

Coping with the climate crisis

How to address climate emotions to galvanize sustainability transformations

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Abstract

Effectively coping with climate emotions has untapped potential to galvanize sustainability transformations. This thesis investigates how individuals cope effectively with climate change, and how to upscale coping for sustainability. First, I used a systematic literature review to define effective coping: coping that ensures emotional wellbeing and climate engagement, encompassing meaning-focused approaches. Next, I used a systematic document review to compare literature to a case study, BeChange, that helps people reduce their emissions and cope with climate emotions. BeChange applied both meaning- and problem-focused coping and demonstrated improved emotional wellbeing and pro-environmental behavior in selfreport surveys. Finally, the results from the two reviews were situated in the three spheres of transformation framework to explore the potential for upscaling effective coping, suggesting that effective coping can contribute to sustainability transformations across scales. Actors working towards sustainability, like social innovations, educators, and social movements, can target effective coping to increase sustainability.

Keywords: climate change, climate psychology, wellbeing, pro-environmental behavior, coping theory, three spheres of transformation framework.

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1 Introduction

The climate crisis is considered the defining challenge of our time (United Nations, n.d.), and limiting its impacts require vast changes in how we interact with the world. Climate crisis here refers to both changes in the physical world caused by human activity, such as global atmospheric warming, biodiversity loss and ocean acidification, and its impacts on humans, such as changes in food and water security, health, displacement and migration, and conflicts, as defined by the Intergovernmental Panel on Climate Change (IPCC) (IPCC, 2018, 2022a). According to current predictions, existing climate action is not enough to limit disastrous and deadly climate impacts (IPCC, 2022a, 2022b). To limit global warming to 1.5 degrees Celsius, we need to implement sustainable solutions across all levels of society. Sustainability is “a dynamic process that guarantees the persistence of natural and human systems in an equitable manner” and thus necessary for climate solutions (IPCC, 2018).

Implementing sustainability to achieve 1.5 degrees requires transformational changes to human life. Transformations are understood as “physical and/or qualitative changes in form, structure, and meaning-making” (O’Brien & Sygna, 2013, p.1) or as “the altering of fundamental attributes of a system” (IPCC, 2018). These attributes include technological innovations (form), political regimes (structure), and values (meaning-making). Transformation can thus be viewed as a psycho-social process that involves “the unleashing of human potential to commit, care and effect change for a better life” (O’Brien & Sygna, 2013, p.1). The transformations needed to avert the climate crisis must foster sustainability to ensure equitable and sufficient climate solutions, as claimed by the United Nations’ Sustainable Development Goals (United Nations, 2020). Therefore, fundamental changes in form, structure, and meaning-making must ensure, enable, and maintain sustainability.

Sustainability has largely been approached with focus on changes in forms and structures, without focus on meaning-making and emotional engagement although this also holds potential to create sustainability transformations (Leiserowitz, 2006; Hulme, 2011; Robinson, 2019; Wamsler et al., 2020; Davidson & Kecinski, 2021; Nielsen et al., 2021a; Woiwode et al, 2021; Wong-Parodi & Feygina, 2021). This thesis explores the knowledge gap in how to achieve sustainability transformations through coping with climate emotions. Specifically, I explore what I termed effective coping with climate emotions, which is coping that ensures emotional wellbeing and pro-environmental behavior (see section 2.1). Coping refers to the dynamic cognitive and behavioral efforts applied to respond to psychological stress (Lazarus & Folkman, 1984). Emotional wellbeing is understood as the presence of positive emotions, such as fulfillment and quality of life, as well as the absence of negative emotions

(IPCC, 2018). Pro-environmental behavior “promotes the quality of the natural environment” (Vandenbos, 2006; Krajhanzl, 2010), such as the use of low-emission transportation, engagement in climate politics, or participation in climate movements. In exploring effective coping, a case study exemplifies how effective coping can be applied in practice. For this, I explored the programs hosted by the social innovation BeChange which help people cope with climate emotions to live more sustainably.

1.1 Thesis aim and research questions

The **aim** of this thesis is threefold: 1) investigate how to cope effectively with climate emotions, and the potential this holds to improve emotional wellbeing and pro-environmental behavior, 2) explore what effective coping might look like in practice, and 3) consider the potential of effective coping to galvanize sustainability transformations across scales.

The overarching **purpose** of this thesis is to answer the question: In what ways can addressing climate emotions galvanize sustainability transformations? To do so, the following research questions (RQs) are posed to bridge the knowledge gap between coping research and sustainability science:

RQ1: What do previous studies suggest for coping effectively with climate emotions?

RQ2: How does the climate emotion program BeChange align with research recommendations for supporting effective climate coping and engagement?

RQ3: Why is effective coping with climate emotions important to achieve sustainability transformations?

1.2 Contribution to sustainability science

Through investigating climate emotions and coping, this thesis applies an interdisciplinary perspective by combining sustainability with psychology with to advance the field of sustainability science. In the last two decades, researchers are beginning to recognize the psychological impacts of climate change (e.g., Clayton, 2020; Pihkala, 2020a), and how people cope with the climate crisis has repercussions for emotional wellbeing and their capacity to engage with the crisis (Homburg & Stolberg, 2006; Homburg et al., 2007; Ojala, 2012a; Andrews, 2019, p. 72). This psychological aspect has recently been recognized as a possible missing link in engaging people with climate change because of its impacts on behavior and engagement (Brosch, 2021; Nielsen et al., 2021a). Because climate emotions influence people’s behavior and engagement, sustainability might be improved if people who contribute most

to the climate crisis, such as the richest percentiles of the global population, learn to cope effectively with their climate emotions (Nielson et al., 2021a).

Research suggests that it is not people's lack of concern that makes them fail to engage with the climate crisis (Andersson et al., 2019, p. 11). Rather, people fail to respond because the crisis brings a wave of negative emotions – worry, fear, guilt, shame, grief, anger – and people are unable to cope effectively with them (Norgaard, 2006; Clayton, 2020; Brosch, 2021). Thus, people who seem unconcerned about climate change might in fact deny or avoid the topic because they are unable to cope. Further, people who engage with climate change also need to cope effectively to sustain their engagement and avoid developing harmful psychological patterns or burn-out. A recent study found that approximately 60% people aged 16-25 globally feel very or extremely worried, and 84% at least moderately worried, about the climate crisis (Hickman et al., 2021). This is supported by studies on various age groups (e.g., American Psychological Association, 2019; Leiserowitz et al., 2020).

This thesis goes on to discuss how effective coping with climate emotions can have implications across scales from personal to societal, and thus speed up the process of sustainability transformations. The findings on how coping impacts emotional wellbeing and pro-environmental behavior on the individual level are scaled up by applying the theoretical framework of *three spheres of transformation*. This suggests that effective coping has powerful potentials to generate transformational changes and open possibilities for high-impact climate solutions. Therefore, the topic of climate emotions and how to effectively cope with them can contribute to sustainability science by providing people with tools that can have an immense effect on our collective response to the climate crisis.

1.3 Thesis outline

Following this introduction to the topic, the second chapter of this thesis expands on pre-existing knowledge, especially regarding climate emotions, the case study, and different views on where to focus sustainability efforts. The third chapter introduces frameworks and theories, namely coping theory and the three spheres of transformation framework. This chapter also situates the case study chosen to answer RQ2. The fourth chapter describes the methodologies used in this. The fifth chapter presents the results of my research, which are discussed in the sixth chapter. Lastly, the seventh chapter offers some concluding remarks.

2. State of the art

2.1 Climate emotions

The psychological impacts of the climate crisis are increasingly recognized, also regarding people who experience climate change indirectly, for example through learning about it in school or consuming climate-related media (Clayton, 2020; Pihkala, 2020a; Ojala et al., 2021). This coincides with the development of climate psychology, a field which among other things studies the role of emotions in climate change (Hoggett, 2019, p. 8-10). The climate crisis is considered a psycho-social crisis; it can be examined by the private experience of individuals situated in their social context (O'Brien & Sygna, 2013; Hoggett, 2019, p. 10-11).

Here, emotional aspects are understood as the 'affective' dimension of the climate crisis, and includes feelings, emotions, affects, and moods (Pihkala, 2022a) – "any experience of feeling or emotions" (Vandenbos, 2006). In this thesis, the concept of emotion is used to encompass all affective dimensions of climate change, as is common in research (Pihkala, 2022a). Emotions are considered 'positive' or 'negative', which has no normative connotations – emotions are not inherently good or bad. Rather, 'positive' and 'negative' distinguishes between the self-reported pleasantness of experience (Vandenbos, 2006): A positive emotion can be the relief one feels when a threat has been avoided, while negative emotions include the fear one feels in anticipating a threat.

Emotions are believed to be anchored in values – the social, moral, or aesthetic principles that individually or collectively guide judgements of goodness, worthiness, and importance (e.g. Deonna & Teroni 2015, p. 155-173; Brosch & Steg, 2021; Davidson & Kiecinski, 2021). For example, anger can be a result of an experience that contradicts one's values, such as injustice or carelessness. Climate emotions are reflections of the value one holds regarding the environment (Pihkala, 2022a) – to quote psychology professor and author Stephen Hayes, "we hurt where we care" (2019 [Abstract]).

Having emotional responses to the climate crisis is considered rational (e.g., Ojala, 2007, 2012c; Clayton & Karaszia, 2020), and climate emotions are thus recognized as a widespread phenomenon, as stated in section 1.2. Anyone who knows about the climate crisis is expected to experience climate emotions (Clayton, 2020). Studies suggest that particularly vulnerable groups to experiencing climate emotions include children and young people, indigenous and marginalized people, resourcedependent populations, people with preexisting anxieties, and people who confront climate change regularly, like climate scientists and activists (Ojala, 2012a, 2012c; Clayton et al., 2017; Minor et al., 2019; Randall &

Hoggett, 2019, p. 240; Clayton, 2020; Godden et al., 2021; Ojala et al, 2021). Research on these vulnerable groups has often taken climate change education and communication into account, for example regarding children, young people, and activists (Ojala, 2015, 2016, 2017, 2019; Pihkala, 2017, 2020b; Stern, 2021).

Research has found that about 65% of people care about the climate crisis, but only a small percentage talk and act upon this publicly (Leiserowitz et al., 2020; Tyson & Kennedy, 2020). When so many people react emotionally to climate change, it seems wrong to assume that people do not care about the climate crisis. Instead, the focus should be on why we have been unable to act on climate change despite that people care (Andersson et al., 2019, p. 11).

Since climate emotions are widespread, effective coping can play a role in solving the climate crisis because of its prevalence and impact on pro-environmental behavior and emotional wellbeing. Climate emotions are linked to behavioral reactions and mental health (Brosch, 2021; Pihkala, 2022a), so how people manage their climate emotions influences their level of climate engagement and wellbeing. This connection makes it important to learn how to cope effectively with climate emotions to increase wellbeing and pro-environmental behavior.

