

forms of media, when thinking about and discussing possible future changes, or when learning about climate change in school (8; for review see 9). These diverse pathways of coming in contact with the climate threat can lead to a range of emotional reactions.

Survey studies performed in different countries also show that many people experience a high degree of worry about climate change (10–13). In this regard, scholars have written theoretical articles about climate change worry and eco-anxiety, arguing that these emotions are possible threats to mental well-being (14–16). In addition to worry and anxiety, ecological grief—the grief felt in response to the loss of beloved places, ecosystems, and species—has emerged as an important research topic (3).

Given this interest in climate change emotions and eco-emotions, empirically based discussion and synthesis are needed to understand the nature, range, and extent of these emotions, and what they indicate. For instance, are emotional responses to climate change a constructive force that leads to much needed public engagement and action? Or, rather, are these emotions connected to feelings of helplessness and perhaps even psychological ill-being? How are these emotions distributed, and who may be most vulnerable to the adverse mental health impacts associated with them? In response to these questions, we analyze and synthesize literature around key emotions, including worry, anxiety, and grief, to better understand the ways in which climate change and other environmental problems are impacting, and will continue to impact, human emotions and actions.

## Aim and Structure of the Article

This narrative review aims to summarize and discuss research about what role emotions like worry, anxiety, and grief regarding climate change and other environmental problems play in people's lives. We concentrate on both studies that have looked at relations to mental health and studies that have explored the possible constructive role of these emotions in the form of, for example, motivating engagement. We include studies from different countries, populations, and age groups.

The article is structured as follows: First, we define the emotional concepts on which the article focuses (worry, anxiety, and grief). Second, we briefly describe climate change as a problem that people experience through connections made to direct weather phenomena and changing environments, as well as through future thinking, the media and other information sources. Third, we review studies that have looked at the relation between emotional reactions to climate change and other environmental problems and subjective well-being, including research on the mental health aspects related to these problems among those especially vulnerable to a changing climate. Fourth, we examine studies about the relationships between these emotional reactions and people's sense of influence on the problem and level of engagement. Finally, we end the article by discussing key insights and practical implications. Because this is a narrative, and not a systematic, review, the main aim is not to capture every study about emotions in relation to environmental problems, but instead to focus on the key and emerging areas of research in this field to present a high-level overview and synthesis, useful to researchers, decision-makers, and the general public.

## DEFINITIONS OF FOCAL EMOTIONAL CONCEPTS

### Anxiety and Worry

Worry can be perceived as a complex emotion derived from the more rudimentary emotions of fear and anxiety (17; see also 18). According to the neuropsychologist Gray (19, 20), fear is about a direct threat to the individual, and its behavioral function is to move the person away from that threat. Fear, then, is related to the fight-or-flight defense system. Anxiety, however, facilitates

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**Climate change worry:** the worry, and accompanying stress, associated with current and predicated damage, loss, and destruction from climate change

**Eco-anxiety:** the anxiety related to current and predicated environmental damage or loss, particularly from the climate crisis

**Ecological grief:** the grief and sadness felt in response to the loss of beloved places, ecosystems, and species

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entry into possible dangerous situations (20). Anxiety—in addition to involving an emotional component—also contains cognitive aspects. This emotion is related to a more complex defense system called the behavioral inhibition system. This defense system detects anticipated threats to a future goal and through anxiety calls the cognitive system into action to decide which action is best to get rid of the threat (19, 20), which is also in accordance with the affect-as-information model (see 21). Thus, anxiety is future-oriented and related to uncertainty.

Some researchers describe a third defense system, which they call the conscious defense system, which is unique to the human species and which is related to the cognitive emotional concept of worry (18). In certain circumstances, when the lower parts of our defense system signal that something is wrong, our conscious defense system—which can make complex cognitive judgments—is activated. Through learning, this defense system also discovers new dangers (e.g., environmental problems), which are thereby incorporated in the emotional network as worry. Worry, in turn, is often defined as repetitive thinking about uncertain future negative events, accompanied by an anxiety-like negative affect (22, 23). Worry includes an even stronger cognitive component than anxiety; although containing emotional aspects, it is also a mental response to risks, and therefore could be said to be a first step in coping efforts (23, 24). These basic theories emphasize that both anxiety and worry can be normal and healthy reactions to different threats in the environment, but if there is a lack of resources to cope with them such as inner or external barriers, they can lead to less constructive outcomes.

Anxiety and worry have mostly been studied from a clinical perspective (25, 26). Therefore, it is hardly surprising that these emotions have been most often associated with negative aspects, such as low well-being and anxiety disorders. However, one early study about the subjective meaning of nonclinical worry showed that this emotion was related to constructive problem-solving and was an emotional motivator, making one alert and charged for action, but also something that prepared oneself for analytical thinking (27; see also 23). More objective studies have also shown that when trait anxiety is controlled for in statistical analyses, nonclinical worry seems to be positively related to problem-focused coping and an information-seeking cognitive style (28, 29; for a review see 23). This resonates with applied research in political psychology showing that anxiety and worry are preconditions for deliberation and critical thinking (30, 31). Through critical thinking processes, these emotions can be a first step to engaging with larger societal issues.

Other studies, however, have found that nonclinical worry facilitates adaptive behavior only when the situation is seen as controllable; when a situation is perceived as uncontrollable, worry can instead lead to stress and low well-being (27, 32). For example, Watkins (33) describes two kinds of worry: one that is constructive as described above, and one that is unconstructive and involves generalized and repetitive worry that is experienced as intrusive and uncontrollable.

