 2018). However, not much quantitative scientific research on the topic has been conducted in Finland. Hickman and colleagues (2021) studied climate worry and climate anxiety in teenagers and young adults (16–25 years) covering ten countries, including Finland. Results showed that more than 45% reported that their feelings about climate change affect their daily life and functioning. In an unpublished master's thesis 39.5% of a Swedish-speaking sample of Finnish high school and vocational school students reported at least moderate climate worry, and 9% experienced mild, moderate, or severe climate anxiety as a pathological phenomenon, measured by a modified climate change related version of General Anxiety Disorder-7 (GAD-7) (Spitzer et al., 2006; Laine, 2022).

Due to the conceptual confusion, studies have major differences in methodology, which is why interpreting the results carefully is important, especially when comparing results of different studies about climate anxiety. For example, in the United States 51% of respondents considered climate change as a moderate or significant stressor (APA, 2018) and in Australia's countryside 56% were concerned about climate change (Berry & Peel, 2015). In a study that covered four European countries, 20–40% of respondents were very concerned about climate change (Steentjes et al., 2017). However, there are only a few studies that use Climate Anxiety Scale (Clayton & Karazsia, 2020; Heeren et al., 2021; Innocenti et al., 2021; Mouguiama-Daouda et al., 2022; Wullenkord et al., 2021) and are therefore quite comparable to each other and the current study. Studies utilizing the scale show that people report low levels of climate anxiety on average. Nonetheless, there seems to be a small proportion of people who report high climate anxiety. The instrument does not have defined cut off points yet, but some interpretations have been made. In Clayton and Karazsia's (2020) study 26–27% of respondents scored higher than midpoint (average answer being 3 = "Sometimes") on functional impairment factor and 17–19% higher than midpoint on cognitive-emotional impairment factor. Heeren and colleagues (2021) found the prevalence of higher than midpoint to be 21% for functional impairment and 11% for cognitive-emotional impairment. Clayton and Karazsia (2020) propose climate change has a significant impact on mental health, as the prevalence of people reporting some difficulty functioning due to climate change is quite high. Altogether, it appears, that climate concern is quite common (APA, 2018; Berry & Peel, 2015; Steenjes

et al., 2017) but climate anxiety is rarer (Clayton & Karazsia, 2020; Heeren et al., 2021; Laine, 2022; Wullenkord et al., 2021).

1.3.5 Correlates

Several environmental and individual psychological properties are associated with climate anxiety. For example, people who experience direct effects of climate anxiety are at a higher risk than people who only experience indirect effects (Clayton, 2020). However, people who only experience indirect effects can suffer from climate anxiety as well (Clayton & Karazsia, 2020). Psychological properties, such as identifying with nature (Dean et al., 2018) and biospheric worry (environmental concern focusing on animals, plants, and nature) (Helm et al., 2018) have been found to increase the risk of climate anxiety.

In the original CAS validation study, no gender differences were found on climate anxiety scores (Clayton & Karazsia, 2020). However, women reported higher climate anxiety than men in a German sample (Wullenkord et al., 2021) and in a French-speaking sample (Heeren et al., 2021). Prior research also suggests that younger people experience higher climate anxiety (Clayton & Karazsia, 2020; Heeren et al., 2021; Wullenkord et al., 2021). Clayton and Karazsia (2020) also found a connection between education level and climate anxiety with higher education being associated with higher reported climate anxiety. However, two studies were not able to replicate the result (Heeren et al., 2021; Wullenkord et al., 2021). There also seems to be a connection between pro-environmentalism and climate anxiety (Heeren et al., 2021; Innocenti et al., 2021; Mouguiama-Daouda et al., 2022; Wullenkord et al., 2021) even though the connection was not found in Clayton and Karazsia's study (2020). Climate anxiety has also been found to be connected to general anxiety (Clayton & Karazsia, 2020; Innocenti et al., 2021; Wullenkord et al., 2021).

1.3.6 Is Climate Anxiety a Pathological Phenomenon?

Defining whether climate anxiety is a pathological disorder, or a rational reaction to a real threat is a central issue for the field. Considering the seriousness and uncertainty of the consequences of climate change, it is not irrational to experience difficult emotions, such as worry or anxiety, related to the situation (Clayton, 2020). Climate anxiety is not a diagnostic disorder, but it could be a form of generalized anxiety disorder, according to

the three following diagnostic criteria. First, immoderate anxiety and worry about various topics, events or activities must occur constantly for at least six months (APA, 2013). Second, controlling the experienced worry is challenging and the topic the anxiety focuses on may vary. Third, in addition to the anxiety and worry, at least three of the following physical or cognitive symptoms appear: edginess or restlessness, tiring easily, impaired concentration or feeling mind going blank, irritability, enhanced muscle ache or soreness, and sleep difficulties. As some studies suggest, there seems to be a connection between general anxiety and climate anxiety (e.g., Clayton & Karazsia, 2020; Searle & Gow, 2010). On the other hand, many people seem to experience climate anxiety, despite not having mental health issues (e.g., Clayton & Karazsia, 2020; Hyry, 2019; Wullenkord et al., 2021). Several studies show that some people suffer from impairment of daily functioning caused by climate anxiety (Clayton & Karazsia, 2020; Gibson et al., 2020; Haaren et al., 2021; Wullenkord et al., 2021). As Clayton (2020) argues, climate anxiety could be a clinically significant phenomenon, if it impairs daily functioning, such as sleep or work.

Anxiety does not automatically indicate mental health issues but could rather serve as an adaptive function to a threat and be a motivator to prepare appropriately (Barlow, Durand, & Hofmann, 2019; House & Stark, 2002). In fact, many researchers have warned about pathologizing climate anxiety (Clayton, 2020; Clayton & Karazsia, 2020; Cunsolo et al., 2020; Pihkala, 2018) and some argue, that reasonable amount of worry about climate change is rational (Clayton & Karazsia, 2020; Ojala, 2007). Comparisons between mental health effects of climate change and worry about the possibility of nuclear war (e.g., Newcomb, 1988; Zweigenhaft et al., 1986) have also been made (e.g., Lifton, 2017; Pihkala, 2019). According to Pihkala (2019) these two have much in common but he states that mental health effects of climate change could be even worse, as climate change is getting worse all the time. Pihkala (2020) argues, that climate anxiety can be seen as a moral emotion, considering Kurth's (2018) concept, practical anxiety. According to Kurth's theory (2018), experiencing climate anxiety could lead to seeking information and motivating to live a more pro-environmental, and therefore a more moral, lifestyle. Findings of an APA survey (APA, 2020) supports this, as participants who reported climate anxiety expressed more motivation to change their behaviour to help mitigating climate change. However, Clayton and Karazsia (2020) did not find such connection. Pihkala (2019) suggests, that to exploit climate anxiety as a resource, having enough time

dealing with emotions and enough effective action to help mitigate climate change is necessary.

Altogether, as Pihkala (2020) states, pathological and rational climate anxiety should be differentiated. It seems that climate anxiety could be a specific existential form of anxiety that can, in some cases, develop into a pathological anxiety, if its symptoms impair functioning, or serve as a single topic of anxiety in people with generalized anxiety disorder. As Pihkala (2020) states, "A key question seems to be: how to increase the adaptive potential in people's experiences of climate anxiety and to alleviate the paralyzing forms of climate anxiety?"

1.4   Coping Mechanisms

Coping mechanisms are behavioural reactions to situations that cause unpleasant emotions, such as anxiety (Wechsler, 1995). The purpose of coping mechanisms is to reduce stress. According to the transactional model of coping (Lazarus & Folkman, 1984), there are two ways to cope: problem-focused and emotion-focused coping. Problem-focused coping focuses on ways to fix the problem that causes unpleasant emotions, while emotion-focused coping means regulating or discarding the unpleasant emotions caused by the problem. Emotion-focused coping can also be divided in two different factors: emotion-focused coping, and avoidant coping (Carver, 1997; Dias et al., 2012).