2.2 The case study

Generally, populations of high socioeconomic status are found to contribute disproportionately to climate change (Nielsen et al., 2021b). While a variety of changes are required to secure sustainability (see section 2.3), unsustainable lifestyles are also considered an impediment to limit climate change, since lifestyle consumption contributes to two-thirds of global emissions (Gore, 2015; Capstick et al., 2020). Lifestyle consumption is partly determined by wealth and income (Nielsen et al., 2020b), for example, Capstick et al (2020) found that the world's richest 10% must consume 10 times less resources by 2030 in order to limit climate change to 1,5 degrees global warming.

Effective coping might thus be especially important in richer populations, and I will therefore compliment the systematic literature review with a case study from Sweden, one of the richest countries in the world. Sweden fronts itself as a sustainable country and has published ambitious goals to limit climate change to 1.5 degrees (e.g., Government Offices of Sweden, 2020). The Swedish population is found to worry about the climate crisis as discussed in section 1.2 (Ungdomsbarometern, 2020; Martinsson & Andersson, 2022). Increasingly, there are Swedish social innovations that aim to help individuals, businesses, and organizations become more sustainable, and some of these

innovations incorporate climate emotions into their methods for change, such as Terra-Pi, ClimateCope, KlimatVardag,, and Det Goda Livet. This offers empirical data on effective coping from sources outside of academia.

For my case study, I selected the Swedish social innovation called BeChange, because of their success in adapting climate emotions into their program methods. BeChange was funded after ecologist Stina Sundquist and mental coach Ann Murugan combined their expertise in 2015 to make programs that encourage sustainability in individuals (BeChange, n.d.b). BeChange is an educational concept that assists people and organizations to embrace sustainability on their own terms. Their mission is to contribute to sustainability transformations through people's willingness to commit and contribute in ways that ensure emotional wellbeing (BeChange, n.d.b). To do so, BeChange offers programs that target the physical and the mental aspects of the climate crisis (BeChange, n.d.a). This involves lectures, mental coaching, group activities, and more, for adults living in Sweden (see section 4.2.2). To date, BeChange has hosted four programs for individuals: in Luleå in 2016/2017, in Norrbotten in 2018, in Eskilstuna in 2019, and in Stockholm in 2019, lasting between four and nine months and involved 168 participants in total (BeChange, 2021).

2.3 Structural and individual change

Despite the indications in literature and promising results from real-world initiatives for sustainability, there are some scholars who are hesitant to incorporate psychological qualities into solutions for climate change. For example, there are those who claim that a focus on structural change holds greater potential than individual change to generate sustainability transformations (see e.g., Werfel, 2017; York, 2017). *Structural change* is here seen as transformations in structures and systems that define the boundaries of action on climate change, like cultural norms, regulations, and political and legal institutions. *Individual change* is transformations in meaning-making, such as beliefs, worldviews, and values, that shifts individual and collective perceptions of climate change. While I too recognize these barriers to sustainability efforts on an individual level, a fundamental premise for this thesis is that structural change and individual change can complement and strengthen each other, and thus galvanize sustainability transformations (e.g., Seto et al., 2016; O'Brien, 2018; Brownstein et al., 2022; IPCC, 2022b). For example, behavioral changes can result in 40-70% reduction in emissions by 2050 if political structures, infrastructure, and technologies facilitates for it (IPCC, 2022c).

Furthermore, the window of opportunity for handling the climate crisis is closing, and we need to activate any fruitful climate solution. By 2030, global emissions must be reduced by at least 43%, and

by 84% by 2050, if we are to limit global warming to 1.5 degrees (IPCC, 2022b). So far, efforts to limit climate change are not extensive enough to reach the 1.5 degree target (IPCC, 2022a, 2022b), and one could argue that this could partly be because climate emotions have not been addressed in sustainability efforts (Wamsler et al., 2020; Nielsen et al., 2021a; Woiwode et al, 2021).

3. Theoretical entry points

3.1 Coping theory

To investigate effective coping regarding climate emotions, I used the coping theory presented by Lazarus and Folkman (1984). In this well-known coping theory, coping concerns "cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person" (Lazarus & Folkman, 1984, p.141). Thus, coping revolves around the process of making conscious efforts to handle a stressor, rather than the results of the coping process. The desirability and outcomes of different kinds of coping is contextual (M. Ojala, personal communication, April 29, 2022), which is worth keeping in mind throughout this thesis.

Lazarus and Folkman's original coping theory from 1984 presented two main categories of coping based on the predicted outcome of the coping: emotion-focused coping and problem-focused coping (Lazarus & Folkman, 1984; Vandebos, 2006). The *emotion-focused coping* mechanism aims to regulate negative emotional reactions caused by stressors through cognitive and behavioral tools (Vandebos, 2006). Coping strategies in the emotion-focused mechanism include denial, avoidance, and distraction. In this thesis, *coping mechanism* is referred to as the category of coping, which is defined by its aim. Mechanisms include *coping strategies*, which I refer to as the more tangible practices and actions one can take to reach the aim of the chosen coping mechanism. For example, the mechanism emotion-focused coping encompasses the strategy of denial, and the aim of this strategy is to reduce negative emotions. *Problem-focused coping* is a mechanism that involves direct confrontation with the stressor (Vandebos, 2006). This mechanism includes strategies such as taking individual or collective action. Generally, emotion-focused coping is applied when a stressor is perceived beyond one's control, while problem-focused coping requires one to perceive the stressor as within one's range of influence (Folkman & Lazarus, 1980).

While emotion-focused and problem-focused coping are both beneficial for handling various issues, certain problems are beyond the effect of these mechanisms. Such problems are usually unavoidable in nature, and while they have no immediate solution, they still require active involvement (Folkman, 1997). The climate crisis is considered this type of problem, because it can not be ignored, and even a very engaged person is unable to solve the crisis at once or without engagement on a global and collective level (Ojala, 2007, 2012a). At the same time, people lead lifestyles that contribute to climate change, and thus individual engagement with this issue is vital for solving it.

When researching stressors that can not be avoided, ignored, or immediately solved, Susan Folkman revised the Lazarus and Folkman coping theory in 1997. Folkman (1997, 2008) found that people who dealt with such stressors, people applied a third coping mechanism: meaning-focused coping. *Meaning-focused coping* aims to increase positive emotions related to the stressor by drawing on people’s values and beliefs to sustain wellbeing (Folkman, 2008). With this, the coping theory expanded from a focus on surviving stress to thriving during it (Ojala, 2007), since coping was no longer only about ridding oneself of negative emotions, but also concerned cultivating positive emotions (Ojala, 2012a). Meaning-focused coping also relates to holding complexity for both positive *and* negative climate emotions (Ojala, 2012a), which is considered to increase wellbeing and generate value changes (Gillespie, 2019, p. 115). Meaning-focused strategies include practicing trust, optimism, and hope (Ojala, 2012a). Some researchers claim that meaning-focused coping can complement problem-focused coping (e.g., Folkman 1997; Park and Folkman, 1997). The coping theory will from here on out refer to the revised theory from 1997 that encompasses emotion-focused, problem-focused, and meaning-focused coping mechanisms (Figure 1).

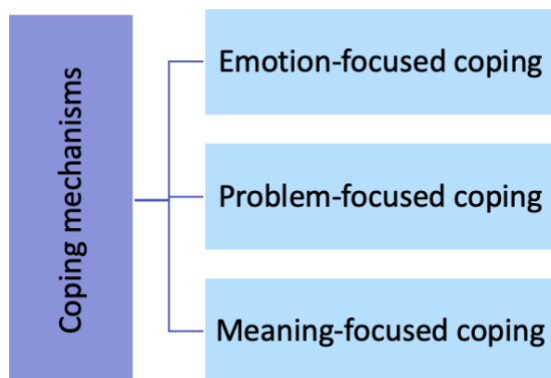


Figure 1. The three coping mechanisms (Figure created by author).

3.2 The three spheres of transformation framework

To answer RQ3 about the importance of effective coping in scaling sustainability efforts, I will utilize the *three spheres of transformations* framework (from here on referred to as the ‘three spheres framework’), which unifies different theories on transformations to argue that sustainability transformations take place in the practical, political, and personal spheres (Figure 2). This framework was created by O’Brien and Sygna (2013) based on the foundations by Sharma (2007) and is “a tool for understanding how, why, and where transformations toward sustainability take place” (O’Brien & Sygna, 2013, p.1). Furthermore, the three spheres framework has proved useful in previous studies,

for example to map incentives for pro-environmental behavior of non-flyers in Sweden (Jacobson et al., 2020), to identify the role of mindsets in achieving sustainability in municipality leadership in Norway (Lindøe, 2021), and to better understand climate change adaptation in rural Nepal (Schorre, 2018). The three spheres framework offers a holistic view on how to respond to climate change regarding the practical, political, and personal spheres of transformation. According to O'Brien and Sygna, climate change responses will be more effective if they take place across the three spheres (2013). These kinds of responses can activate transformations in the three aspects mentioned in chapter 1: form, structure, and meaning-making.

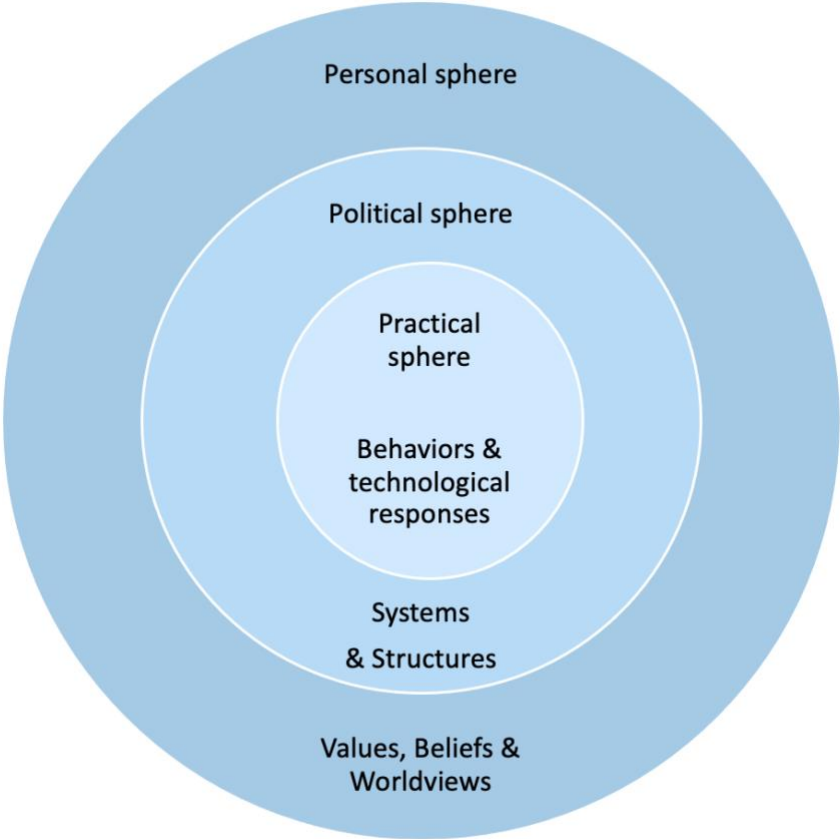


Figure 2. The three spheres of transformation (Figure created by author, adapted from O'Brien & Sygna, 2013).