## Grief

Sadness is an emotion considered to be closely related to grief. Lazarus (34) perceived sadness as the end result of irrecoverable loss of something or someone that a person highly values. Whereas sadness implies a more passive stance of acceptance, according to Lazarus, grief and grieving are more active cognitive-emotional phenomena that are also practice-based. Grief, just like worry, is not only an emotion but is also part of a coping process during which a person attempts to deal with the loss of important relationships (34, 35). In this regard, grief is related to struggle, whereas sadness is more closely related to resignation. In addition, Gross (36) points out that grief, like all other emotional phenomena, has a bodily component. Just like anxiety and worry, grief can be an adaptive process but in worst case scenarios, can also lead to negative outcomes like persistent complex bereavement disorder and depression (34, 36, 37).

## EMOTIONS IN RELATION TO CLIMATE CHANGE AND OTHER ENVIRONMENTAL PROBLEMS

### Eco-Anxiety and Climate Change Worry: Operationalizations of the Concepts

How, then, have the emotional concepts just discussed been studied in relation to climate change and other environmental problems? Worry and anxiety about these problems have been operationalized in quantitative studies as general emotional-cognitive phenomena; for example, researchers ask in questionnaires how much (or how strongly) people experience worry or anxiety concerning climate change or other environmental problems (38–41). Aggregated measures of specific worries about, for instance, one's own health, animals and nature, and future generations have also been utilized (39, 42). In addition, in some studies focusing on habitual worry, participants documented specific worries they experienced in relation to climate change and the frequency at which these worries occurred (43, 44). Thus, in all this research, worry is treated as a separate phenomenon, and thereafter relations to, for example, measures of well-being, efficacy, and engagement are investigated.

Clayton & Karazsia (45) recently created a measure of climate change anxiety that includes not only pure emotional aspects such as worry or anxiety, but also rumination and functional impairment. In addition, researchers have developed a measure of climate change distress that mixes different emotional reactions with items about negative effects on quality of life (46). Although these kinds of measures are important for understanding population-level experiences of problematic climate anxiety, it is also important not to use them as pure measures of emotions, since these measures already consist of aspects capturing low subjective well-being or other unconstructive aspects.

In this context, one must realize that measuring emotions in relation to environmental problems through quantitative scales in questionnaires, as described above, is not unproblematic. For example, if the wording is not consistent around terms—for example, “climate change” versus “global warming”—it can affect how people react to and understand the questions, and therefore their answers (47). Thus, wording questions about emotions and emotional responses related to climate change differently may potentially lead to different results.

Another way of looking at anxiety and worry in relation to environmental problems is from an existential perspective, where anxiety and worry are seen as rational, often constructive reactions to threats to important values that people embrace and as a mature way of facing one's responsibility as a human (48, 49). Ojala (50) has argued that climate change worry can be seen as a form of existential anxiety, given that this problem touches on three aspects central to this kind of anxiety (see 51): the ontic part, since it is a threat to the future survival of humanity, and for some groups a direct threat to well-being; the moral part, as it is related to moral questions about whether it is right to live the way we do in relation to nature and other humans; and the spiritual part, given that it raises questions about whether there is any point in being an active citizen at all considering the seriousness and complexity of this problem. Climate change and other environmental problems have also been perceived as related to a loss of ontological security, where there is a feeling of existential anxiety related to something being deeply wrong with the natural world and our relationship to it (52). Although existential worries are healthy reactions to perceived threats, they can be hard to cope with and potentially lead to low well-being (15, 48).

### Preconditions of Eco-Anxiety and Climate Change Worry

Many argue that high levels of worry about climate change arise from a perception that climate change threatens one's object of care (53). For some, worry about global environmental problems, including climate change, is a kind of macro worry, with moral/ethical undertones, where people

do not primarily worry about themselves and loved ones but rather think about more distant aspects such as people living in faraway countries, animals and nature, and future generations (54, 55). This kind of macro worry and thinking is most common among people with strong universal and biospheric values, that is, people who value highly global justice, peace, equality, and the well-being of nature and animals (38, 48, 56). Political orientation also seems to play a role, whereby people who self-identify as being politically left-leaning express greater levels of worry than those who identify as being right-leaning (11, 40). Thus, not only do scientific facts play a role in whether people worry, but other factors related to subjective aspects, such as values and political orientation, are also important.

What studies focusing on macro worry miss, however, is that for subgroups of people around the world, climate change and other environmental problems are direct threats to their livelihood, cultural practices, connections to nature, and sense of well-being. In these contexts, experiences of tangible damages and losses (e.g., adverse changes in weather patterns and loss of plant and animal species) can produce less visible forms of loss such as an altered sense of place and identity, and perceptions of low levels of control over important aspects in one's life (3, 6, 7). These forms of loss can, in addition to prompting strong emotional responses, give rise to various negative mental health outcomes including depression, clinical anxiety, and psychological distress (3, 57, 58).

In addition, people who at first glance do not seem to have direct contact with the catastrophic dimensions of climate change and other environmental problems can still worry about more personal issues. For example, a qualitative study with Swedish parents identified a care-worry where concern for others not close to oneself was mixed with care and worries about the future of one's children and grandchildren (59; see also 60). Another qualitative study found that refugee children living in Sweden sometimes have experiences from their former home countries that influence their worries (61). Furthermore, worries about the future effects of climate change can sometimes be related to thoughts about not having children in the future (see 15 for a review). Finally, people who work in climate change-related fields, such as climate change scientists, can feel a more personal, micro worry and stress (62).