Considering coping with climate change specifically, two models have been created. Hamilton and Kasser's (2009) model consists of adaptive, maladaptive and denial. Adaptive coping means accepting facts and emotions related to climate change, and then acting to mitigate climate change. Maladaptive coping means avoiding emotional reactions by only accepting the facts about climate change to some extent. Denial means not accepting the facts about climate change to avoid feeling anxious. The model of mental acceptance, on the other hand, consists of becoming more attentive to the issue, accepting climate change as a threat, adopting a problem-solving attitude, and shifting values to a more pro-environmental position (Reser et al., 2012; Bradley et al., 2014). These missions can be demanding, and as Pihkala (2019) states, battling with them can cause stress and anxiety. In most context problem-focused coping is often associated with wellbeing, as emotion-focused coping does not solve the stress-causing problem (Clayton, 2020). However, in the case of climate change, the threat is impossible to solve just by an individual and problem-focused coping could cause even greater stress.

According to Clayton (2020), it is possible that when coping with climate change, a perfectly functional coping response does not exist. In contrast, several studies show positive connections between happiness and pro-environmental action (Bradley et al., 2014; Corral-Verdugo et al., 2011; Howell & Passmore, 2013). This supports the positive role of problem-focused coping when it comes to coping with climate change.

The associations with climate anxiety and coping styles have not been widely studied, but an unpublished master's thesis found climate anxiety to be positively associated with avoidant and problem-focused coping (Laine, 2022). No connection between climate anxiety and emotion-focused coping was found. Wullenkord and colleagues (2021) found that the higher reported climate anxiety, the fewer self-protective strategies were used. People reporting high climate anxiety were also found to deny climate change less, rationalize climate change less, deny global consequences of climate change less and avoid climate change related stimuli in their everyday lives more than people with low climate anxiety (Wullenkord et al., 2021).

Ojala (2012; 2013) has investigated coping mechanisms specifically used to cope with climate change. She found children and adolescents using problem-focused coping to report higher behavioural engagement and efficacy but also higher negative affect. Children and adolescents using emotion-focused coping were low on behavioural engagement and efficacy, but high on negative affect. Ojala (2012) also recognized a third coping strategy, meaning-focused coping, an attempt to obtain positive emotions towards the stressor, while not eliminating the negative emotions. Using meaning-focused coping was associated with more positive affect, optimism towards climate change, behavioural engagement, and feelings of efficacy (Ojala, 2012; Ojala, 2013).

1.5   Research Questions and Hypotheses

The purpose of this study is to investigate whether the Finnish translated version of CAS-13 (CAS-13-FI) has similar factor structure as the original instrument (Clayton & Karazsia, 2020) in a Finnish sample. In addition, prevalence of climate anxiety and its associations with demographic factors and coping styles will be investigated.

The research questions are:

1. Do CAS-13-FI and CAS-22-FI have similar factor structure in a Finnish sample as the original instruments (Clayton & Karazsia, 2020) and do all items explain significant

proportion of the variance in the overall score? The focus will be on the short version, CAS-13-FI, but CAS-22-FI will be investigated too. The hypothesis is that CAS-13-FI will have a two-factor structure of the original instrument and a Cronbach's alpha over 0.80 in our sample. Fit indices are expected to be satisfactory. However, should the structure not be replicated, exploratory analyses will be conducted to find the best structure fitting our data.

2. How are demographic factors associated with climate anxiety? The associations of climate anxiety and gender, age, income levels and having children will be investigated. Based on prior research, young people are expected to report higher climate anxiety than older people (Clayton & Karazsia, 2020; Heeren et al., 2021; Wullenkord, 2021), and women to report higher climate anxiety than men (Heeren et al., 2021; Wullenkord, 2021). Despite the prior research suggesting that income level is not associated with climate anxiety (Wullenkord et al., 2021), people with low income are expected to report higher climate anxiety than people with high income, since having little money could cause experience that the amount of money limits the ability to live a pro-environmental lifestyle. People who have children are expected to report higher climate anxiety than people who do not have children, because they are expected to be worried about the future of their children. Prevalence of climate anxiety will also be reported, with the caveat that our sample is not representative of Finnish population. Climate anxiety scores are expected to demonstrate significant floor effects.

3. How are different coping styles associated with climate anxiety? Based on prior research on association between avoidant coping and anxious behaviour (e.g., Quah et al., 2020), avoidant coping is expected to predict higher climate anxiety. According to Ojala (2012) to avoid the effects of climate anxiety that impair functioning, having enough time for both dealing with emotions and participating in effective action is necessary. Therefore, problem-focused, and emotion-focused coping are expected to predict lower climate anxiety.

2   Methods

The current study is a part of research project CLIMATE NUDGE: Using behavioral sciences for steering communities to reduce greenhouse gas emissions and fortify carbon sinks (https://www.ilmastotuuppaus.fi/en/), and the results offer relevant information for future studies of the project. The present study was pre-registered in Open Science Framework (https://www.osf.io/jduwv) and study protocol was approved by the ethic committee of University of Turku before the data collection.

2.1   Participants

Participants were recruited by sending email invitations to the students and staff of all Finnish Universities and Universities of Applied Sciences. The link to the survey was also shared on social media and participants were encouraged to share the study invitation to their contacts. Thus, the sample consisted of a convenience sample reinforced with snowball sampling. A minimum of 18 years of age was required to participate with no upper age limit. The study invitation read that we are investigating how climate change affects emotions and the study is an important part of development of psychological instruments for investigating psychological effects of climate change. It was clarified that all unfinished responds will be deleted and not used in our data. Instructions on where to reach for help if the questionnaire causes nonpleasant emotions were also presented.

2.2   Procedure

Research Electronic Data Capture (REDCap) was used to collect the dataset. Data consists of 795 fully completed responds. All participants gave an informed consent to the study and were required to answer all questions in the questionnaire, which included questions about climate anxiety, experience of climate change, climate action, the state-trait anxiety, coping mechanisms, and other questions, which are not used in this study. The survey was open for anyone with a link to answer. It took 10 to 15 minutes to complete, and participants did not receive any rewards for participating to the study.

The survey was open for two weeks in June 2021, and during that time 1000 people started to answer the survey. The final sample consisted of 795 completed surveys. The process of forming the final dataset is presented in Figure 1.

Figure 1

The process of forming the final sample (n = 795).
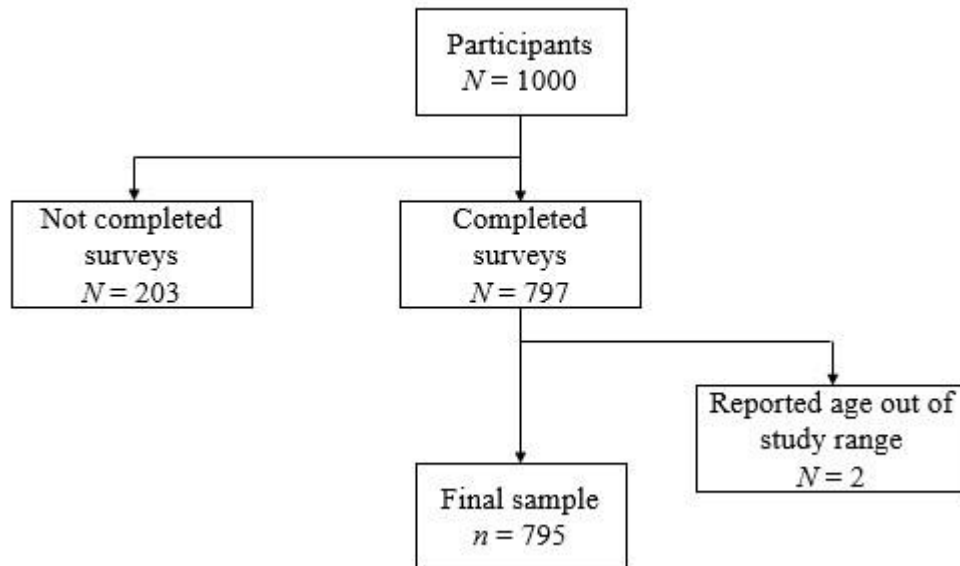
2.3 Measures

2.3.1 Demographic Variables

Participants answered questions about their gender, birth year, native language, education level, work situation, and relationship status. They were also asked about number of residents in their household, number of children, number of under 7-year-old children, and yearly income level of their household.