The *practical sphere of transformation* encompasses observable and measurable sustainability efforts; the part of transformations dealing with changes in physical or qualitative form (O'Brien & Sygna, 2013). This sphere is thus considered the core of transformation. Belonging to the practical sphere are behaviors, technological innovations, social innovations, economic incentives, and other direct changes that foster measurable results. These can for example be to recycle one's waste or to install renewable energy technology to the power grid. Given that the practical sphere holds the most

observable sustainability efforts, this sphere has traditionally been targeted for sustainability transformations, as introduced in the previous chapter. The political sphere of transformation lies between the practical and personal spheres (O'Brien & Sygna, 2013).

The *political sphere* captures the systems and structures that define the possibilities of action based on the dominant paradigm. This includes institutions, norms, rules, and regulations, as well as political, economic, legal, financial, social, cultural, and ecological systems and structures. Systems and structures in the Western world include a capitalist economic system and the norm of driving to work. Increasingly, there have been calls for structural and system change to respond to climate change, as discussed in the previous chapter.

The *personal sphere of transformation* is the outermost of the three spheres, and involves changes in meaning-making required for transformation to actually occur (O'Brien & Sygna, 2013). Within this sphere are the individual and collective values, worldviews, and beliefs that make up people's understandings and assumptions of the world. For example, this sphere encompasses the value of justice or beliefs about human nature. Of the three spheres, the personal sphere is the least included in sustainability efforts, and various scholars argue that it is high time to incorporate this sphere because of its influence over political and practical climate solutions, as presented in the previous chapter.

The three spheres are embedded and interact with each other, meaning that the state of one sphere will catalyze or constrain change in the other two (O'Brien & Sygna, 2013). The practical sphere is dependent on support from the political sphere – to recycle one's waste, for example, requires the existence of and accessibility to recycling facilities. The political sphere is constrained by the personal sphere since the personal sphere shapes the way systems and structures are viewed. For example, if all humans are valued equally, the dominant paradigm will prevent systems and structures that discriminate. Indirectly, the dominant paradigm created in the personal sphere also limits the practical sphere through its constraints on the political sphere. The three spheres also catalyze change in each other. For example, the personal sphere can spark changes in the political sphere by changing the public opinion on discriminatory practices. The personal sphere can also change what practical solutions and behaviors are deemed 'possible' and thus effect change in the practical sphere. Further, the political sphere can be shaped by the practical sphere, through for example social movements or politics. Sustainability efforts that target all three spheres can thus catalyze beneficial changes in each other while also reducing the constraints.

4. Methodology

4.1 Research design

My research was designed as a qualitative study and its main purpose was to answer questions about the what, how, and why regarding sustainability and coping with climate emotions. To answer this, I focused my research around three RQs (see section 1.1). Given that the collected data and applied framework concerned qualitative data, I conducted a qualitative analysis. In doing so, I avoided attempting to quantify emotional responses to the climate crisis and coping, so as to not limit or obscure the analysis.

Data was collected and analyzed for one RQ at a time, because the findings from RQ1 were incorporated in answering RQ2, and the findings from RQ1 and RQ2 were used to answer RQ3 (Figure 3). First, I conducted a systematic literature review to answer what existing literature suggests for effective coping with climate emotions based on empirical evidence. The literature was analyzed by categorizing the coping strategies and their outcomes regarding emotional wellbeing and pro-environmental behavior. Second, I conducted a systematic document review of reports from my case study, BeChange. This was to accompany the empirical findings in academic literature with a real-life case to further investigate the advantages of effective coping. The documents were analyzed by categorizing the use of coping strategies based on the findings from RQ1. Third, the theoretical framework of the tree spheres (O'Brien & Sygna, 2013) was applied to the findings from RQ1 and RQ2, to explore the impact effective coping can have on sustainability transformations. I operationalized the framework by manually grouping the coping strategies from RQ1 and RQ2 into one of the three spheres based on whether the strategy generated changes in form, structures, or meaning-making.

To guide my research, I applied Lazarus and Folkman's coping theory (Lazarus & Folkman, 1984; Folkman, 1997). It was chosen because it is the one of the most established theories on coping and it was foundational in most of the literature retrieved from the systematic literature review. The theory was applied to guide the categorization of coping strategies from the literature, which served as a basis for answering all three RQs.

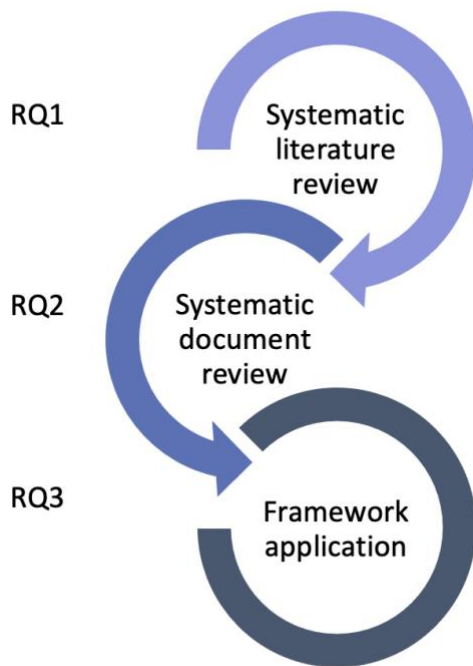


Figure 3. Visualization of research design (Figure created by author).

To address RQ1, I conducted a systematic literature review. This guided the systematic document review of BeChange’s reports that answered RQ2. Both these reviews were applied to the tree spheres of transformation framework in order to answer RQ3.

4.2 Data collection

4.2.1 RQ1: *Systematic literature review on effective coping with climate emotions*

A systematic literature review was conducted to explore what coping strategies exist regarding the climate crisis and whether these are effective. Systematic literature reviews are rigorous methods for data collection that reduce researcher’s bias through transparency and thoroughness (Bryman, 2012, p.102). They are useful for getting an overview of the scope of the topic and for reviewing all articles that might be relevant based on the search terms (Mertens, 2018, p. 112). The literature review also provided useful insights that are incorporated into the introduction, background, and theoretical frameworks of this thesis. The process of the literature sampling is illustrated by Figure 4.

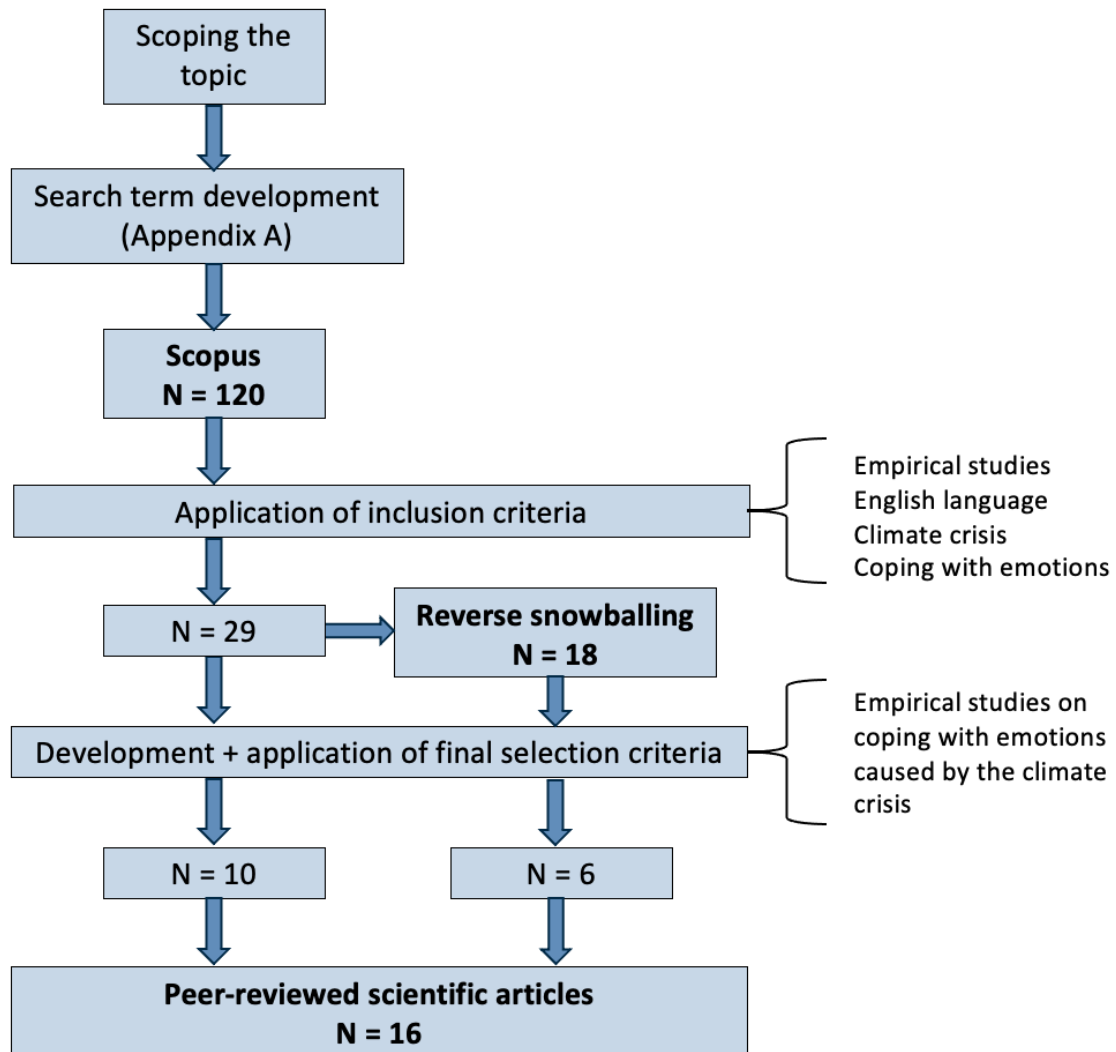


Figure 4. The process of the systematic literature review (Figure created by author).

Steps conducted for the systematic literature review of peer-reviewed scientific articles. See Appendix A for a list of search terms.

I have collected materials on climate emotions throughout my studies, and this pre-existing knowledge guided the scoping of the literature review. This material formed the basis for formulating the search terms used in the literature review. Search terms were based on at least one term related to the climate crisis, together with at least one term related to emotions (see Appendix A). Given the many terms associated with the climate crisis and emotions, relevant terms were included in the literature search, such as ‘global warming’, ‘sustainability’, ‘worry’, ‘cop*’, and ‘climate anxiety’.

The search terms were applied in Scopus to conduct a systematic literature review of peer-reviewed, scientific articles. The 63 search strings provided N = 1072 articles, which were reviewed between February 9 and February 23, 2022. Based on their title, abstract, and keywords, N = 120 articles were retrieved.

I introduced inclusion criteria to increase the consistency, reliability, and objectivity of my research. For studies to be included in the literature review, they needed to be **empirical studies**, and focus on **coping with emotions** regarding the **climate crisis**. Empirical studies were recognized by collection and analysis of primary data, such as administering a questionnaire, conducting interviews, or other observation and experimentation. The definition of coping was as presented in section 3.1 (Lazarus and Folkman, 1984; Folkman, 1997), which included the three coping mechanisms and the specific strategies these entail. Furthermore, studies had to be available on Scopus and in **English** to be included in the literature review. Only N = 29 articles of the 120 met these inclusion criteria. It was expected that the number of relevant articles would be low, given that the field of study is relatively young. Because of this, further excluding criteria, such as sample size, age group, country of study, or publication year, were not introduced.