## Ecological Grief

An emotion considered closely related to climate change worry and anxiety, as well as eco-anxiety, is ecological grief, or grief felt in response to environmental degradation and loss of species and beloved environments (3). Ecological grief takes many forms, differs based on place, culture, and geography, varies by individuals, is experienced differently over time and place, and is expressed through various emotional responses, including anger, frustration, fear, stress, distress, hopelessness, helplessness, and pre- and post-traumatic stress disorder (3, 63–65). Ecological grief is often considered a form of disenfranchised grief, or grief that is often unacknowledged publicly or reflected through socioeconomic and sociocultural structures and policies (3, 66).

Cunsolo & Ellis (3) characterize ecological grief through three overarching categories: (*a*) grief associated with physical ecological losses, including the disappearance or degradation of ecosystems, landscapes, and/or species, which can be due to acute events, such as extreme weather events or natural disasters, or in response to longer-term changes to weather patterns, landscapes, or ecosystems; (*b*) grief in response to disruptions to or erosion of environmental and place-based knowledge and identities, including loss of sense of self related to landscapes, seasonal patterns, and ecosystems; and (*c*) grief due to anticipation or expectation of future losses of ecosystems, lands, species, and related place-based culture and knowledge systems.

Ecological grief has been associated with, for example, losses of sea ice and Northern ecosystems, and related land-based cultural practices in Labrador, Canada (3–5); the degradation of

farmland and associated losses to livelihoods in the Australian Wheatbelt (3, 6); the destruction and death of the Great Barrier Reef in Australia (often called reef grief) (65); the disappearance of specific species (64, 67); the loss of wild soundscapes (68); and the destruction of property and lands caused by wildfires in the Northwest Territories, Canada (69).

In addition, Head (62) argues that in relation to climate change, people, especially in the Western world, grieve the modern self, the view of the future as containing both unlimited and positive potential, but they also grieve a stable and pristine past. Head focuses on grief as a rational response, arguing that if we are going to be able to effectively fight and adapt to climate change, we need to face and talk about our grief together with other people.

## **GLOBAL ENVIRONMENTAL PROBLEMS AS BOTH PROXIMAL AND DISTAL PHENOMENA**

### **Exposure to Extreme Weather Events**

People tend to articulate an understanding of climate change from their personal experiences with the weather (70, 71). When people experience extreme weather events that they perceive to be attributable to climate change, their level of concern or worry about climate change can become elevated (7, 71–73). Extreme weather experiences shape people's feelings about climate change through an experiential process, whereby negative emotions triggered by the harmful consequences of extreme weather events become intuitively associated with climate change, and memories of these harmful consequences simultaneously increase the psychological salience of climate risks (74). Research shows, for example, that experiences of flooding are associated with greater concern for and heightened psychological salience of climate change, which in turn predict behavioral intentions and climate change policy support (72, 75). Negative emotions about climate change, including fear, sadness, guilt, and regret, have also been found to increase following exposure to a major hurricane (76). Similar effects have also been observed among people experiencing prolonged drought in Australia (6).

In the aftermath of extreme or unusual weather events, the degree of worry people feel about climate change may be moderated by several factors. One such factor is the proximity of the extreme weather event. In a recent study, Norwegians who had been personally affected by flooding reported greater climate change concern than those who simply witnessed flooding in their local area, suggesting that direct individual experiences of extreme weather events generate stronger emotional responses to climate change than less proximate experiences (77). A second factor is ability to cope with the adverse impacts of the event. In a UK study, for example, flood victims with lower capacity to cope with flooding impacts experienced greater anxiety and distress, which were further associated with greater climate change mitigation intentions. Conversely, anxiety and distress were lower among flood victims with higher coping capacity, which seemingly weakened climate change mitigation intentions (78). Distressing emotions may also be dependent on place and cultural identity as well as living and working relationships related to the natural world (3, 69).

Finally, political affiliation and ideology predict whether or not people subjectively attribute extreme weather events to climate change (73, 79). Members of political/ideological groups that typically hold skeptical views about anthropogenic climate change, such as conservatives (80), may not necessarily feel more worried about climate change following extreme weather experiences.

### **Mediated Experiences**

Many people experience climate change and other global environmental problems indirectly, or vicariously, through media representations rather than from direct exposure (2, 14). Exposure to climate change information through the media plays an important role in determining how

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**Eco-worry:** similar to climate change worry, encompassing worry for the current and predicted ecological damage and destruction

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worried people are about climate change. For example, a recent study showed that exposure to the Intergovernmental Panel on Climate Change special report on 1.5°C global warming was associated with a significant increase in climate change concern among a national sample of Norwegians (81). The majority of participants in the study (75%) encountered the report through the traditional television and print media. In addition, other studies in a Northern European context show that young people, a group that often stands out regarding climate change concern and worry (see 16), come in contact with climate change information foremost through media but also through school (8, 61).

In many parts of the world, media coverage of climate change has risen (82, 83), and this rise appears to be correlated with an increase in public concern about climate change (84, 85). However, people tend to be more attentive to media content that supports their personal values and worldviews (86). In addition, research on media and communication has shown that people interpret and make meaning of media reports about global problems in relation to their own frames of reference and experiences (87). Furthermore, media sources often have other agendas than simply presenting accurate scientific information about climate change (88). Consequently, media exposure alone does not invariably increase worry about climate change (89).