2.3.2 Climate Anxiety Scale

Climate Anxiety Scale (CAS) (Clayton & Karazsia, 2020) was used to measure climate anxiety. Original items were translated into Finnish using back translation. First, a professional translator translated the instrument into Finnish, after which another professional translator back-translated it into English. Next, researchers debated the differences between the original instrument and the back translation and formulated the final Finnish version. As there are different versions of the instrument with different number of items, CAS-N-FI is used to refer to these Finnish-translated versions, N indicating the number of items in that very instrument. In our sample CAS-10-FI demonstrated high internal consistency ($\alpha = .91$).

2.3.3 State - Trait Anxiety Inventory

The state - trait anxiety inventory (STAI) was used to measure respondent's tendency to feel anxiety. STAI is commonly used in both clinical and research settings (Spielberger et al., 1983) and it has several versions, which differ on the number of items. In the present study a shortened version, STAI-6, which has six items that measure state and trait anxiety, was used. It provides comparable results to the version with 20 items (Marteau & Becker, 1992). Higher scores indicate greater anxiety. In our sample STAI-6 demonstrated high internal consistency (α = .88).

2.3.4 Brief-COPE

To measure use of different coping styles, a self-evaluation instrument, BriefCOPE (Carver, 1997) was used. It consists of 28 items, which measure 14 different coping mechanisms: self-distraction, active coping, denial, substance use, use of emotional support, use of instrumental support, behavioural disengagement, venting, positive reframing, planning, humour, acceptance, religion, and self-blame. The scale can also be divided into three subscales and thus be used as a three-factor instrument, that consists of problem-focused coping, emotion-focused coping, and avoidant coping (Dias et al., 2012). Each item is to be answered on a scale of 1 to 4, based on how relatable it is, 1 meaning "not at all relatable" and 5 meaning "very relatable." We used Finnish-translation (courtesy of FinnBrain). In our data the instrument demonstrated good internal consistency on problem-focused coping (α = .85) and emotion-focused coping (α = .80), but insufficient internal consistency on avoidant coping (α = .74).

2.4 Statistical Methods

Analyses were conducted using IBM SPSS Statistics version 27.0 (IBM Corp., Armonk, N.Y., USA) except for confirmatory factor analyses, which were conducted using software IBM SPSS Amos version 26.0 (Arbuckle, 2016).

Sum scores for continuous variables, CAS-13-FI, CAS-22-FI, CAS-10-FI, STAI-6, problem-focused coping, emotion-focused coping, and avoidant coping, were calculated. For STAI-6, standardized values were calculated by dividing the total score by six, and then multiplied it by 20 to make it comparable with the STAI-20 scoring.

Confirmatory factor analysis (CFA) was conducted to investigate whether the original two-factor structure of CAS-13-FI (Clayton & Karazsia, 2020) could be replicated in Finnish population. We used robust maximum likelihood estimation method. Since a large sample affects p-value of the Chi-Square test (Hu & Bentler, 1999), multiple fit indices were used to evaluate the model, as Kline (2005) recommends. In addition to the Chi-Square test, same fit indices as in the original study (Clayton & Karazsia, 2020) were used: Root Mean Square Error of Approximation (RMSEA), the Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI). According to Hu and Bentler (1999), values over 0.95 for CFI and over 0.90 for TLI and values under 0.08 for RMSEA suggest a good model fit. Standardized factor loadings were also investigated: Factor loading of single items should be highest for factors they are expected to fall into. Additionally, Cronbach Alpha was calculated with values exceeding 0.80 suggesting good internal consistency. χ^2/df ratio was investigated, and values of < 3 were considered to indicate good fit and and values of > 3 to indicate poor fit (van Zomeren et al., 2013).

Since the hypothesized structure of CAS-FI was not satisfactory based on fit indices, we continued with explorative factor analysis to investigate the possibility of a better structure for the Finnish translated instrument. Principal axis factoring with direct oblimin was used since items were expected to correlate. Item suitability for factor analysis were studied with KMO and communalities with values $> .40$ were considered satisfactory.

After finding the most suitable for Finnish sample, CAS-10-FI, its associations to different demographic factors were explored. One-way ANOVA with Dunnett's T3 post hoc tests, Pearson's correlation coefficient with scatter plots and Spearman rank-order correlation coefficient were used for these analyses. General linear model (GLM), in which the dependent variable was CAS-10-FI score, income level was a fixed factor, and age was controlled, as a covariate, was also constructed.

The association between climate anxiety and coping styles was investigated with linear regression analysis. Three linear regression models were constructed. The fulfilment of requirements for linear regression analysis were investigated.

Distribution of CAS-10-FI scores was investigated with Kolmogorov-Smirnov test, with p-value smaller than .05 indicating nonnormality. Variances of predictors were investigated by VIF-value. VIF-value over 5 indicates multicollinearity in data. Distributions and variances of residuals were investigated by interpreting scatterplots and

The Durbin-Watson test. A DW value of 1.5–2.5 demonstrates no autocorrelation between residuals.

3 Results

3.1 Descriptive Statistics and Correlations

The characteristics of the sample are presented in Table 2. Data was skewed regarding gender, age, education level, work situation, number of children and income level. Participants in the final sample were 18–85 years old ($M = 30.44$, $Md = 26.00$).

The descriptive statistics of instruments used are presented in Table 3, and correlations between instruments in Table 4. On average, participants experienced low climate anxiety ($M = 15.47$,[range $= 10–60$]) and moderate state and trait anxiety ($M = 41.02$). STAI-6 correlated moderately with CAS-13-FI ($r = .55$) and CAS-10-FI ($r = .54$).

Table 2

Characteristics of the sample (n = 795).

Characteristics	n	%
Gender		
Men	296	37.2
Women	483	60.8
Others	16	2.0
Age		
18–27	477	60.0
28–37	171	21.5
38–47	61	7.7
48–57	48	6.0
≥ 58	38	4.8
Education level		
Elementary or primary school	4	0.5
Lower secondary school	0	0
Vocational school or comparable	51	6.9
High school	242	30.4
Lower polytechnic degree	14	1.8
Polytechnic degree	91	11.4
University, lower degree	225	28.3
University, higher degree	143	18.0
University, doctoral degree	25	3.1
Work situation		
In full-time job	276	34.7
In part-time job	77	9.7
Students	353	44.4
Laid off	2	0.3
Unemployed	31	3.9
On family leave or as a homemaker	7	0.9
Retired	23	2.9
Unable to work	11	1.4
Other work situation	15	1.9
Number of children		
0	690	86.8
1	48	6.0
≥ 2	57	7.2
Income level		
< 15.000€	325	40.9
15,000–19,999€	92	11.6
20,000–39,999€	126	15.8
40,000€–69,999€	134	16.9
70,000€–99,000€	61	7.7
100,000–119,000€	28	3.5
≥ 120,000€	29	3.6

Table 3

Descriptives of psychological instruments (n = 795).

Variable	items	*M*	*SD*	min	max	α
CAS-13-FI	13	19.88	7.56	13.00	75.00	.92
CAS-10-FI	10	15.47	6.19	10.00	50.00	.91
STAI-6	6	41.02	12.93	20.00	80.00	.88
Problem-focused coping	8	20.08	4.92	8.00	32.00	.85
Emotion-focused coping	12	29.38	6.18	12.00	48.00	.80
Avoidant coping	8	14.35	3.72	8.00	32.00	.74

Table 4

Pearson's correlations between psychological instruments.