Reverse snowball sampling was used to increase the number of suitable articles. This was done by looking at the references of the 29 retained articles and including any reference that met the inclusion criteria. This sampling added N =18 articles to the 29 from the original literature review, meaning I had N = 35 articles.

I then developed and applied a final inclusion criterion to further ensure rigor in the review process so that all included articles contributed to answering RQ1. The final inclusion criterion was that all articles provided **empirical evidence on coping with climate emotions**. This criterion was regarded necessary, because some of the 35 articles looked at climate emotions without coping, or at coping with other stressors than climate change. For example, an empirical study by Eisenbeck et al. (2021) looked at coping with COVID-19 but not with climate emotions and was thus no longer part of the literature sample. This final inclusion criterion left me with a sample of N = 16 articles, as introduced in Table 1

Table 1. Final articles retrieved for the systematic literature review (Table created by author).

A table that presents the 16 articles sampled for the systematic literature review. The articles are ordered chronologically after publication date and the I have assigned them each an article ID to which they will be referred to in following tables and figures. Further, the articles are presented with full titles and their journal of publication (except for article 1, which is a doctoral dissertation available online at Örebro University). The sampling source of each article is presented as either ‘Systematic literature review’ or ‘Snowball sampling’ respective to whether they were sampled from the original literature sampling or the reverse snowball sampling.

Article ID	Author(s) and year	Article title	Journal	Source
1	Ojala (2007)	Hope and worry: exploring young people’s values, emotions, and behavior regarding global environmental problems	Doctoral Dissertation, Örebro	Systematic literature review
2	Homburg et al. (2007)	Coping With Global Environmental Problems	Environment and Behavior	Reverse snowball
3	Van Zomeren et al. (2010)	Experimental evidence for a dual pathway model analysis of coping with the climate crisis	Journal of Environmental Psychology	Reverse snowball
4	Ojala (2012a)	How do children cope with global climate change? Coping strategies, engagement, and well-being	Journal of Environmental Psychology	Systematic literature review
5	Ojala (2012b)	Hope and climate change: The importance of hope for environmental engagement among young people	Environmental Education Research	Systematic literature review
6	Ojala (2012c)	Regulating worry, promoting hope: How do children, adolescents, and young adults cope with climate change?	International Journal of Environmental and Science Education	Systematic literature review
7	Ojala (2013)	Coping with Climate Change among Adolescents: Implications for Subjective Well-Being and Environmental Engagement	Sustainability	Systematic literature review
8	Ojala (2015)	Hope in the Face of Climate Change: Associations With Environmental Engagement and Student Perceptions of Teachers’ Emotion Communication Style and Future Orientation	The Journal of Environmental Education	Systematic literature review
9	Andrews (2017)	Psychosocial factors influencing the experience of sustainability professionals	Sustainability Accounting, Management and Policy Journal	Systematic literature review

10	Ojala & Bengtsson (2018)	Young People's Coping Strategies Concerning Climate Change: Relations to Perceived Communication With Parents and Friends and Proenvironmental Behavior	Environment and Behavior	Reverse snowball
11	Mock et al. (2019)	"Something inside me has been set in motion": Exploring the psychological wellbeing of people engaged in sustainability initiatives	Ecological Economics	Systematic literature review
12	Lie & Monroe (2019)	Development and Validation of the Climate Change Hope Scale for High School Students	Environment and Behavior	Reverse snowball
13	Clayton & Karazsia (2020)	Development and validation of a measure of climate change anxiety	Journal of Environmental Psychology	Systematic literature review
14	Budziszewska & Jonsson (2021)	From Climate Anxiety to Climate Action: An Existential Perspective on Climate Change Concerns Within Psychotherapy	Journal of Humanistic Psychology	Systematic literature review
15	Gago & Sá (2021)	Environmental worry and wellbeing in young adult university students	Current Research in Environmental Sustainability	Reverse snowball
16	Helm et al. (2021)	Coping profiles in the context of global environmental threats: a person-centered approach	Anxiety, Stress and Coping	Reverse snowball

4.2.2 RQ2: Document analysis on coping with climate emotions

After answering RQ1, I investigated how effective coping with climate emotions could be translated into practice. I explored how the social innovation BeChange incorporated climate emotions in their programs, as presented in section 2.2. BeChange has hosted four programs that all resulted in increased emotional wellbeing and pro-environmental behavior in participants. In these programs, BeChange adapted climate emotions into their methods, which makes the BeChange programs a suitable case study for this thesis. To identify what coping strategies BeChange applied to achieve their results, I sampled the final reports from each of the four programs and one summary report (Table 2). These documents were provided by BeChange, who ensured the anonymity of their participants. The reports included an introduction to BeChange, their methods, and the program results. These were the only documents from BeChange that presented their methods for each program and were thus included in the sample.

Table 2. The BeChange reports for the systematic document analysis (Table created by author).

The five reports used from the BeChange program – one report from each of the four programs and one summarizing report. All five documents were written by BeChange and provided through a personal contact as these are not readily available publicly. Note that the summary report is in English while the other reports are written in Swedish. The English translations of these document titles were done by me.

Document type	Document title
Final report	BeChange-effekten: En slutrapport från "BeChange koldioxidbanta med klimatterapi" [The BeChange effect: A final report from "BeChange CO ₂ reduction with climate therapy"]
Final report	BeChange-effekten fortsätter: En slutrapport från "BeChange – intensivprogram i Norrbotten" [The BeChange effect continues: A final report from "BeChange – intensive program in Norrbotten"]
Final report	BeChange Eskilstuna: En slutrapport från "BeChange – CO ₂ banta med klimatterapi – intensivprogram" [BeChange Eskilstuna: A final report from "BeChange – CO ₂ reduction with climate therapy – intensive program]
Final report	BeChange Stockholm: Slutrapport [BeChange Stockholm: final report]
Summary report	Supporting climate action through lasting behavioral change: A summary of results from BeChange public programs

4.2.3 RQ3: Applying a theoretical framework

For RQ3, I needed to situate the findings from RQ1 and RQ2 and scale up the results. From RQ1 and RQ2 I had gathered a small number of empirical studies of how to cope with climate emotions and five documents to analyze the case study. To this I applied the three spheres framework (Figure 2) to

convey the findings from RQ1 and RQ2 into recommendations for generating sustainability transformations. The three spheres framework was chosen due to its ability to capture why, how, and where sustainability transformations can happen. Applying the three spheres framework thus positions effective coping in relation to the practical and structural aspects of climate change, and addresses the critique of climate emotions that was presented in section 2.3.

4.3 Data analysis

4.3.1 RQ1: Categorizing coping strategies

The articles retrieved from the systematic literature review were manually coded based on their findings regarding coping and climate emotions. First, the articles were read to identify what strategies of coping were included. These strategies were noted in an Excel spreadsheet that documented which coping strategy was mentioned in which article. The categories were thus created inductively, based on what strategies were presented in the literature.

In some of the articles, similar coping strategies were given different names; in these cases, I assessed whether these strategies were different enough to be separated or not based on the outcomes of adopting them. An example of similar but separate coping strategies is trusting others and trusting oneself. These remained separate because literature described them as having different effects although both strategies shared dimensions of trusting. An example of a strategy where I combined multiple similar terms was holding space. This strategy included concepts like ‘emotion work’ (Robinson, 2019, p. 90), ‘critical emotional awareness’ (Ojala, 2017, 2022), ‘staying with the trouble’ (Haraway, 2016), ‘, and ‘surfing on the waves of emotions’ (Greenspan, 2004), which all referred to some kind of identification, regulation, and acceptance of one’s emotions.

The coping mechanisms and strategies were analyzed based on their outcomes for emotional wellbeing and pro-environmental behavior. Emotional wellbeing was understood here as “a state of existence that fulfills various human needs, including [...] quality of life, as well as the ability to pursue one’s goals, to thrive, and feel satisfied with one’s life” (IPCC, 2018). Emotional wellbeing was indicated by the amount of positive or negative emotions people experience: high emotional wellbeing is identified by the presence of positive emotions and absence of negative emotions, and vice versa. Pro-environmental behavior was referred to as behaviors that are taken to protect the environment (Krajhanzl, 2010; IPCC, 2018), such as purchasing sustainable and local products, conserving energy and water, or changing mode of transportation.

4.3.2 RQ2: Categorizing and comparing documents with literature

A document analysis is “a systematic procedure for reviewing or evaluating documents” (Bowen, 2009, p. 2) and can supplement the systematic literature review to verify or corroborate its findings. This method is also useful for reviewing non-research documents, such as the BeChange reports. Specifically, the document analysis provided empirical knowledge on how coping mechanisms can be applied with the examples from the BeChange program. Text labeling was used to identify which of the literature review’s coping strategies were used in BeChange’s program, and how these were implemented. The document analysis thus built on the findings from the literature review and the categories used for analysis were the ones found from the literature review in answering RQ1.

4.3.3 RQ3: Situating the findings in the three spheres framework

The findings from RQ1 and RQ2 were applied to the three spheres framework. The findings from the literature and document reviews were first categorized into one of the three spheres. This was done using the definitions of each sphere as presented in section 3.2 and identifying whether the results contribute to transformations in form, structure, or meaning-making. For example, actions that reduced emissions from the BeChange participants, such as changing diet or transportation style, were categorized as belonging to the practical sphere.

While most of the findings from RQ1 and RQ2 were easy to place into one of the three spheres, there were a few findings that were difficult to categorize. I found this especially true for findings that had strong implications on all three spheres, such as increased communication about climate change. To overcome this difficulty, I created case-specific criteria of what qualified for each sphere. In the practical sphere, I accepted only observable changes, such as changed behaviors and interventions. The political sphere included the actual changes in structure, like the forming of new governments or adapting of new social norms. In the personal sphere, I placed value-laden emotions and states of emotional wellbeing – drivers behind changes in form and structure. Thus, the example of increased climate communication was made possible through change in the personal sphere and had implications for the political sphere, but ended up being placed in the practical sphere as it was a change in behavior and form, more than meaning-making or structure.

5. Results

5.1 Effective strategies for coping with climate change

RQ1: What do previous studies suggest for coping effectively with climate emotions?

5.1.1 The 26 studies in the 16 articles

From the 1072 articles reviewed, I identified 16 relevant articles containing 26 empirical studies on climate emotions and coping (Table 3). The low number of retained articles relative to the number of reviewed articles suggested that the field of climate psychology lacks empirical evidence for how to respond effectively to climate emotions, or because my search terms were not targeted enough. It was also apparent that such research is currently conducted by a limited number of researchers and in a homogeneous context. Of the 26 retained studies, 12 were conducted by the psychology researcher Maria Ojala based at Örebro University in Sweden. Therefore, a large portion of the studies were conducted in Sweden, while the remaining studies were conducted in other countries in the global North. The 26 studies were conducted on a variety of age groups, ranging from late childhood to adulthood.