## **NEGATIVE EMOTIONS ABOUT GLOBAL ENVIRONMENTAL PROBLEMS AND RELATIONS TO MENTAL HEALTH**

### **Worry, Anxiety, Hopelessness, and Relations to Subjective Well-Being**

How, then, do climate and eco-worry and eco-anxiety relate to psychological well-being and different aspects of mental health? Quantitative cross-sectional surveys among general populations of adults show somewhat mixed results. A UK study found no relation between worry about climate change and pathological worry (44), whereas an Australian study showed only weak associations with lower subjective well-being, general anxiety, and depression, which the authors interpreted as insignificant from a practical perspective (90). Two US studies, however, found significant relationships between measures of different kinds of mental health problems (depression and general anxiety) and climate change anxiety (45), as well as perceived ecological stress (56). The difference between these studies is that the two studies that found no meaningful relations focused on worry/anxiety only, whereas the two that did find significant associations with mental health included unconstructive/pathological aspects already in their measure of climate change anxiety/distress, such as rumination and stress. Therefore, the findings of the latter studies are rather expected. However, they show that although not many of the included people score high on the measures of more severe climate change/eco-anxiety/distress, some people do. In addition, two studies, one including substudies in many countries, found that those who scored high on measures of climate distress also had a tendency to score high on measures of general anxiety, depression, stress, and insomnia symptoms (91, 92), as well as to score low on a one-item measure of mental health (92). The climate distress scales in these studies consisted of various emotions including hopelessness and being terrified, which are rather different emotional reactions than worry (see below for a discussion about hopelessness). Finally, in a recent article, two separate studies showed significant positive relations between trait pathological worry and global warming worry; this relationship was, however, nonsignificant when controlling for worry about personal issues (43).

If we turn to children and adolescents, some scholars argue that it could be more difficult for this group to deal with climate change worry given developmental factors and the fact that young people have even less control over this issue than adults (see 16, 42). Many studies performed in different countries have found that young people have a rather dark picture of the global future, not least in relation to climate change and other global environmental problems, with dystopic

and science fiction-inspired imageries (55, 60, 93–97). However, these dark views are often not related to views of young people's own personal futures (94, 97), suggesting that climate change is still a distant macro worry for some young people. Although, recent research from the US showed that many young people do worry about the future for their own potential children, indicating a worry that is more personal (60).

Opinion articles have also been published in recent years where researchers discuss the anticipated mental health impacts of climate change on children and young people when, for example, in the future various climate change-related events will be more common for more people (16, 98–100). There are, however, limited empirical studies that have investigated the relation between worry about global environmental problems and broader aspects of psychological well-being among young people. A few quantitative studies from Europe and the United States, however, do exist and similar to studies with adults, they show mixed results. Hokka et al. (101), for example, found that young people in three European countries who were highly worried about global environmental problems were less likely to engage in risky behaviors, such as drinking alcohol and smoking, than were young people who were less worried. Antilla et al. (102) identified among young Finnish people a positive relationship between environmental worry and a high sense of coherence regarding the personal future; that is, the future was perceived as meaningful, comprehensible, and manageable. Yet, they also found a positive relation between environmental worry and a high degree of neurotic defense style. Klöckner & Beisenkamp (103) conducted a study with German children aged 9 to 14; these children experienced a variety of emotions in the face of climate change, including worry/anxiety (most common), as well as feelings of guilt. However, these feelings did not have significant associations with a measure of mental well-being. In addition, Ojala (41) performed a study with Swedish adolescents and found a significant, albeit weak, negative relationship between worry about global environmental problems and a measure of subjective well-being, including questions about, for example, how well the young people cope with life and its difficulties. Another study by the same researcher, and this time with Swedish children, showed that worry about climate change was associated with a higher tendency to experience general negative affect, which is an aspect of the subjective well-being concept (54), a result that was also found in another study with adolescents (104). In addition, worry was unrelated to a more cognitive measure of life satisfaction and was positively related to meaning in life (54). In this study, only 4% answered that their worry about climate change made them feel bad.

Also, in one of the studies mentioned above the main focus was on patterns of emotion (41). Specifically, a hierarchical cluster analysis identified two groups of adolescents who were highly worried about global environmental problems, one low on well-being and one high on well-being. The difference between the two groups was that the young people who were worried but still experienced a high degree of subjective well-being also scored significantly higher on hope, meaningfulness, and anger, compared to participants with a low degree of subjective well-being. On the basis of emotion theories, it was argued that these emotional aspects can work as buffers hindering worry from turning into low well-being. More empirical studies are needed to confirm this, however.

How then can these mixed results from the few quantitative studies that have looked at the relation between environmental/climate worry and well-being in children and young people, but also adults, be interpreted? Looking first at a high degree of meaning in life, this aspect is often closely related to being engaged in the surrounding world (see, for example, 105), which could also lead to an awareness of different societal problems, such as global environmental problems, and therefore also lead to more worry. Some research concerning worry about nuclear war also showed that those who worried the most had more positive life experiences (106). The argument was that young people who do not have more acute things to fear in everyday life have more energy left



to worry about a distant problem like nuclear war. Perhaps this argument is also true to a certain extent regarding worry about climate change among people living in places that are not directly affected by weather-related catastrophes; that is, climate worry in this case is a macro worry.

That worry about more specific threats like climate change and other environmental problems is related to more general measures of anxiety/worry is not surprising, given that these measures share a common thing, namely negative affect. Because the studies reviewed are cross-sectional, there is no possibility of capturing casual relations and, therefore, it could be that no such relation exists but rather that there is a third factor, such as general negative affect due to personality factors, that explains most of the associations found (see 43). These kinds of positive associations were also found with regards to worry about nuclear war; that is, kids who were worried in general also worried about nuclear war (107). The results are less consistent regarding associations between worry and cognitive measures of well-being. Moreover, it is important to note that the studies with young people are rather old, and that the climate change threat has become more acute during recent years, which can influence the relation between worry and well-being.