Variable	1.	2.	3.	4.	5.	6.
1. CAS-13-FI	1.00					
2. CAS-10-FI	.99**	1.00				
3. STAI-6	.55**	.54**	1.00			
4. Problem-focused coping	.19**	.20**	.17**	1.00		
5. Emotion-focused coping	.20**	.20**	.30**	.71**	1.00	
6. Avoidant coping	.34**	.35**	.49**	.36**	.52**	1.00

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

3.2 Structure of Climate Anxiety Scale

To investigate the structure of the CAS-22-FI and CAS-13-FI, confirmatory factor analyses were conducted for each model. Results are presented in Table 5. According to Chi-square test, there were significant differences in both models from the dataset. However, since Chi-Square test is affected by large sample size, paying more attention to the other fit indices is warranted. Fit indices (Comparative fit index (CFI), Tucker-Lewis Index (TLI) and Root-mean-square error of approximation (RMSEA)) suggested poor fit with data. χ^2/df ratios for both CAS-22-FI (8.31) and CAS-13-FI (17.10) also indicated poor fit. Thus, both models failed to have a satisfactory fit. In addition, all items did not have proper factor loadings. Standardized factor loadings are presented in Table 6.

Table 5

Results of confirmatory factor analyses.

Model	CFI	TLI	RMSEA (CI90%)	Chi-Square test	χ^2/df ratio
CAS-22-FI	.884	.867	.096 (.092-.100)	χ^2 (203, n = 795) = 1685.977, p < .001	8.31
CAS-13-FI	.885	.859	.142 (.135-.150)	χ^2 (64, n = 795) = 1094.262, p < .001	17.10

Table 6

Standardized factor loadings of items.

	CAS-13-FI		CAS-22-FI			
	Standardized factor loadings on target factors					
Item	1	2	1	2	3	4
1	.71		.71			
2	.72		.72			
3	.59		.59			
4	.66		.66			
5	.73		.73			
6	.69		.70			
7	.58		.58			
8	.69		.69			
9		.74		.74		
10		.74		.73		
11		.71		.71		
12		.68		.68		
13		1.04*		1.04*		
14					.91	
15					.76	
16					.74	
17						.80
18						.53
19						.39
20						.85
21						.76
22						.69

*A value > 1.0 indicates strong multicollinearity within items.

Since neither model was supported by the fit indices, and all items did not have proper factor loadings, we concluded that the original factor structure of CAS does not replicate in Finnish sample. Therefore, we proceeded with exploratory factor analyses to investigate possibility of finding a structure that would work better in the current sample.

Explorative factor analysis was used to replicate Clayton and Karazsia's (2020) study, using the principal axis factoring approach with direct oblimin (oblique) rotation, which allows correlations between factors. In CAS-22-FI, items were suitable for factor analysis (KMO = .94). Four factors were recognized (Eigenvalues = 1.02–8.79, 61.6% cumulative explained variance), – two of which were similar to the original study: experience of climate change (items 14–16) and behavioural engagement (17–22). Other two factors were emotional and functional impairment (items 1–4; 9–13) and cognitive impairment (5–8). Thus, the original factor structure did not replicate.

In the case of CAS-13-FI items were also suitable for factor analysis (KMO = .93). Two factors were discovered (Eigenvalues = 1.01–6.58, 57.4% cumulative explained variance): emotional and functional impairment (items 1–4; 9–13) and cognitive impairment (5–8). However, items 7 (I write down my thoughts about climate change and analyze them), 8 (I think, "why do I react to climate change this way?") and 13 (My friends say I think about climate change too much.) had weak communalities ($h^2 < .40$), so these items were excluded to form a new version of the questionnaire, CAS-10-FI. Since we were interested in the part of the instrument that measures climate anxiety instead of experience of climate change and behavioural engagement, following analyses are focused on CAS-10-FI.

When explorative factor analyses were used with CAS-10-FI, items were suitable for factor analysis (KMO = .92). Exclution of the three problematic items changed the factor structure, and only one factor, climate anxiety (Eigenvalue = 5.79), was formed in CAS-10-FI. The model explained 57.9% of total variance. Communalities were strong on all items (h^2 = .44–.71). These analyses led to a one-factor model, CAS-10-FI (items 1–6 and 9–12). This model had a good internal consistency (α = .91). Factor loadings of CAS-10-FI are shown on Table 7.

Table 7

Factor loadings of CAS-10-FI.

Item	Factor loading
Thinking about climate change makes it difficult for me to concentrate.	.76
Thinking about climate change makes it difficult for me to sleep.	.84
I have nightmares about climate change.	.63
I find myself crying because of climate change.	.69
I think, "why can't I handle climate change better?"	.65
I go away by myself and think about why I feel this way about climate change.	.67
My concerns about climate change make it hard for me to have fun with my family or friends.	.79
I have problems balancing my concerns about sustainability with the needs of my family.	.64
My concerns about climate change interfere with my ability to get work or school assignments done.	.82
My concerns about climate change undermine my ability to work to my potential.	.78

3.3 Prevalence of Climate Anxiety

The total scores of CAS-10-FI were not normally distributed (Kolmogorov-Smirnov, $p < .001$), and demonstrated strong, floor effects (see Figure 2). CAS-10-FI scores ranged between 10–60 points, 27.8% of respondents got the minimum score, 10 points, 68.6% got 11–29 points and 3.6% over 30 or more points.
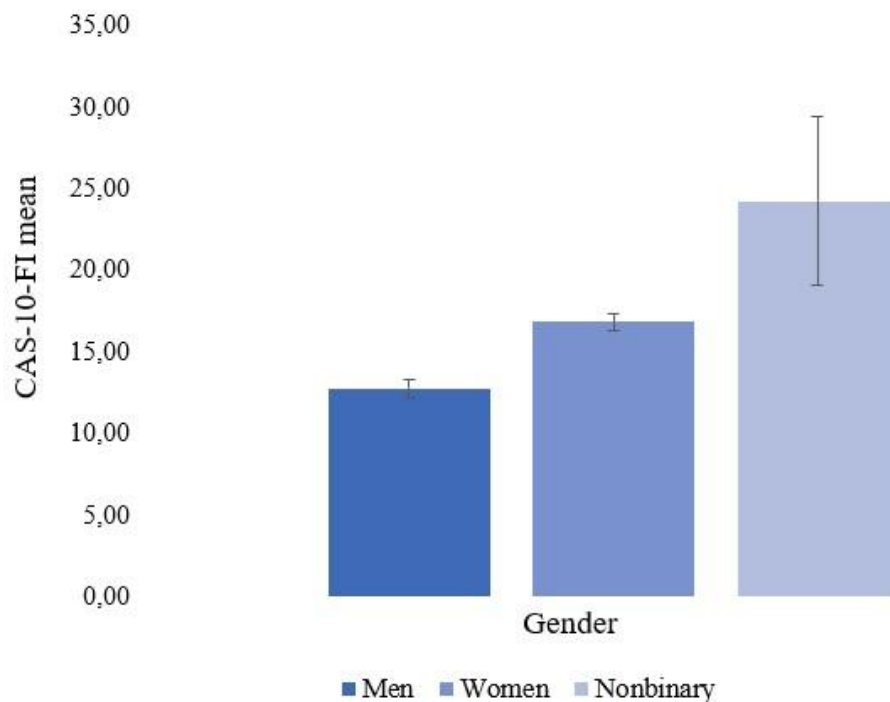
Figure 2