Table 3. The 26 studies in the 16 reviewed articles from the systematic literature review (Table created by author).

A table about each study in the 16 articles retrieved from the systematic literature review. Each article is referred to by article ID, as presented in Table 1. The basic approach, population sample, and country of study are presented. The population sample is presented with the following abbreviations: a = adolescence, A = adulthood. Thus, 'A (early)' is short for early adulthood. Based on the definitions from the 16 articles, I define adolescence from age 10 to 18 and adulthood from age 19.

Article ID	Basic approach	Population sample	Country
1	Survey	a (late)	Sweden
	Interview	A (early)	Sweden
	Survey	A (early)	Sweden
	Interview	A (early)	Sweden
2	Survey	A	Germany
	Survey	A	Germany
	Survey	A	Germany
3	Survey	A	Netherlands
	Survey	A	Netherlands
4	Survey	a	Sweden
5	Survey	a	Sweden
6	Survey	a (early)	Sweden
	Survey	a (late)	Sweden
	Survey	A (early)	Sweden
7	Survey	a (late)	Sweden
8	Survey	a (late)	Sweden
9	Interview	A	UK & Canada
10	Survey	a (late)	Sweden
11	Interview	A	Austria, Germany, Italy, Netherlands & Romania
12	Survey	a (late)	USA
	Survey	A	USA
	Survey	A	USA
	Survey	A	USA
14	Interview	A	Sweden
15	Survey	A (early)	Portugal
16	Survey	A	USA

5.1.2 The 17 coping strategies

From the 26 retrieved studies, I identified 17 coping strategies. These were distributed among the three coping mechanisms emotion-focused, problem-focused, and meaning-focused coping (Lazarus & Folkman, 1984; Folkman, 1997) (Table 4). The five strategies under emotion-focused coping are: 1) *hope based on denial*, 2) *de-emphasizing*, 3) *distancing and avoiding*, 4) *social support*, and 5) *hyperactivation*. The five coping strategies mentioned in problem-focused coping are: 1) *information-seeking*, 2) *awareness*, 3) *planning action*, 4) *direct actions (individual)*, and 5) *direct actions (collective)*. For meaning-focused coping, seven strategies were mentioned: 1) *constructive hope*, 2) *cognitive reappraisal*, 3) *trusting others*, 4) *trusting oneself*, 5) *holding space*, 6) *being in nature*, and 7) *finding purpose*.

Further, it is worth noting that coping mechanisms varied in their frequency of attention amongst the 26 studies, as seen in the 'Source' column of Table 4. The most researched strategies are *information-seeking*, *constructive hope*, and *trusting oneself*, each found in five different articles. However, this count says nothing about how much space each strategy was given in the articles. For example, an article could mention two strategies, but examine one in detail while only discussing the other in passing. This contrast in attention seems natural, given that emotion-focused and problem-focused coping has been around for decades, while meaning-focused coping only was introduced in 1997 by Folkman. Thus, the meaning-focused approaches have had less time to gain traction in academia.

Table 4. Overview of coping mechanisms identified by the systematic literature review (Table created by author).

An introduction to the 17 coping strategies mentioned in literature. The coping strategies are grouped by coping mechanism. There are examples provided to aid the understanding of and differences between these strategies. Every article in which I identified a coping strategy in the systematic literature review is listed by its article ID (see Table 1) to present where each coping strategy is sourced from.

Coping mechanism	Coping strategy	Example	Source article ID
Emotion-focused	Hope passed on denial	Blind optimism where one experiences hope by denying unpleasant facts, such as by denying the scope of climate change.	5, 6, 8
	De-emphasize	Believing the climate threat is severely exaggerated, not as important as other threats, does not exist, will not impact oneself, is even positive for oneself and society.	3, 6, 10, 15
	Distancing and avoiding	Use of cognitive or behavioral distraction and avoidance, such as deliberately thinking about something else or turning off climate related news.	3, 6
	Social support	Finding assistance and comfort in other people by talking to others or seeking company in order to calm one's negative emotions around the climate crisis. Is thus different from Direct actions (collective).	6
	Hyperactivation	Elevated awareness and a passive approach to climate change, like ruminating over worry and guilt.	6
Problem-focused	Information-seeking	Increasing one's knowledge about climate change by seeking out information and content.	1, 5, 6, 12, 13
	Awareness	Applying a 'climate lens' to everyday life, such as thinking about how consumption choices influences climate change.	6, 13
	Planning action	Preparing for how to approach climate change and its impacts, such as insuring one's home against natural disasters or implementing community emergency strategies.	6, 13
	Direct actions (individual)	Individually acting to limit climate change, such as talking to others about climate change and choosing environmentally friendly transportation.	1, 3, 6, 13
	Direct actions (collective)	Collectively acting to limit climate change, such as engaging in one's local community or in climate activism, and building relations with likeminded people. Differs from Social support because it aims to gain a sense of control over climate change, not to limit negative emotions.	3, 6, 11, 14
Meaning-focused	Constructive hope	An optimistic outlook that focuses on positive aspects while also acknowledging the threats, for example by hoping that climate change can be solved.	1, 5, 6, 8, 9

Positive reappraisal	Acknowledging the situation, but reframing climate change to recognize the positive aspects of it too, such as by recognizing that awareness around climate change has increased over the last decades. Considered a facilitator to practicing Constructive hope.	6
Holding space	Creating a space to hold emotions, so they can be identified, understood, and accepted, by sitting with difficult emotions and feeling what values they articulate.	9, 13, 14
Trusting others	Holding trust and confidence in sources outside of oneself, such as trusting politics and international agreements, environmental organizations, businesses, and humanity in general. Similar to collective efficacy.	1, 3, 6, 12
Trusting oneself	Holding trust and confidence in one's own capabilities, such as believing that your behavior has an impact. Similar to self-efficacy.	1, 3, 8, 12, 13
Being in nature	Spending time in nature in ways that are restorative, motivational, or increases a sense of connectedness with the world.	1, 9
Finding purpose	Cultivating a feeling of pursuing meaningful goals that are rooted in values, by holistically aligning one's actions to one's values.	1, 11, 14

5.1.3 Coping strategies and emotional wellbeing

The 26 studies suggested various connections between coping strategies and emotional wellbeing, both in terms of positive and negative emotions. Generally, emotion-focused coping seemed to decrease negative emotions, problem-focused coping seemed to increase negative emotions, and meaning-focused coping seemed to increase positive emotions.

The studies found that engaging with the emotion-focused coping mechanism generated fewer negative emotions, such as stress (Homburg et al., 2007) and worry (Ojala, 2012a, 2013), without supplying any positive emotions. One study (Ojala, 2013) found a link between emotion-focused coping and optimism, but on closer inspection, this optimism turned out to be the emotion-focused strategy *hope based on denial*. Emotion-focused coping did reduce negative emotions which would make it an effective approach, but it failed to generate positive emotions and literature has found that this mechanism leads to poorer mental health in the long run (Andrews, 2019, p. 80).

The problem-focused coping mechanism generally resulted in increased negative emotions (Homburg et al., 2007; Ojala, 2012a, 2013), such as stress (Homburg et al., 2007). However, one study (Ojala, 2007) suggested a link between the specific strategy of *direct actions (individual)* and positive emotions, especially hope if it was accompanied by high levels of worry. Another study found that *information-seeking* had no causal relationship with feelings of hope or efficacy (Li & Monroe, 2019). Thus, problem-focused strategies seemed to spur both positive and negative emotional reactions, depending on which strategy was used. While problem-focused coping mostly increased negative emotions and was thus not considered effective coping, when paired with meaning-focused approaches, these negative emotions could be replaced by positive emotions. Problem-focused coping was thus not considered effective on its own but could be effective in combination with meaning-focused coping.

Meaning-focused coping seemed to generally coincide with positive emotions, and while negative emotions were not necessarily increasing, there were some studies that implied that meaning-focused strategies reduced the experience of negative emotions. Studies found a link between positive emotions, especially hope and optimism, and the meaning-focused coping mechanism (Ojala, 2012a, 2012c, 2013). Some articles also studied specific meaning-focused strategies in relation to emotional wellbeing; these were *constructive hope*, *trusting others*, and *trusting oneself* (Ojala, 2007, 2015). These three were all found to increase positive emotions – but they also increased negative emotions such as worry. Ojala (2007) found that *trusting oneself* increased both positive and negative emotions, while *trusting others* and *constructive hope* increased positive emotions and buffered negative

emotions. Meaning-focused strategies therefore seemed to be mostly related with increased positive emotions but might also increase or decrease negative emotions. In terms of emotional wellbeing, I found that applying meaning-focused coping is most effective, because it increased positive emotions and perhaps decreased negative emotions. Meaning-focused coping was identified as effective for emotional wellbeing, both on its own and in combination with problem-focused coping.

How each coping mechanism related to emotional wellbeing coincided with their aims: emotion-focused coping’s core function is to reduce negative emotion; problem-focused coping means getting involved with climate change and the stress that brings; and meaning-focused coping attempts to alleviate the negative emotions associated with climate change so one can be involved with it with less suffering.

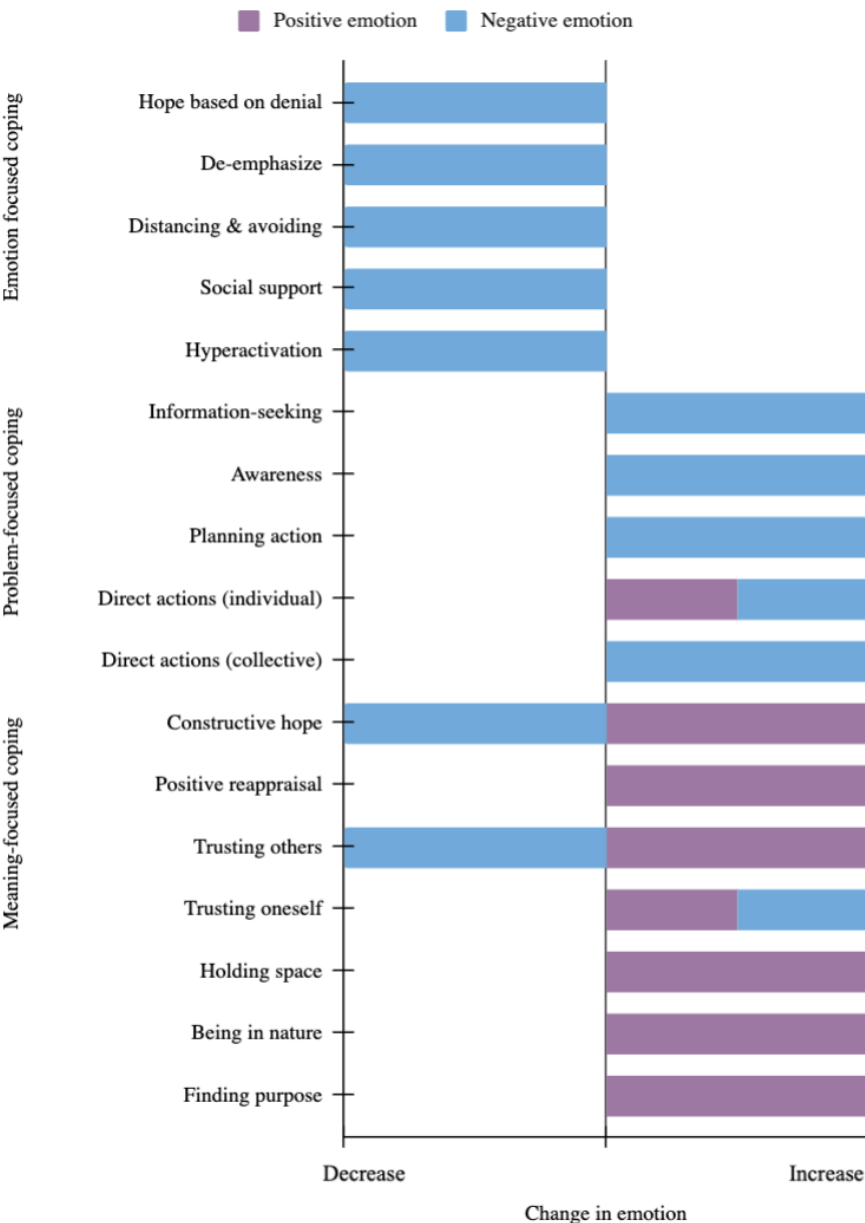


Figure 5. Coping strategies and emotional wellbeing (Figure created by author).