Finally, some studies focus on a concept that often gets mixed up with worry/anxiety: hopelessness. Hopelessness stops people from engaging constructively with climate change (108) and can increase the likelihood of negative impacts on mental health. In one of the studies with children, hopelessness concerning climate change was in opposition to worry, clearly related to all aspects of low subjective well-being (54). Again, the direction in which the causal relation goes cannot be stated, but this shows that hopelessness and worry need to be separated in a clearer way. Importantly, hopelessness must also be distinguished from a pessimistic outlook on climate change. Research shows that pessimistic anticipation of the future promotes proenvironmental behavior (109), a constructive response to climate change, which in turn is associated with increased life satisfaction and subjective well-being (for a review, see 110).

### **Populations With Amplified Mental Health Impacts**

Most of the studies reviewed above are quantitative and were performed in European, Northern American, or Australian contexts. In addition, although associations between worry/anxiety in the general public have been studied, interesting and important subgroups of people who may be more vulnerable to climate change have not been included as specific and in-depth populations of analysis. This is unfortunate, as the mental health impacts of climate change are and will continue to be unequally distributed globally, and those anticipated to feel these impacts first and foremost include people living in ecologically sensitive areas; resource-dependent populations such as farmers, fishers, and many Indigenous Peoples; people with pre-existing health conditions and stressors; and people with limited resources to respond to change (3, 111). Historically, these most sensitive populations have not been well represented in global climate change discourse; however, over the past decade there has been growing research focusing explicitly on these groups and the distinct mental health challenges they face. Examples from global research include long-term and episodic drought linked to poor mental health outcomes and solastalgia among Indigenous Peoples in rural Australia (6); sea ice loss and altered Arctic and Subarctic landscapes being felt as grief and mourning among Inuit (3–5, 100); suicide associated with crop-damaging temperatures and economic hardship among farmers in India (112); and flooding and displacement of coastal Iñupiat communities in Northwest Alaska causing stress, fear, and anxiety related to safety, security, and rapid cultural changes (113).

The majority of empirical research that has explicitly focused on mental health and climate and ecological change among the most sensitive populations has been conducted at a community or local level often using qualitative methods (7, 111). Much of this work has come from Indigenous



populations in high-income countries such as Canada, Australia, and the United States; however, there is growing global representation in the research of populations from low- and middle-income countries, such as India (112), Tuvalu (114), South Africa (115), and parts of China (e.g., 116), for example. These studies have linked acute and extreme weather events and trends such as temperature, humidity, drought, and flooding, with a range of psychological and behavioral outcomes, including post-traumatic stress disorder (e.g., 117, 118), depression (e.g., 117, 118), and suicidality and self-harm (119, 120). Moreover, a large amount of literature has documented how multiple environmental conditions come together to broadly impact mental health in the form of emotional distress (e.g., 4, 5); challenges to identity and self-esteem (e.g., 4); fear and anxiety for individuals and their loved ones about future climates (e.g., 121); the altering and/or severing of connections to valued places that support well-being, livelihoods, culture, social structures, and identity (4, 5, 7, 71); and concern that, over time, repeated emotional and ontological stresses may be precursors to mental illness, suicidality, substance abuse, and reduced psychological resilience (4). Importantly, there is evidence that distress caused by both lived and anticipatory threats of climate change is already impairing people's day-to-day functioning, such as with residents of the island nation of Tuvalu, who face displacement among many other inequitable harms (111, 114).

Another common pathway through which mental health, loss and damage, and climate are connected in the literature is through the intersection of food systems and environmental change (121). For example, loss of wildlife and livestock illustrates both intangible emotional and tangible economic losses related to a deteriorating environment (7, 121). Furthermore, human mobility is a growing concern, including, for example, displacement due to flooding in low-lying coastal areas (e.g., 113) and migration due to the loss of livelihoods from desertification in more arid and semiarid regions of the world (7, 122, 123). Human mobility is a major mental health stressor in and of itself; it has been linked with higher rates of mental illness and substance abuse (124), in conjunction with the loss of critical social and cultural support systems (122). These situations can be further exacerbated for many Indigenous Peoples and historically marginalized communities globally, where climate change is resurfacing past traumas, such as forced relocation, residential schools, systemic cultural erosion, and ongoing colonization (e.g., 4). Experiences of historical harms and disempowerment can heighten feelings of helplessness and deep anxiety about future climates and livelihoods (e.g., 4, 121).

Mental health stressors also vary by gender and age. For example, women, children, and the elderly are identified in the global literature as particularly vulnerable to climate-sensitive mental health outcomes, such as suicide and depression (7). Indeed, several articles speak to the importance of working with youth on the climate crisis. Interestingly, Inuit youth, for example, not only expressed concern for their own futures, but also for how changes in climate and place may be felt even more so among Elders and seniors within their communities (100); additionally, Sami young people in Sweden worried a lot about how the reindeer, on which their way of living depends, would cope with a warmer climate and changing environmental conditions (125). The impact on mental health of these concerns and worries, however, is somewhat unclear.