Distribution of CAS-10-FI total scores (n = 795).
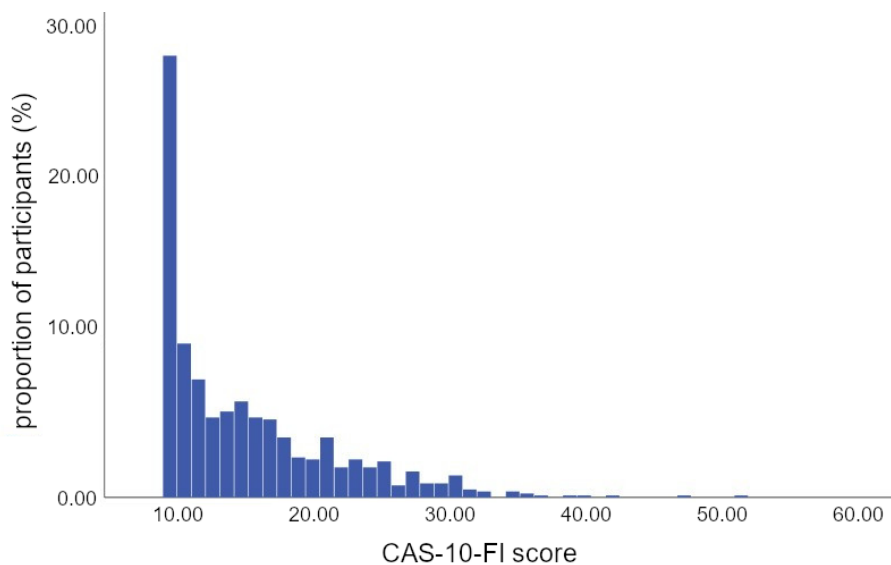
Levene's test indicated unequal variances between gender groups ($F = 20.30$, $p < .001$), age groups ($F = 8.57$, $p < .001$), and income level groups ($F = 5.69$, $p < .001$), and equal variances between participants with children and participants without children ($F = 3.50$, $p < .062$).

There were significant differences on CAS-10-FI scores between genders, $F(2, 792) = 64.50$, $p < .001$, $\eta_p^2 = .14$. Further comparisons were conducted with Dunnett's T3 post-hoc tests, which indicated that there were significant differences between all three genders. Women scored higher on CAS-10-FI than men (95% CI = 3.10, 5.00, $p < .001$), and nonbinary people scored higher than both men (95% CI = 4.98, 17.97, $p < .001$) and women (95% CI = 0.93, 13.92, $p = .023$). Gender differences are presented in Figure 3.

Figure 3

Gender differences on CAS-10-FI mean with 95% confidence intervals.

Age and CAS-10-FI score correlated negatively, $r = -.19$, $n = 795$, $p < .001$. The association of age and CAS-10-FI is presented in Figure 4. Both the figure and the correlation coefficient indicate linear association between these variables. The scatter plot shows that there are low CAS-10-FI scores regardless of age, but high CAS-10-FI scores are more common among younger participants.

Spearman's rank correlation was calculated to assess the association of age and income level, both of which displayed skewed distributions. There was a positive correlation

between income level and age, $r(793) = .56$, $p < .001$. When age was controlled, income level did not have a significant effect on CAS-10-FI score, $F(1, 786) = 1.30$, $p = .245$, $\eta_p^2 = .01$.

Spearman's rank correlation was calculated to assess the association of age and number of children, both of which displayed skewed distributions. There was a positive correlation, $r(793) = .34$, $p < .001$. When age was controlled, having children did not have a significant effect on CAS-10-FI score, $F(1, 792) = 0.70$, $p = .404$, $\eta_p^2 = .00$.

Extensive analysis of prevalence and risk factors of climate anxiety is out of scope of this study and will be conducted in later study utilizing the CAS-10-FI in a larger representative sample.

Figure 4

The scatterplot of CAS-10-FI score and age.
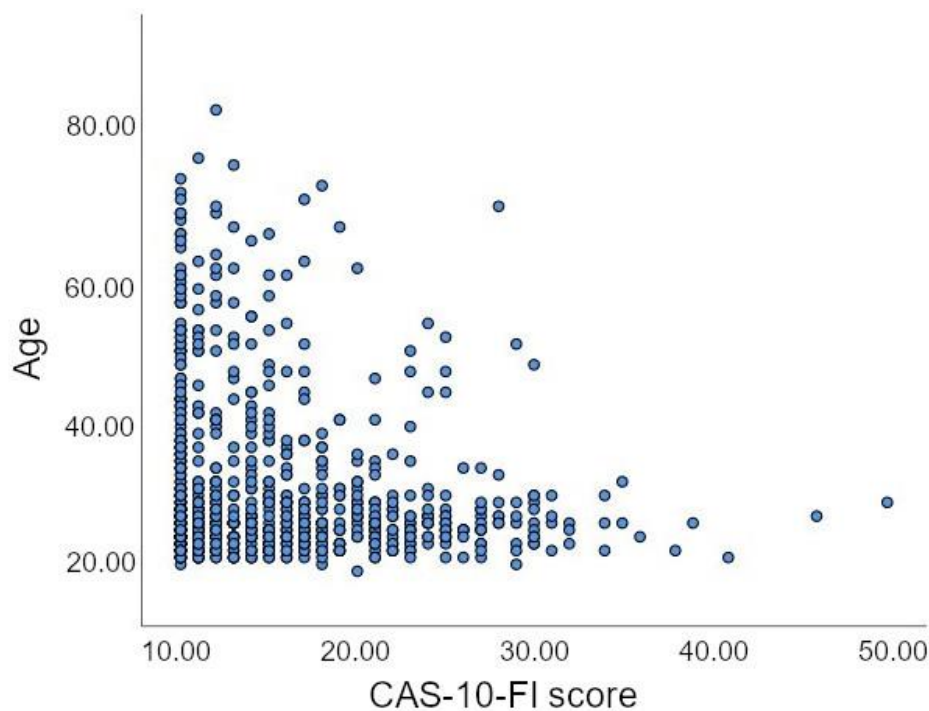
3.4 Climate Anxiety and Coping Styles

All criteria for linear regression analysis were not met; data was not normally distributed, and outliers were not removed, since extreme values are interesting when it comes to measurement of climate anxiety. However, our sample size is large enough that deviation from normality assumption of data should not pose significant problems according to Green (1991). All predictors correlated with the response variable, CAS-10-FI, and data

did not present multicollinearity (VIF < 5). Residuals presented heteroscedasticity, were skewed and not normally distributed. However, according to Schmidt and Finan's (2018) simulation study, this should not skew the models in such a large sample. The Durbin-Watson test indicated no autocorrelation between residuals (DW = 1.5–2.5).

Three models were constructed, which are presented in Table 8. Model 1 had a good fit to data, (F(3, 791) = 38.26, $p < .001$) and explained 12.3% of the variance in CAS-10-FI scores. Of the three coping factors, only avoidant coping style predicted CAS-10-FI score significantly, with an increase in avoidant coping score predicting increased CAS-10-FI score.

In the second model, the effects of two covariates, age and gender, were controlled. Model 2 had a good fit to data (F(6, 788) = 35.96, $p < .001$) and explained 20.9% of the variance in CAS-10-FI scores. With gender and age as covariates, avoidant coping style remained as a significant predictor of CAS-10-FI score.

In the third model, four more covariates were added: education level, income level, having children and STAI-6 score. Model 3 had a good fit to data (F(10, 784) = 44.52, $p < .001$) and explained 35.4% of the variance in CAS-10-FI scores. All three coping factors; problem-focused, emotion-focused, and avoidant coping, predicted CAS-10-FI scores significantly. Problem-focused and avoidant coping increased, and emotion-focused coping decreased CAS-10-FI scores.