Bar chart of the changes in emotion that follow each coping strategy. On the horizontal axis, the scale from -1 to 1 represent the decrease or increase in emotions respectively. The vertical axis holds the coping strategies, grouped by mechanism. Emotion-focused strategies and two meaning-focused strategies decrease negative emotions. Problem-focused strategies and one meaning-focused strategy increase negative emotions. Meaning-focused strategies and one problem-focused strategy increases positive emotions.

5.1.4 Coping strategies and pro-environmental behavior

The literature review suggested that pro-environmental behavior increased with problem-focused and meaning-focused coping, in contrast to emotion-focused coping which corresponded with decreased engagement. The studies on pro-environmental behavior and coping all found that the emotion-focused coping mechanism was connected to reduced pro-environmental behavior, while the problem-focused and meaning-focused coping mechanisms resulted in increasing pro-environmental behavior (Figure 6).

Emotion-focused coping was found to decrease pro-environmental behavior. Two emotion-focused strategies were specifically studied in relation to pro-environmental behavior by the studies: *hope based on denial* (Ojala, 2012b, 2015) and *de-emphasizing* (Ojala & Bengtsson, 2018). These were both found to reduce pro-environmental behavior. Emotion-focused coping was thus not effective in terms of increasing pro-environmental behavior.

Problem-focused coping increased pro-environmental behavior and was therefore identified as an effective way to cope in terms of pro-environmental behavior. Problem-focused coping was found to increase pro-environmental behavior the most (Ojala, 2013). Of the problem-focused strategies, *information-seeking* was the only strategy studied specifically in relation to pro-environmental behavior (Ojala, 2007) and was found to increase pro-environmental behavior.

Like problem-focused coping, meaning-focused coping coincided with increased pro-environmental behavior. The meaning-focused strategies that were mentioned specifically regarding pro-environmental behavior change are: *constructive hope* (Ojala, 2007, 2012b, 2015), *trusting others* (Ojala, 2007; Van Zomeren et al., 2010), *trusting oneself* (Ojala, 2007), *being in nature* (Ojala, 2007), and *finding purpose* (Ojala, 2007). These were all found to increase pro-environmental behavior. Thus, the problem-focused and meaning-focused coping mechanisms can be deemed effective because they increased pro-environmental behaviors.

The coping mechanisms' relation to pro-environmental behavior was consistent with their aims: emotion-focused coping decouples stressful emotional reactions from climate change; problem-

focused coping attempts to change the outcome of climate change through action; and meaning-focused coping attaches purpose to actions for them to be sustained.

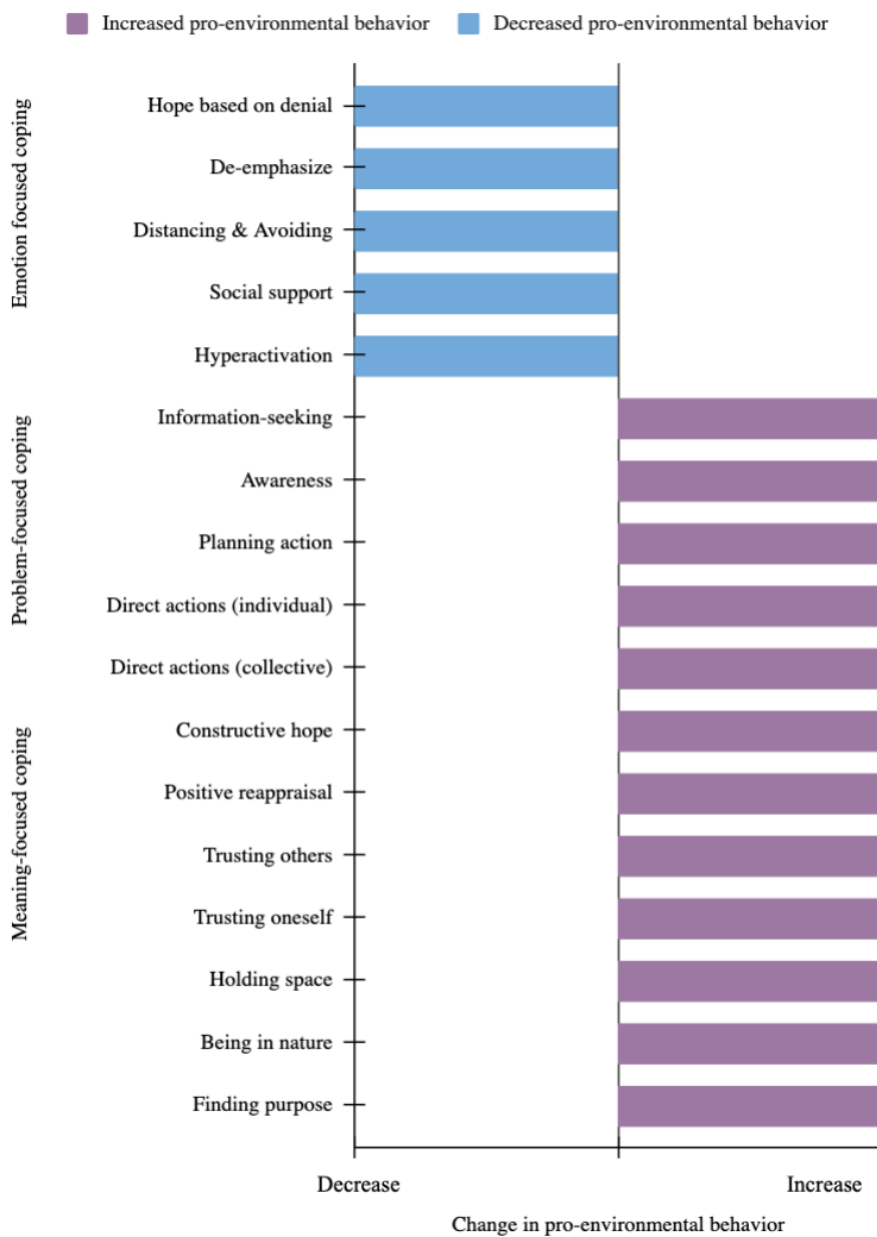


Figure 6. Coping strategies and pro-environmental behavior (Figure created by author).

Bar chart of the changes in pro-environmental behavior that follow each coping strategy. On the horizontal axis, the scale from -1 to 1 represent the decrease or increase in pro-environmental behavior respectively. The vertical axis holds the coping strategies, grouped by mechanism. Emotion-focused strategies were found to decrease pro-environmental behavior, while problem-focused and meaning-focused strategies increase it.

The results from the systematic literature review suggested that effective coping with climate emotions involve a mix of problem-focused and meaning-focused coping strategies. As stated in the Introduction, effective coping is here understood as coping that is beneficial for emotional wellbeing and increases pro-environmental behavior. Emotion-focused strategies were found to limit the

experience of negative emotion which can improve emotional wellbeing, but at the same time, pro-environmental behavior decreased because of strategies such as avoidance and denial. Emotion-focused coping was therefore not deemed efficient for dealing with climate emotions. Problem-focused approaches generally invoked negative emotion, although the engagement with pro-environmental behavior was high. This suggested that problem-focused coping was not effective either. Meaning-focused coping strategies were found to either buffer or generate negative emotion in some cases but were generally linked to positive emotion. Also, meaning-focused coping brings about pro-environmental behavior. Therefore, I consider meaning-focused coping as effective coping. Interestingly, some of the studies indicated that meaning-focused coping strategies could be paired with problem-focused coping for increased pro-environmental behavior and improved emotional wellbeing (e.g., Folkman 1997; Park and Folkman, 1997). On this basis, I will suggest that the combination of problem-focused and meaning-focused approaches might also be considered effective coping, but without making any definitive conclusions. This will be further discussed in chapter 6.

5.2 Applying effective coping in practice

RQ2: How does the climate emotion program BeChange align with research recommendations for supporting effective climate coping and engagement?

From the systematic document review, I found that BeChange's methods included lectures, coaching, and practical exercises to apply four problem-focused strategies and six meaning-focused strategies (Table 5). According to the five documents reviewed, the participants of the BeChange program reported improvements in emotional wellbeing and increased pro-environmental behavior by the end of the program (BeChange, 2021). Participants' emotional wellbeing was measured on a scale from 1 to 5 by self-assessment tools that focused on hopefulness, climate anxiety, and quality of life (BeChange, 2021). Participants increased their hope and decreased feelings of climate anxiety, while also maintaining or improving their perceived quality of life (BeChange, 2021). This means that before the program, the average participant measured a 3 on the scale from 1 to 5, indicating moderate levels of hopelessness and climate anxiety (BeChange, 2017; 2018; 2019a; 2019b). By the end of the program, the average score had risen to between 4 and 5, which indicated decreased feelings of hopelessness and climate anxiety (BeChange, 2017; 2018; 2019a; 2019b). This state was exemplified by statements such as "it is exciting to create a more sustainable lifestyle and world," "I am convinced that I, society, and the world, has what it takes to create a sustainable world," and "I understand environmental issues but am not stuck in them" (BeChange, 2018; 2019). These results suggested that the BeChange program did in fact improve the emotional wellbeing of its participants.

Participants increased their pro-environmental behavior. Pro-environmental behavior was measured by yearly personal CO2 emissions from transportation, food consumption, resource use in the home, and a category of “other” such as services (BeChange, 2021). This was calculated by self-assessment and a verified online calculation tool called Klimatkontot (BeChange, 2021). By the end of the program, the average participant decreased their emissions by 47%, equaling 3.6 tones of CO2 per person per year (BeChange, 2021). One year after completing the program, participants calculated their emissions again, and it was found that the pro-environmental behaviors had stuck because emissions remained approximately the same as by the end of the program (BeChange, 2021). Participants also reported on other pro-environmental behaviors that were not accounted for in the emissions calculation. For example, participants found themselves more likely to talk about climate change and their climate emotions, they experienced increased engagement in their local community and in political and climate organizations, some had changed their workplace to align with their environmental values, and increasingly incorporated the environment into their hobbies and leisure activities (BeChange, 2021). Participants also experienced that their family members, friends, and colleagues were inspired to act more pro-environmentally as well (BeChange, 2021).