## **NEGATIVE EMOTIONS AS MOTIVATIONAL FORCES**

### **Worry and Efficacy Concerning Global Problems**

That experiences and acknowledgment of the risk posed by climate change and other environmental problems can generate negative emotions, such as worry, not only is a potential threat to mental health, but these same emotions may also constitute a source of motivation for pro-environmental actions that help protect the environment. Negative emotions have been described as the wellspring of human action (74). People generally tend to take precautions against risks

that invoke worry or anxiety. However, to engage in any specific course of action, people need to believe that their action(s) will effectively deliver the desired outcome (i.e., mitigate the risk). Several influential theoretical paradigms within psychology such as Bandura's (126) social cognitive theory and Lazarus & Folkman's (127) theory of stress, appraisal, and coping suggest that efficacy beliefs function as a buffer against emotional responses in the face of a threatening or stressful situation. In other words, efficacy beliefs are understood to enable people to respond adaptively to stressors by attenuating their emotional responses. From this perspective, one would expect efficacy beliefs to be inversely related to negative emotions.

However, this expectation has not been borne out in the context of climate change. Several studies have found moderately large positive correlations between climate change concern and efficacy beliefs among adults (128–130), implying that people who feel threatened by climate change also feel more efficacious about their ability to tackle the issue. Similar observations among young people have also been reported whereby young people with negative views of the global future also express strong beliefs that they can influence the climate problem and make changes for a better future (94; for a review see 54). Furthermore, a Swedish study discovered that children who were worried about climate change also had a tendency to feel that they could influence this problem if they wanted (the correlation was moderately strong), a result that is in line with the studies on adults (54). This result is also backed up by a study with adolescents (41) and one with children and adolescents (131), although the focus in the latter case was on risk perception and locus of control. Taber & Taylor (132) in turn showed that teaching about climate change among middle-school children increased their concern about this problem, but also their sense that this problem can be prevented.

According to Hornsey et al. (133), climate change threat perception may be causally related to efficacy beliefs by a process of motivated control. They suggested that heightened efficacy beliefs can result from perceived threat as a part of a motivated coping attempt whereby acknowledgment of the threat posed by climate change also operates as a motive to believe that the threat can be mitigated. In other words, people do not simply cave in the face of the threat posed by climate change. Rather, they demonstrate an innate motivation to restore control over the threat, and this manifests as heightened efficacy or control beliefs that may not necessarily be founded on an objectively rational basis. Although the studies included in the article did not explicitly test the effect of worry on efficacy beliefs, worry represents an affective dimension of climate change risk perception (134), and the studies therefore provide important insights into how climate change worry can indirectly influence individuals' responses to climate change by shaping their efficacy beliefs.

Another possible explanation is based in the theories described earlier about basic worry/anxiety (18–20). These emotions are part of ancient defense systems, and they can motivate people to focus on the threat at hand, talk with others about it, and search for information about the problem and how to deal with it, all of which could result in more worried people also getting more information about what they can do about climate change, and thereby increasing their sense of efficacy (see 48 for a review). In this case, worry and anxiety come first and motivate information-seeking, which then increases the feeling of being able to influence. Research showing that worry about climate change is positively related to information-seeking supports this explanation (44, 135). Yet another alternative explanation, based in existential theories, is that it is people who are high on efficacy that have the strength to take on responsibility for global environmental problems, and taking on responsibility is always to some extent related to worry/anxiety (see 48).

### **Worry and Associations to Proenvironmental and Climate Friendly Actions**

If, as shown above, worry about climate change and other global environmental problems is positively associated with a sense that one can influence these problems, it is reasonable to speculate

that worry also can have an indirect or direct relation to engagement around these problems. Studies with adults from different age groups and from different time periods consistently show that worry about these threats is positively related to private-sphere proenvironmental and/or climate friendly behavior and behavior intentions (38, 78, 136–141). In addition, some recent studies relate climate change worry to climate policy support (see 38, 39, 142). Qualitative studies have also found that some people in a subjective sense see their worry about climate change and other environmental problems as a driving force for engagement (59, 143). Even though these studies are cross-sectional, the results are interpreted as if worry motivates behavior. However, there could be other explanations; for example, people who are more knowledgeable about climate change and other environmental problems could both worry about them and know what to do about them. Interestingly, a recent study about climate change anxiety, which did not only capture pure emotions but also negative mental health aspects like rumination in the measure of anxiety, did not find any relation to proenvironmental behavior (45).

Studies about young people and the relation between worry and private-sphere environmental behavior are fewer, and also older, than the studies with adults. Klöckner & Beisenkamp (144) as well as Ojala (54) showed that worry about climate change in groups of German and Swedish children in late childhood was positively related to environmentally friendly behavior. In Taber & Taylor's (132) qualitative study, worry about climate change increased after a course about this issue among 11- to 12-year-olds. However, given that the feeling that one could influence the situation also increased, these aspects, together with better knowledge of the climate problem, seemed to lead to a high motivation to contribute to an improvement of the climate problem. In addition, a Finnish study found that teenagers who were very worried about environmental problems also felt a greater environmental responsibility and behaved in a more environmentally friendly manner (e.g., they were careful not to litter) (101). A more recent study with middle-school students in the United States also found a positive relation between concern about climate change and engagement, whereas the association between engagement and despair was the opposite (145).

To summarize, worry in these studies seems to represent a commitment to environmental issues and climate change. Worry, in most cases, has a direct effect on engagement; that is, a high degree of self-efficacy, or collective efficacy, is not always needed for behaving proenvironmentally. If we look at basic research about worry, three explanations for the positive association between worry and motivation for action are emphasized: Worry signals that something is wrong and therefore motivates people to deal with the problem; worry makes people focus on the problem causing the worry, and the stressor is therefore at the fore of people's mind and gives regular cues to action; and worry is unpleasant and therefore people are motivated to get rid of the problem through problem-focused coping and actions, which, as a side effect, are thought to reduce one's worry (23).