Table 8

Results of linear regression analyses (n = 795).

	b [95% CI]	β	t	p
Model 1	6.44 [4.33, 8.55]		5.99	< .001
Problem-focused coping	0.81 [-0.13, 1.74]	.08	1.70	.090
Emotion-focused coping	-0.50 [-1.73, 0.72]	-.04	-0.80	.422
Avoidant coping	4.59 [3.57, 5.61]	.34	8.83	< .001
Model 2	12.68 [9.93, 15.44]		9.04	< .001
Problem-focused coping	0.41 [-0.49, 1.31]	.04	0.90	.367
Emotion-focused coping	-0.85 [-2.04, 0.34]	-.07	-1.41	.160
Avoidant coping	3.58 [2.59, 4.57]	.27	7.09	< .001
Gender: man	-3.01 [-3.94, -2.23]	-.24	-7.10	< .001
Gender: other	6.28 [3.51, 9.05]	.14	4.45	< .001
Age	-0.05 [-0.09, -0.02]	-.10	-2.97	.003
Model 3	7.61 [4.65, 10.58]		5.04	< .001
Problem-focused coping	0.92 [0.09, 1.75]	.09	2.17	.030
Emotion-focused coping	-1.40 [-2.48, -0.33]	-.12	-2.56	.011
Avoidant coping	1.17 [0.21, 2.14]	.09	2.38	.018
Gender: man	-2.12 [-2.90, -1.33]	-.17	-5.28	< .001
Gender: other	4.77 [2.25, 7.29]	.11	3.72	< .001
Age	-0.03 [-0.07, 0.00]	-.06	-1.80	.072
Education level	-0.03 [-0.24, 0.19]	-.01	-0.23	.819
Income level	0.06 [-0.18, 0.30]	.02	0.51	.614
Having children	-0.35 [-1.47, 0.77]	-.02	-0.61	.541
STAI-6	0.22 [0.19, 0.25]	.45	13.45	< .001

4   Discussion

The aim of this study was to investigate whether CAS-13-FI has the same factor structure as the original instrument (Clayton & Karazsia, 2020) in a Finnish sample. In addition, prevalence of climate anxiety and its associations with demographic factors and coping styles were investigated.

4.1   Structure of Climate Anxiety Scale

This is the first study to measure climate anxiety with CAS in a Finnish sample. Both versions of the instrument, CAS-22-FI and CAS-13-FI, failed to have a satisfactory fit in our sample. All fit indices and χ^2/df ratios suggested poor fit. Explorative factor analysis recognized the same number of factors as the original study (Clayton & Karazsia, 2020) for both versions of the instrument, four in CAS-22-FI and two in CAS-13-FI. However, the factor structure of CAS-13-FI in our sample differed from the structure found in the original study (Clayton & Karazsia, 2020). According to Clayton and Karazsia (2020) two factors, cognitive-emotional impairment (items 1–8) and functional impairment (items 9–13), should form CAS-13-FI. In our sample emotional impairment (items 1–4) and functional impairment (items 9–13) merged to form an emotional-functional impairment factor, and cognitive impairment (items 5–8) formed a factor on its own. However, the factors correlated strongly with each other. The other two factors of CAS-22-FI, experiences of climate change and behavioural engagement, separated from items investigating climate anxiety (CAS-13-FI; items 1–13).

In CAS-13-FI three items, 7 (I write down my thoughts about climate change and analyse them), 8 (I think, "why do I react to climate change this way?"), and 13 (My friends say I think about climate change too much) had weak communalities, indicating bad fit in our sample, and were therefore deleted. The new model, CAS-10-FI, was one-factored. CAS-10-FI demonstrated high internal consistency in our data, and all items had satisfactory communalities and factor loadings.

These results are inconsistent with the first hypothesis of the present study, as the factor structure of the original CAS did not replicate in our sample. However, they support the findings of two validation studies conducted with Italian and German samples (Innocenti et al., 2021; Wullenkord et al., 2021), that suggest a one-factor structure has a better fit compared to the originally found two-factor structure of CAS-13 (Clayton & Karazsia,

2020). On the other hand, in addition to the original CAS study (Clayton & Karazsia, 2020), a validation study of multinational French-speaking sample (Mouiguiama-Daouda et al., 2021) suggests a two-factor structure. Findings of previous validation studies also differ on the number of statistically significant items. In two previous validation studies all 13 items measured climate anxiety reliably (Innocenti et al., 2021; Mouguiama-Daouda et al., 2022), but in the German validation study (Wullenkord et al., 2021) item 6 ("I go away by myself and think about why I feel this way about climate change.") was deleted due to weak communality and factor loading. This item presented satisfactory psychometric values in our data.

The fit indexes and cut off points do not remarkably differ between the original study and validation studies, including the present study. Thus, the reasons for different structure of CAS could be based on cultural and language differences. The theoretical argument for the two-factor structure of CAS-13, according to Clayton and Karazsia (2020), is to investigate the possibility of distinguishing adaptive response to climate change (behavioural engagement, negative emotions) and maladaptive climate anxiety (functional impairment). This is an appealing point of view and were it true, climate anxiety could be considered a pathological phenomenon, if it impairs daily functioning significantly.

So far, there is evidence for both one-factor and two-factor structure of CAS. Therefore, drawing conclusions about the best structure overall is difficult. However, there is evidence that climate anxiety is a separate phenomenon from behavioural engagement and does not directly depend on experiences of climate change. Altogether, a one-factor CAS-10-FI seems to work the best in Finnish population. More research needs to be conducted, and a larger and a representative Finnish sample utilizing CAS-10-FI is currently being collected as a part of a larger research project (https://www.ilmastotuuppaus.fi/en/).

4.2   Prevalence of Climate Anxiety

The results demonstrate that on average Finnish people report low climate anxiety scores, as only 3.6% scored over mid point, at least 30 points of maximum of 60. As expected, the results demonstrate significant floor effects, as 27.8% got the minimum score. This is consistent with our hypothesis, that CAS scores demonstrate significant floor effects. However, as our sample is not representative of Finnish population, these results should

be interpreted with caution. In a representative sample the prevalence of minimum score is expected to be even higher. The timing of the study could also affect the results, as the data were collected in June 2021, during which historical heatwaves took over Finland (Hämäläinen, 2021) and the protests of Extinction Rebellion Finland were widely discussed in the media (e.g., Aaltonen, 2021; Harju, 2021).

Compared to previous studies, prevalence of over mid-point CAS scores was low. In Clayton and Karazsia's (2020) study 26–27% of respondents scored over mid-point on functional impairment and 17–19% over mid-point on cognitive-emotional impairment. In a multinational French-speaking sample 20.7% scored over midpoint on functional impairment and 10.8% over midpoint on cognitive-emotional impairment (Heeren et al., 2021). However, the mid-point of the scale does not represent a clinically significant cut off point, as no cut off points have been defined for the instrument. Over mid-point score only expresses the average response to be at least 3 = "Sometimes" (on a scale of 1−5) to each item.

Compared to the prevalence of general anxiety disorder, the 3.6% prevalence of climate anxiety in our sample is relatively equivalent. In international research the prevalence of general anxiety disorder is estimated to be 1.8−5.1% (Ruscio et al., 2017; Wittchen, 2002), and in Finland approximately 1.3% (Pirkola et al., 2005). In our study climate anxiety and general anxiety correlated moderately (r = .54). This is in line with Clayton & Karazsia's (2020) findings, that participants reporting high climate anxiety also report high general anxiety. They found general anxiety being associated with both functional impairment factor (r = .56 in study 1; r = .47 in study 2) and cognitive-emotional factor (r = .60 in study 1; r = .54 in study 2). On the other hand, Wullenkord and colleagues (2021) found a weaker correlation between climate anxiety and general anxiety (r = .25). Considering the relatively equivalent prevalences of climate anxiety and general anxiety disorder, the moderate correlation between CAS-10-FI and STAI-6, and the results of Clayton & Karazsia's (2020) and Wullenkord and colleagues' (2021) study, the evidence for the association between climate anxiety and general anxiety seems strong. On one hand, experiencing climate anxiety could possibly increase general anxiety scores, or people with tendency to feel anxious and therefore feel anxious of climate change too. On the other hand, the correlation between climate anxiety measure and general anxiety measure is logical, as climate anxiety is a specific form of anxiety. Our findings demonstrate that some people report climate anxiety but not general anxiety.