The BeChange coaching program was successful in promoting environmental wellbeing and pro-environmental behavior, but what specific methods were used? I identified coping strategies that were problem-focused (*information-seeking, planning action, direct actions (individual), and direct actions (collective)*) and meaning-focused (*constructive hope, trusting others, trusting oneself, holding space, and being in nature*) (Table 7). Of the coping strategies used in the program, four were problem-focused and six were meaning-focused approaches. This coincided well with what the current literature suggested for effective coping with climate emotions, as presented in 5.2, because of the attention on meaning-focused approaches which are most effective at promoting emotional wellbeing and pro-environmental behavior. Further, BeChange combined strategies from all three coping mechanisms, which is explored as part of chapter 6.

Table 5. Implementation of coping strategies in the BeChange programs (Table created by author).

The coping strategies identified from the document analysis of BeChange’s program reports. The programs apply the 11 strategies that are given examples from BeChange’s method. The strategies without examples were not identified in the document analysis.

Coping mechanism	Coping strategy	BeChange’s method with examples
Emotion-focused	Hope based on denial	
	De-emphasize	
	Distancing and avoiding	
	Social support	
	Hyperactivation	
Problem-focused	Information-seeking	Lectures on the roles of communication, thoughts, and feelings regarding climate change.
	Awareness	
	Planning action	Preparatory actions are encouraged, for example as increased self-sufficiency on energy and fresh produce.
	Direct actions (individual)	Individual homework, such as actively search for positive news, use public transport to work, or prepare meatless meals.
	Direct actions (collective)	Practical group work to share thoughts, feelings, and experiences.
Meaning-focused	Constructive hope	Coaching on constructive hope.
	Positive reappraisal	Talks and study circles on recognizing the positive sides of the climate crisis in addition to the negative. Aids <i>constructive hope</i> .
	Holding space	Study circle and lectures on mental health and recognizing emotions.
	Trusting others	Lectures by various social actors can increase trust in sources outside oneself. Being in a group can increase trust that other individuals care deeply about the climate and want to contribute to solutions.
	Trusting oneself	Coaching on self-efficacy combined with practical exercises that can increase trust in one’s own capabilities for contributing to climate solutions.
	Being in nature	Study circles with eco-therapy in nature to connect participants with nature and improve their emotional wellbeing.
	Finding purpose	

BeChange applied four of the problem-focused strategies presented through the literature review. These were *information-seeking*, *planning action*, *direct actions (individual)*, and *direct actions (collective)*. The first two strategies are individual while the latter is collective. The *information-seeking* strategy was applied through learning about the importance of thoughts, feelings, and climate communication (BeChange, 2017; 2018; 2019a; 2019b). This increased the participants' knowledge regarding the climate crisis to encourage action. *Direct actions (individual)* were applied by handing out homework to the participants. The homework could be practical tasks to reduce climate impact, such as consuming less meat, but could also have a dimension of emotional wellbeing, for example, participants could be encouraged to focus on positive climate stories (BeChange, 2017; 2018; 2019a; 2019b). Participants also engaged in *direct actions (collective)* through practical group work activities, such as preparing vegan food or trying out electric vehicles (BeChange, 2017; 2018; 2019a; 2019b). Both the collective and individual exercises demanded the strategy of *planning action*, where participants had to consider what and how they wanted to live more sustainably (BeChange, 2017; 2018; 2019a; 2019b). In addition to the direct action, such as testing out environmentally friendly transport, the group served as a place to share experiences, thoughts, and feelings about the climate crisis. The three problem-focused coping strategies included in the BeChange programs mixed the practical orientation of problem-focused coping with emotion work, such as sharing one's feelings and working on seeing the positive. This could serve as an example of how problem-focused coping can be effective in the face of the climate crisis.

The BeChange participants applied six meaning-focused coping strategies through the programs. These were *constructive hope*, *positive reappraisal*, *trusting others*, *trusting oneself*, *holding space*, and *being in nature*. The coaching sessions, study circles, and talks encouraged practicing *constructive hope* and *positive reappraisal*, for example by discussing positive climate-related news or reasons to be hopeful (BeChange, 2017; 2018; 2019a; 2019b). The BeChange program brought in various social actors, like employees from a train company and the municipality's energy sector, to talk with the participants, which I identified as a way of encouraging *trusting others* because it highlighted other actors' contributions and care for the climate is emphasized (BeChange, 2019b). Participants applied *trusting oneself* too, through coaching and practical exercises like changing their diet, to strengthen the belief that they can lead more sustainable lives (BeChange, 2017; 2018; 2019a; 2019b). Participants learned about and practiced *holding space* through lectures and study circles where they reflected upon their emotions (BeChange, 2017; 2018; 2019a; 2019b). Participants were *in nature* through eco-therapy and study circles that allowed for motivation, relaxation, and connection to the natural world (BeChange, 2017; 2018; 2019a). These five meaning-focused strategies aimed to increase the participants'

emotional wellbeing in a way that complimented the practical actions taken throughout the programs to increase pro-environmental behavior.

5.3 The potential of climate emotions in sustainability efforts

RQ3: Why is effective coping with climate emotions important to achieve sustainability transformations?

By applying the three spheres framework to my findings from RQ1 and RQ2, I found that effective coping can take place across all three spheres of transformation and is therefore a powerful addition to existing sustainability efforts (Figure 7). Most evident was the presence of effective coping in the personal sphere and the practical sphere, where effective coping increases pro-environmental behavior and emotional wellbeing respectively, but there are also implications for the political sphere, such as increased political engagement. Given the span of effective coping through every sphere, effective coping with climate emotions can be valuable for cultivating sustainability through mental health practitioners, governmental bodies, educators, researchers, and social movements.

The personal sphere of transformation deals with meaning-focused coping strategies, and emotional reactions to climate change are considered to hold value connotations. Consequently, the personal sphere holds space for coping effectively with these kinds of emotions. The meaning-focused strategies *constructive hope*, *trusting others*, *trusting oneself*, *holding space*, and *being in nature* belonged in the personal sphere because they contributed to changes in meaning-making by tapping into values, beliefs, and worldviews. For example, the strategy of *trusting oneself* involved perception of one's own capabilities, while the strategy of *positive reappraisal* required shifting perspective. Engaging with the personal sphere for sustainability transformations could be done through practices, counseling, and lectures, as illustrated by the case study for RQ2. Since the spheres are embedded, engaging with the personal sphere corresponded with changes in the other two spheres. Meaning-focused coping seemed to sustain problem-focused coping and therefore also lasting climate engagement (see sections 2.1 and 5.1). Changes in the personal sphere could thus support pro-environmental behavior and sustainability transformations, as described in section 5.2, and visualized in Figure 7.

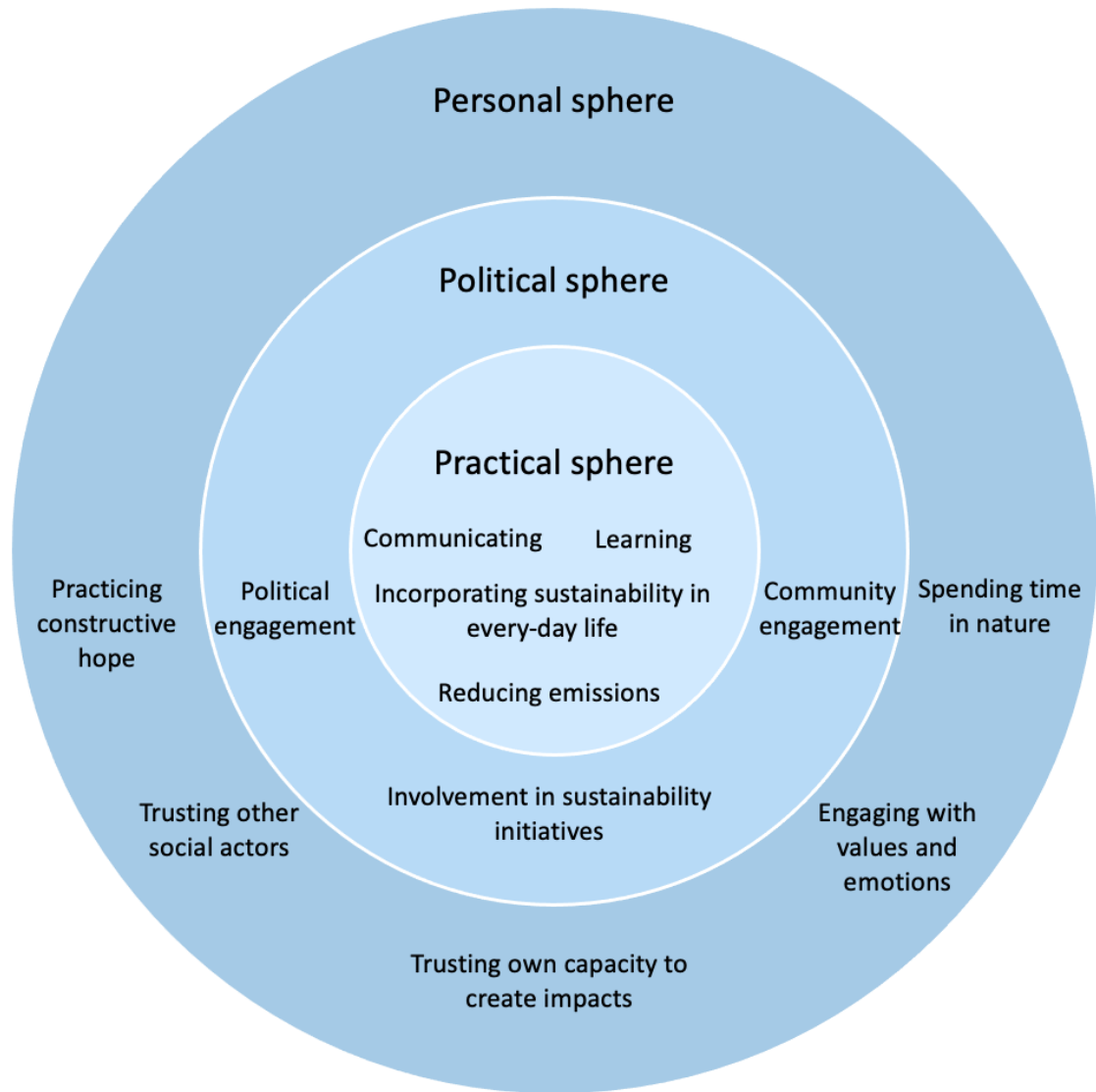


Figure 7. The three spheres of transformation applied to the results from previous RQs (Figure created by author, adapted from O'Brien & Sygna, 2013).

The practical sphere holds the behavioral changes in the BeChange participants, such as reducing their personal emission learning more about climate change and the role of emotions. The political sphere includes changes in values and behavior that impacts systems and structures, like engaging politically with the climate crisis. The personal sphere includes practices where the participants engaged with meaning-making, like practicing constructive hope and trusting other actors.