## Emotions and Collective Engagement

Recently, many organizations and networks focusing on fighting climate change and other environmental problems have emerged, not least among young people. Some research has concentrated on emotions as a driving force for this kind of collective engagement. For example, young adults engaged in environmental and global justice organizations in Sweden argued that worry played an important part in their engagement, making them aware of injustices in relation to these problems and providing motivation to keep up their engagement (143). However, two types of worry were a constant source of psychological struggle, namely worry related to guilt about not doing enough and worry related to feelings of helplessness and hopelessness when confronting these complex problems. Here, different sources of hope played an important role in helping the young to face and transform their worry into action. Another qualitative study also identified an interaction of, in this case, fear and hope in motivating and sustaining climate-activist

engagement (146). However, this emotion mix was more prominent among activists from the Global North, whereas activists from the Global South instead expressed an emotional pattern consisting of fear, guilt, and anger. This indicates that cultural and/or structural differences could be factors influencing emotional involvement with regard to climate change.

Another important aspect in this context is that collective engagement seems to be related to many positive aspects, such as getting social support, and thereby can prevent worry and anxiety from turning into low well-being (143, 147). This could perhaps be especially true for people who live in places where mental health impacts from climate and environmental changes are amplified (7, 147). For example, Inuit-led research and programming, including environmental health monitoring (148) and land-based programming (149), are key ways in which Inuit across Canada are taking action in understanding their changing environment and health, and creating valuable spaces for Inuit to discuss and have a sense of self-efficacy in changes happening around them.

## DISCUSSION AND CONCLUSIONS

### Key Findings

In this article, we have focused on research about emotional reactions such as worry, anxiety, hopelessness, and grief in relation to environmental problems, particularly climate change. Many studies show that these emotions are quite common among people around the world, but fewer have explored in a more evolved way what they stand for. First, we reviewed studies that looked at the relation between these emotional reactions and subjective well-being and mental health aspects. In this regard, there are two strands of research: first, larger, often cross-sectional quantitative survey studies with different age groups that focus on worry, sometimes anxiety, and distress about these problems, and these were mostly performed in Northern Europe, North America, and Australia. These studies reveal a somewhat mixed pattern, as there sometimes exist statistically significant relations between negative emotions about these problems and different aspects of low psychological well-being, especially regarding measures that focus on general negative emotions or clinical anxiety. Additionally, sometimes there exist no relations, and in other cases, a high degree of worry is related to positive aspects such as a high degree of felt meaningfulness. However, the cross-sectional designs of the studies preclude drawing any conclusions regarding causality. Looking at those studies that found significant relations between climate worry/anxiety/distress and low well-being, three explanations are possible: (a) Negative emotions about environmental problems could lead to low well-being; (b) low general psychological well-being to a certain extent causes negative environmental emotions; (c) or there is no casual relation at all, but rather a third factor, for example a general tendency to experience negative affect due to personality factors, causes both environmental/climate worry/anxiety/distress and low psychological well-being.

Also important is that these studies rely on self-reports and should not be seen as proof of mental health problems in a clinical sense among the persons scoring low on the measures of well-being or high on measures of general negative emotions. The focus in these studies is rather on subjective well-being. Some of the reviewed studies included less constructive aspects, for example rumination and functional impairment, already in the measures of climate change anxiety or distress. They show that these more unconstructive reactions to climate change are present among some people, although it is not especially common. Interestingly, the studies that focus on hopelessness concerning climate change more consistently find associations to lower subjective well-being than studies focusing on worry, although they are not very many of them.

The second strand of research reviewed is about groups of people who are especially vulnerable to negative effects from weather-related phenomenon and eco-catastrophes. This research is

often based on smaller, more in-depth, qualitative studies with clearly defined groups of people, such as Indigenous Peoples (e.g., 4, 5, 71), farmers (e.g., 6, 123), and those living in low-lying island nations (e.g., 114). Although these studies have provided important and foundational information in understanding mental and emotional impacts related to environmental change and demonstrate a broad range of climate and eco-emotions—including worry, anxiety, and grief—through place-specific understandings of impacts and responses, further research is required to conduct in-depth qualitative case studies with diverse populations to globally understand the ways in which geographic location, systems of power and privilege, and systemic racism and marginalization intersect with mental and emotional outcomes.

We also reviewed research that has explored potential positive aspects related to worry about climate change and other environmental problems, such as engagement concerning these problems. These studies show more consistent results where worry is associated with a sense that you can influence the problems, and with different kinds of engagement, ranging from small things people do in everyday life, to policy support and collective engagement. Although the results are often interpreted as though worry is a motivating force that drives engagement, again, due to the design of most of these studies, questions about causality cannot be answered in an empirical sense.

## Practical Implications

Since this review indicates that worry and other negative emotions concerning global environmental problems can be both constructive and less constructive reactions, one could argue that perhaps one should not focus that much on the emotions themselves, but rather on how people deal and cope with their emotions (42, 56, 150). For example, Ojala and colleagues (42, 104) found that young people actively cope with climate change, and these coping strategies are differently related to well-being and engagement. The most constructive coping strategy from a well-being and engagement perspective seems to be meaning-focused coping consisting of trust in different societal actors and a capability to switch perspective between worry and hope. Meaning-focused coping has also been found in the broader coping literature to be a constructive way to deal with stressors (see 151).