Distinguishing climate anxiety from general anxiety should be strived in the future research.

Climate anxiety is associated with several demographic factors. In our sample, women reported higher climate anxiety than men, which supports prior findings (Heeren et al., 2021; Wullenkord et al., 2021) and our hypothesis. On the other hand, Clayton and Karazsia (2020) did not find differences on climate anxiety between men and women. In our sample nonbinary people reported higher climate anxiety than both men and women. This is the first study to report such differences. In our sample, 16 of 795 respondents were nonbinary, which is the largest sample of nonbinary people in climate anxiety research so far (Clayton & Karazsia, 2020; Heeren et al., 2021; Innocenti et al., 2021; Wullenkord et al., 2021). However, the proportion of nonbinary people is still small compared to sample sizes of men and women, and this poses problems for statistical analyses. Despite the small sample of nonbinary respondents, the results were statistically significant. Nonetheless, these results should be interpreted carefully due to a small sample of nonbinary people, and more research with a larger, representative sample is necessary before drawing further conclusions on the subject.

In this sample climate anxiety and age had a linear negative association. Younger people reported higher climate anxiety, which is consistent with our hypothesis, that younger people report higher climate anxiety than older people. The results also support findings of previous studies conducted in the USA and a multinational French-speaking sample (Clayton & Karazsia, 2020; Heeren et al., 2021) but differ from findings of a German study (Wullenkord et al., 2021). To gain a further knowledge of the association between climate anxiety and age, the phenomenon should be investigated with a larger, representative sample.

Income level was not associated with climate anxiety score in our sample when age was controlled for. The result is inconsistent with our hypothesis, as we expected people with low income to report higher climate anxiety than people with high income. On the other hand, the result is consistent with prior research (Wullenkord et al., 2021). However, our sample was skewed to the right regarding both age and income level, as most respondents were young and had low income. It is possible that people with low income feel that their income level limits their possibility to influence mitigating climate change. This is the second study to investigate the association between CAS and income level, and more

research with a larger and a representative sample is necessary before drawing further conclusions. In addition, investigating conceptions people have about their possibility to participate in mitigating climate change is recommended.

People with children and people without children did not differ in climate anxiety score in our sample when age was controlled. This is inconsistent with our hypothesis, that people who have children report more climate anxiety than people who do not have children. However, in our sample most of respondents were young, and only 13.2% of respondents had children. This study, to the author's best knowledge, is the first to investigate the association between climate anxiety and having children, and more research on the subject with a larger and representative sample is necessary before drawing further conclusions.

4.3   Climate Anxiety and Coping Styles

To investigate the associations between coping styles (problem-focused, emotion-focused, and avoidant coping) and climate anxiety, three linear regression models were constructed. In the first model, only avoidant coping of the three coping styles was a significant predictor of climate anxiety. In the second model, after controlling for age and gender, avoidant coping retained its significance. In the third model, in addition to age and gender, education level, income level, having children and STAI-6 were used as covariates. This led to all three coping styles emerging as significant predictors of climate anxiety, but also to weaker associations. Problem-focused and avoidant coping increased, and emotion-focused coping decreased CAS-10-FI scores. Controlling for STAI-6 score caused significant changes in the results. CAS-10-FI and STAI-6 correlated moderately (r = .54). These results indicate that controlling for tendency to feel anxious is important when investigating coping styles as predctors of climate anxiety. STAI-6 seems to be more relevant predictor of climate anxiety than coping styles.

These results are partly consistent with our hypothesis, that tendency to use avoidant coping predicts higher climate anxiety, and tendency to use problem-focused, and emotion-focused coping predicts lower climate anxiety. As we expected, tendency to use avoidant coping style predicted higher climate anxiety. This result is consistent with prior research on the connection between avoidant coping style and anxiety (e.g., Chan, 1995; Gomez & McLaren, 2006; Herman-Stabl et al., 1995; Seiffge-Krenke &

Klessinger, 2000; Quah et al., 2020) and an unpublished master's thesis that found avoidant coping to predict higher climate anxiety scores (Laine, 2022).

The second part of our hypothesis, that people who use more problem-focused and emotion-focused coping mechanisms report lower climate anxiety, was only partly supported. In our sample both avoidant and problem-focused coping style predicted higher climate anxiety. Nonetheless, in our sample tendency to use emotion-focused coping style predicted lower climate anxiety. This result is congruent with former research (e.g., Cooper et al., 2008; Li et al., 2012; Perez-Ordóñez et al., 2016) and partly in line with the results of an unpublished master's thesis that found problem-focused coping style to predict higher climate anxiety scores but did not find a connection between emotion-focused coping style and climate anxiety score (Laine, 2022). However, emotion-focused coping and problem-focused coping together are usually considered as adaptive coping. The ineffectiveness of problem-focused coping style could possibly be explained by the nature of climate change as a threat. Climate change is a particularly extensive threat, which cannot be solved by an individual. Thus, using emotion-focused coping may, in fact, be the most adaptive coping style. However, as scholars have previously emphasized (Ojala 2012; Pihkala, 2020), compounding emotion-focused coping and climate action is probably the best combination to reduce and prevent climate anxiety.

These findings are interesting and significant especially from a clinical point of view. Evidently, more research on the subject is needed. However, it seems that psychoeducation about emotion-focused coping could be useful to support people who experience high climate anxiety and people with multiple risk factors. As Ojala (2012) has emphasized, combining emotion-focused coping with pro-environmentalist action could potentially be the best combination for both dealing with one's emotions and participating in climate relevant action.

4.4 Strengths and Limitations

This study has few major strengths and limitations. The most significant limitation is that our sample is not representative of Finnish population. The sample is skewed with respect to age, gender, income level, education level and number of children. Therefore, little conclusions can be drawn about prevalence of climate anxiety and its associations with

gender, age, income level and having children. On the other hand, considering the investigation of the factor structure of CAS, the sample size ($n = 795$) is a strength.

In the process of investigating the factor structure of CAS-13-FI, the original two-factor structure did not replicate. However, climate anxiety (items 1–13) distinguished from the other two factors, experience of climate change and behavioural engagement. This supports the validity of the instrument. One-factor structure seems statistically reasonable and supports the possibility of using the instrument in clinical settings in the future, as only one score, climate anxiety, will be reported.

Second remarkable limitation is lack of defined cut off points for CAS, as it limits drawing conclusions about prevalence of climate anxiety and its associations with demographic factors. Since defined cut off points for low, normal, or high climate anxiety do not exist, drawing conclusions about possible pathological climate anxiety is difficult. Nonetheless, high climate anxiety appears to be rare. In our sample 27.8% of respondents got the minimum score and on average people in both our sample and prior studies (Clayton & Karazsia, 2020; Wullenkord, 2021) reported relatively low climate anxiety.

Relying on self-report can be considered a limitation of the present study. Some people are more aware of their emotions than others, and some phenomena, such as coping mechanisms, are partly unconscious. Thus, the results rely on self-awareness of the respondents. However, self-report is possibly the only way to investigate phenomena such as climate anxiety and coping style. From a clinical point of view, subjective experiences of respondents are more relevant than possible physiological measurements. Altogether, phenomena related to the subjective experiences of people, such as climate anxiety, cannot be investigated objectively.

4.5 Future Directions

The original structure of CAS-13 did not replicate in our sample, but a better structure for our sample, single factor CAS-10-FI, was found. An important part of the validation process is to investigate whether CAS-10-FI has a satisfactory fit in a larger sample that is representative of Finnish population. This is a necessary step before the instrument can be used reliably in wider research settings. A larger and representative sample is currently being collected for this purpose as a part of a larger research project (https://www.ilmastotuuppaus.fi/en/).