How then, can one best promote constructive coping with climate change and other environmental problems from both an engagement and well-being perspective? Research shows that for worry to lead to adaptive behavior, people need to perceive the situation as at least somewhat controllable (27, 32). One way is to put words to one's worries and talk about these feelings. This is a first step to get some control over one's emotions. In this regard, it is interesting that there are now different research and community projects that focus on climate change communication among diverse groups of people, for example Britain Talks Climate. Talking about emotions together with other people can also create a shared meaning around these problems, and studies among young people show that to talk about one's worry is a way to deal constructively with this emotion (for a review, see 9).

Another way to promote constructive coping is to help people find ways to deal with the stressors causing the negative emotions (23). In this regard, it is important to give information about different things that people can do in everyday life concerning living in a proenvironmental way, but also regarding policy support and putting demands on politicians and other more powerful actors to promote and support a transformation to a more sustainable society. Studies indicate that even small things people do in everyday life concerning these problems can lead to a higher degree of well-being (for a review, see 110).

However, to focus on only individualized problem-focused coping, where people concentrate on things that they as individuals can do in everyday life, can be too burdensome given that no

one can solve environmental problems alone. Researchers argue that individual coping needs to be addressed in the context of community resilience (150, 152). To increase feelings of control and efficacy, participatory approaches where people of all age groups together can help communities to deal with environmental problems seem to be especially valuable (9, 147, 148). As has been touched upon in this review, going together and doing something collectively in different kinds of organizations can also be a way to increase well-being and to create constructive forms of hope (143, 148). In addition, as already mentioned, studies with young people have found that to have trust that different societal actors will do their part in the fight against the climate threat is a part of meaning-focused coping and as such is related to both well-being and engagement (42, 104). Perhaps this is because it is easier to feel that it is worthwhile to do something oneself if one trusts that others are also doing their best. This form of coping can be promoted among young people, for example, by inviting different actors who work with these problems to schools, such as climate change scientists and politicians. Participatory processes are also well-known for increasing trust.

In addition to promoting coping at an individual and community level, there is also a need to support more vulnerable groups, with pre-existing health conditions, other stressors, and limited resources, through structural and material/economic interventions (7). The ecological crisis is rooted in social injustices, and to fight both the crisis as such and related mental health issues these injustices need to be confronted and dealt with.

## Future Studies

Although this review shows that some studies do exist about the emotional dimension of climate change and other environmental problems, the need for more studies is urgent, as climate change impacts on emotions and mental health are widespread, profound, and cumulative (14). There is a need for longitudinal studies to identify population-level impacts, causal factors, and moderating and mediating factors. Furthermore, qualitative studies that explore these associations in-depth can shed more light on the ways in which climate change and other environmental problems impact diverse peoples and places differently. Further studies with young people, and more quantitative studies with people living in other parts of the world than Northern Europe, Northern America, and Australia, are also needed (see 92 for an exception). In these survey studies, it is also important to look in-depth at subgroups in order to identify groups that are especially vulnerable, for example. In addition, intervention studies about how to best promote constructive coping and identify locally appropriate and culturally relevant mental health supports are crucial.

Finally, there is also a need to communicate the results of the studies that do exist in a better way to actors outside the social-science community. There is considerable interest in this topic among different societal actors, and it is important to go beyond a lay understanding of emotions when discussing eco-anxiety, climate change worry, and ecological grief, and to base these deliberations in the research and the many studies about basic emotions that have been conducted. This is particularly important when implementing different programs to help people deal constructively with their negative emotions about the ecological crisis.

## SUMMARY POINTS

1. Studies show that a significant number of people around the world worry about climate change, but there are still rather few studies that focus on getting an in-depth understanding of what role emotions such as worry, anxiety, and grief in relation to climate change and other environmental problems play in people's everyday lives.

2. Cross-sectional quantitative survey studies with different age groups that focus on worry—sometimes anxiety—about these problems, mostly performed in Northern Europe, North America, and Australia, reveal mixed results: Sometimes these emotions are related to lower general well-being; sometimes there are no associations; or, in some few cases, these emotions are instead related to a high degree of meaning in life.
3. Qualitative in-depth studies with groups of people who are especially vulnerable to negative effects from a changing climate and weather-related phenomena reveal a pattern of more profound negative emotions, such as anxiety and grief, and more acute implications for general mental health.
4. Research that has explored potential positive aspects related to worry about climate change and other environmental problems, such as environmental engagement, shows more consistent results where worry is associated with a sense that you can influence the problems, and with different kinds of engagement, ranging from small things people do in everyday life, to policy support and collective engagement.
5. Although the studies are few, there seem to exist constructive coping strategies to deal with these problems, such as meaning-focused coping, that potentially can help people to do something constructive with their worry and prevent it from turning into low well-being.
6. In addition, participatory approaches as well as place-based and culturally relevant strategies can help people cope with these emotions.

## FUTURE ISSUES

1. More studies performed in countries besides those in Northern Europe, North America, and Australia, including longitudinal studies, are needed to identify population-level impacts, causal factors, and moderating and mediating factors regarding worry about climate change and other environmental problems and the relation to general well-being.
2. Many researchers have written opinion pieces about children and young people potentially being particularly sensitive with regard to climate change worry and anxiety, but fewer empirical studies have been conducted and therefore more research studies with this group are needed.
3. Intervention studies about how to best promote constructive coping and identify locally appropriate and culturally relevant mental health support are crucial, especially for those more vulnerable to negative effects from a changing climate and weather-related phenomena.
4. Different societal actors are considerably interested in this topic, and it is important to go beyond a lay understanding of emotions when discussing eco-anxiety, climate change worry, and ecological grief and to base these deliberations on the research that does exist; this will require better ways of communicating information about these research studies to the public.