Wullenkord and colleagues (2021) raised a question of the content and clinical significance of CAS as a measure of climate anxiety. They discussed whether climate anxiety can be distinguished from other climate change related emotions by using CAS. They suggested the term climate-related emotional impairment to describe the measure better, since CAS focuses on cognitive-emotional and functional impairment, rather than climate change related anxiety. The criticism is justified. The items of cognitive-emotional impairment emphasize rumination, which is typically linked to depression rather than anxiety (Wullenkord et al., 2021). The items of functional impairment, on the other hand, focus on the consequences of climate change related emotions rather than the nature of climate anxiety. This affects the scores significantly and could underestimate the prevalence of climate anxiety. Wullenkord and colleagues (2021) suggest that the instrument should be modified to capture anxiety better by focusing on anxiety-related emotions, such as anxiety, fear, and worry. In prior research and the present study, climate anxiety correlated significantly with general anxiety. This supports CAS measuring anxiety, while still partly distinguishing climate anxiety from general anxiety. However, as Wullenkord and colleagues (2021) suggest, more research of CAS and its relations to general anxiety and depression instruments should be conducted to gain a further understanding of the associations of the instrument and mental health problems. In addition, we suggest that the instructions of CAS should be reconsidered. Typically, instructions of anxiety measures advise respondents to answer the items based on a determined exact time period, such as usually or in the last two weeks (See e.g., Spielberg et al., 1983; Spitzer et al., 2006). The instruction of CAS, "Please rate how often the following statements are true of you" does not define a time period and could make answering to its items difficult.

Wullenkord and colleague's (2021) criticism demonstrates a larger issue, lack of consensus of the definition of climate anxiety and how it should be measured. As was found out, on average people report low climate anxiety. However, judging from the state of climate change, people could experience milder negative emotions towards climate change without it affecting their daily functioning. In future research finding a way to distinguish climate anxiety from a milder state, climate worry, is important. Further analysis could demonstrate that climate anxiety is not a pathological phenomenon, but in fact an adaptive reaction (see Verplanken et al., 2020). This would help defining the term climate anxiety. Altogether, climate anxiety measured with CAS and its associations to

other climate related emotions and mental health problems should be investigated more, as being the only instrument that is claimed to measure climate anxiety does not necessarily mean it is the most valid way to measure climate anxiety.

Cut off points and clinically significant categories should be defined for the instrument. This is a prerequisite for clinical use of the instrument. Cut off points should be defined by combining the instrument with clinical assessment interviews and standardizing the scores. Defining cut off points could enable using CAS more reliably in future research, but also in clinical settings.

Research of climate anxiety is still scarce, and more research should be conducted globally and in Finland. Our study had a convenience sample, and more research with a larger and representative sample should, and will, be conducted to gain further and more reliable knowledge of prevalence of climate anxiety and its associations to demographic factors. This could help recognizing risk factors for high climate anxiety in the future and thus enable developing clinical support and treatment for people experiencing high climate anxiety that decreases their daily functioning. In addition, to gain a better understanding of people experiencing high climate anxiety, people with extremely high climate anxiety should be investigated, as Wullenkord and colleagues (2021) suggest. By combining CAS with questions of optimism about the future, life satisfaction, and eudaimonic happiness could provide further understanding why climate change related emotions impair some people. In this study and in prior research (Clayton & Karazsia, 2020; Wullenkord, 2021) 18 years of age was required to participate. However, as we found, climate anxiety seems to be more common in young population. Searle and Gow (2010) also found that especially young people expressed reflection of the ethical dimensions of having children because of its effects on climate change. Thus, investigating climate anxiety with a sample including 16–17-year-olds could offer an interesting comparison in the future.

The present study is to the author's best knowledge the first published study to investigate the association between climate anxiety and coping styles. As our findings demonstrated, controlling general anxiety is important when investigating the role of coping style. More research should be conducted to gain more reliable knowledge of the role of coping style when battling with a threat as universal as climate change. Should the results replicate in a larger representative sample, could psychoeducation and strengthening of emotion-

focused coping skills be a potential addition to recommended treatments for people experiencing high climate anxiety or people with multiple risk factors (Baudon & Jachens, 2021).

Altogether, the effects of climate change on mental health, including climate anxiety, should be investigated more to gain more reliable knowledge about the associates of climate anxiety. In addition, investigating the covariates of pro-environmentalism and climate action could provide new ways for psychology as a field to help mitigate climate change. Further understanding would enable providing support and help for people who experience paralyzing effects of climate change and activate people who are not motivated to change their lifestyle to mitigate climate change.

We are currently working on further research about climate anxiety in Finnish population (https://www.ilmastotuuppaus.fi/en/). A representative sample (N = 3600) of Finnish population was collected during April and May of 2022. The aim of the study is to investigate whether the structure of CAS-10-FI will be replicated in a representative sample. The prevalence of climate anxiety and its correlates will be investigated. We will also compare the prevalence of climate anxiety measured by CAS-10-FI and climate worry and investigate their association.

4.6 Conclusions

Finnish translated version of Climate Anxiety Scale, CAS-13-FI, did not have the same factor structure as the original instrument (Clayton & Karazsia, 2020) in a Finnish convenience sample. A modified, one-factored version, CAS-10-FI, had a better fit in a Finnish sample. Nonbinary people reported higher climate anxiety than both men and women, and women reported higher climate anxiety than men. Climate anxiety and age had a negative linear association. No differences between income levels or people with children and people without children on climate anxiety score were found. All coping styles explained climate anxiety scores. Emotion-focused coping decreased climate anxiety scores, while problem-focused and avoidant coping increased climate anxiety scores. More research needs to be conducted with a larger and a representative sample to gain more reliable knowledge about CAS as a measure of climate anxiety and its correlates.

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Appendices

Finnish-translated Climate Anxiety Scale (CAS-22-FI)

Translated from English into Finnish by Lingsoft, perfected by Sandman, N., Salo, P., & Tuominen, J.

Arvioi kuinka usein olette ajatelleet tai tunteneet seuraavalla tavalla.

1 = ei koskaan, 2 = harvoin, 3 = joskus, 4 = usein, 5 = lähes aina

1. Ilmastonmuutoksen ajatteleminen vaikeuttaa keskittymistäni.

2. Ilmastonmuutoksen ajatteleminen vaikeuttaa nukkumistani.

3. Näen painajaisunia ilmastonmuutoksesta.

4. Itken ilmastonmuutoksen vuoksi.

5. Ajattelen: "Miksi en pysty käsittelemään ilmastonmuutosta paremmin?"

6. Vetäydyn omiin oloihini ja mietin, miksi koen ilmastonmuutoksen tällä tavoin.

7. Kirjoitan muistiin ajatuksiani ilmastonmuutoksesta ja analysoin niitä.

8. Ajattelen: "Miksi reagoin ilmastonmuutokseen tällä tavoin."

9. Minun on vaikea pitää hauskaa perheeni tai ystävieni kanssa, koska olen huolestunut ilmastonmuutoksesta.

10. Minulla on ongelmia sovittaa yhteen ympäristöön liittyvät huoleni ja perheeni tarpeet.

11. Huoleni ilmastonmuutoksesta häiritsee työ- tai koulutehtävieni tekemistä.

12. Huoleni ilmastonmuutoksesta heikentää kykyäni työskennellä niin hyvin kuin voisin.

13. Ystävieni mielestäni ajattelen ilmastonmuutosta liikaa.

14. Ilmastonmuutos on suoraan vaikuttanut elämääni.

15. Tunnen jonkun, jonka elämään ilmastonmuutos on suoraan vaikuttanut

16. Olen huomannut muutoksia minulle tärkeässä paikassa ilmastonmuutoksen vuoksi.

17. Haluaisin käyttäytyä ympäristöystävällisemmin.

18. Harjoitan kierrätystä.

19. Sammutan valot.

20. Yritän vähentää sellaista toimintaani, joka edistää ilmastonmuutosta.

21. Tunnen syyllisyyttä, jos tuhlaan energiaa.

22. Uskon, että voin tehdä jotain ilmastonmuutoksen torjunnassa.