Effective coping also directly impacted the practical sphere of transformation. This is the sphere that encompasses measurable and observable changes, and the findings in section 5.2 and 5.3 suggested that effective coping increases pro-environmental behavior (Figure 6). This was most evident in the problem-focused strategies, including *information-seeking* and the two types of *direct actions*. In addition, increased climate-related communication belonged in the practical sphere. This involved changes in form, like becoming engaged in an environmental movement, talking to others about sustainability, or partaking in environmental education. Pro-environmental behavior contributed to

sustainability transformations, especially be supported by meaningful approaches in the personal sphere. This served as an example of how the spheres can interact to generate transformation. BeChange and programs and initiatives like it were themselves part of the practical sphere because they are social innovations for sustainability transformations.

Although the results on effective coping mostly dealt with the personal and practical spheres, the political sphere was impacted indirectly because of the embeddedness of the three spheres. This meant that the personal and practical spheres catalyzed change in society's structures to align them with the new form and meaning-making processes. Here, I identified *direct actions*, both individual and collective, like engagement in communities, politics, and sustainability initiatives, through voting or campaigning for a climate movement. These involve some elements of structural change resulting from the changes in the personal and practical spheres. BeChange participants reported that they got active in climate organizations and political parties, and that they communicated more often about climate change (BeChange, 2017; 2018; 2019a; 2019b; 2021). The participants also noticed increased pro-environmental behavior in people around them, such as family members and friends, and in their workplace and community, possibly as results of participants communicating more about climate change and leading by example (BeChange, 2017; 2018; 2019a; 2019b; 2021). Further, one study from the literature review found that people who practiced the meaning-focused coping strategy *constructive hope* voted for sustainability in political elections (Ojala, 2015). Practicing effective coping can thus have ripple effects throughout one's social networks, political institutions. One can also argue that any of the pro-environmental behavior changes in the practical sphere – such as switching to a plant-based diet, recycling, or reducing energy use – has ripple effects on the political sphere, since it impacts social norms and drives demands of consumption. This is further discussed in the next chapter, along with other implications of the results.

6. Discussion

From the systematic literature review, I identified 17 coping strategies across the three mechanisms of emotion-, problem-, and meaning-focused coping. I found that emotion-focused coping strategies generally correspond to less negative emotions without an increase in positive emotions, and it resulted in reduced pro-environmental behavior. Problem-focused strategies were generally associated with increased negative emotion, but not when paired with meaning-focused coping. Problem-focused coping resulted in increased pro-environmental behavior. The meaning-focused strategies were found to increase positive emotion but could also increase or decrease negative emotion. It generated pro-environmental behavior. Thus, effective for coping with climate emotions is identified as meaning-focused coping, alone and in combination with problem-focused coping.

The systematic document review of the case study BeChange revealed that the BeChange program was successful in increasing both participants' emotional wellbeing and pro-environmental behavior. This was done by applying a combination of different coping strategies from the meaning-focused and problem-focused mechanisms. BeChange thus applied a method that corresponded well with the findings from the literature review. For example, BeChange encouraged trust in social actors and in oneself in combination with direct action alone and in groups. Additionally, the success from combining problem-focused and meaning-focused strategies complimented the discussions in the literature about the potential in such a pairing.

By applying the three spheres framework to the findings from the systematic literature and document reviews, I found that effective coping spans across all three spheres of transformation. The reviews predominantly presented effective coping strategies that targeted changes in form and meaningmaking. Thus, the practical and personal spheres were addressed through effective coping. The changes in structure, in the political sphere – occurred indirectly through the changes in the two other spheres, as explained in section 3.2. Such indirect changes included engaging in the climate movement or changing one's consumption patterns. Using the three spheres framework, effective coping was situated as a powerful catalyzer in the efforts for sustainability transformations.

6.1 Alignment of findings with existing knowledge

My finding that meaning-focused approaches are most effective to cope with climate emotions, while emotion-focused and problem-focused coping might be ineffective on their own, is in line with what has been suggested by existing literature (e.g., Ojala et al, 2021; Brosch & Steg, 2021). The results from

the BeChange case study further supports these suggestions, as it offers empirical data collected outside of academia and still aligns with the outcomes from RQ1. Effective coping frees up capacity to respond to the climate crisis (Ojala et al., 2021; Andrews, 2019, p. 80). Further, it became clear that coping on the individual level can galvanize transformative change beyond the individual, by applying the three spheres framework. This analysis showed that effective coping strategies for dealing with climate emotions spanned across all three spheres, which makes effective coping strategies promising for achieving sustainability transformations in the face of climate change.

The finding that individual-level coping can catalyze transformations suggests that the perceived dualism between structural change and individual change is at least oversimplified. According to the three spheres framework, the personal, political, and practical spheres of transformation all influence each other. Given that effective coping with climate emotions impacts all three spheres, the psychological aspects of climate change should be considered as part of sustainability solution. The embeddedness of the three spheres implies that the two strategies for change are compatible and can even strengthen each other's impact. To solve the climate crisis, we need holistic solutions that tackle the psychological, structural, and behavioral barriers to change, including learning how to cope effectively with climate emotions.

My results might also differ from existing knowledge regarding climate emotions because of the lack of consistency and consensus in the field. It can be difficult to maneuver through the many definitions and concepts involved with climate emotions – such as eco-anger, solastalgia, ecological grief, and dread. These nuances in terminology are considered important because one risks obscuring things if one term is used for a major emotional dimension, such as anger or sadness. Clinical psychologist and researcher Thomas Doherty explained this importance with a metaphor of colors (Doherty & Pihkala, 2022): If anger was a color, it would be a primary color – for example red. By labeling any kind of angeremotion as anger, one fears losing sight of the various kinds of anger, such as spirited, righteous anger, vengeful rage, or silent fury – hues of oranges and purples. Since there is a myriad of theories and understandings regarding climate emotions, some nuances might differ in the literature and between my thesis and existing knowledge.

6.2 Further speculations

While literature suggests that combining different coping mechanisms and strategies could increase coping effectiveness (e.g., Folkman 1997; Park and Folkman, 1997), neither empirical data from the literature review (RQ1) nor the case study (RQ2) explicitly studied the results of combining coping

strategies to handle climate emotions. Although meaning-focused strategies are the most effective for coping, the various strategies might impact one another, or they might be applied in combination with problem-focused or emotion-focused approaches. This was the case with the BeChange program, where problem-focused and meaning-focused strategies were combined for effective coping. There is some literature that suggests that meaning-focused strategies can be coupled with other strategies to improve emotional wellbeing or pro-environmental behavior (e.g., Ojala, 2007). Common to these studies, as well as to the case study, is that the effective combination of coping always involves meaning-focused approaches. This might suggest that effective coping can involve more than only meaning-focused strategies, but that meaning-focused coping must be part of the coping. This could mean that emotion-focused and problem-focused coping becomes more effective when paired with meaning-focused coping. This pairing seems more intuitively effective for some strategies than others: for example, pairing *trusting others* and *direct actions (collective)* might support mental health and engagement, while pairing *trusting others* with *de-emphasizing* can cause disengagement and blind optimism, which do not increase emotional wellbeing (Figure 5) or pro-environmental behavior (Figure 6)

6.3 Generalizability of findings

There are some issues with generalizability to be aware of regarding the conclusions drawn in this thesis, which will be expanded upon in the next section. Firstly, there exists only limited empirical data on how to cope with climate emotions. The results originate from 26 empirical studies reported in 16 publications, and the reports from four programs, which does not provide a large enough sample to make hard conclusions for the global population. Rather, the results offer a pointer to how people in various ages in the global North might be affected by different ways of coping with climate change, and my findings make robust claims for the adult population of Sweden. Secondly, the framework of the three spheres will differ based on context. What constitutes meaning-making, structures, and form differs across cultures and societies, which means that what exactly fills in the three spheres will differ from Figure 4 based on context.

6.4 Limitations

Given that my research builds on the systematic literature review for RQ1, there are limitations from this review throughout the thesis. I was only able to retrieve 16 articles, which does not provide an extensive foundation for results. My search terms were perhaps not targeted enough to provide more relevant articles. Furthermore, the studies retrieved for the literature review were conducted by a small number of researchers, and these researchers' biases consequently shaped the foundation of my

findings. The studies from literature, as well as the case study, was conducted in the global North. Because coping is a psycho-social process it is context-dependent, and my research was conducted with limited contexts. This limits the transferability of my findings. It is also not possible to draw any definite conclusions about how coping might differ between age groups, because of the restricted empirical data available. There were no longitudinal studies included in the literature review, making it difficult to provide insight on how coping and its effects change over time.

The case study of the four BeChange programs offered real-world data to supplement the literature review, but it came with two main challenges. Firstly, there were some inconsistencies between the four programs in how data was measured. For example, the wording of the self-assessment surveys was modified over time, which could potentially impact the results. Secondly, there were issues with generalizability in the sample. The sample size was relatively small, and in addition one can assume that the participants were already interested in climate change before joining. The sample therefore cannot represent the entire population, because not all Swedes are interested in living more sustainably. Also, participating in the program required economic and time investments, which further limited accessibility for participating and thus also the generalizability of the results.

6.5 Further research

The research limitations identified above calls for further research in three aspects. Firstly, there is a need to further fill the knowledge gap between coping with climate emotions and sustainability transformations – on combining strategies and mechanisms, and in different contexts, such as cultures, genders, age groups, and economic classes. Longitudinal research is also needed to be able to make conclusions about the impact of coping over time. Secondly, further research can systematically explore how social initiatives such as BeChange contribute to sustainability transformations. Specifically, research can investigate the coping strategies used by different programs and how this coincides with their outcomes. Thirdly, there is a need for researching the ripple effects of effective coping to compliment the theoretical idea provided by the three spheres framework.

My findings on how effective coping has ripple effects beyond the individual can only offer suggestions based on a theoretical framework. The suggestions drawn from this might look different if a different framework was applied. There exist no empirical studies that explore how effective coping appears in the three spheres in practice, which is something future research might thus consider investigating.

6.6 Implications of findings

This thesis offers a systematic assessment of what constitutes effective coping with climate emotions and how this coping can be applied in practice. Effective coping is situated in the theoretical framework of the three spheres of transformation that finds effective coping to contain transformative potential towards solving climate change. Thus, the results of the framework application in RQ3 point to an under-acknowledged and unrealized approach to sustainability that complements the existing approaches for practical solutions in the practical sphere and calls for structural change in the political sphere, to include transformation in the personal sphere. Because effective coping spans all three spheres and is thus considered most effective for generating sustainability transformations, effective coping should be considered in sustainability efforts, such as through environmental education, social movements, and social innovations.

Implementing programs and practices to effectively cope with climate emotions in efforts for sustainability will not be without constraints, but if it is effective in bringing about sustainability transitions it will cost much less than having to adapt to climate change. For example, individual change is claimed to consume much time – time we do not have. It will also have an economic cost to add effective coping to the list of climate mitigation. However, research on social change finds that only 25% of a population is needed to generate substantial changes to society (Centola et al., 2018). These 25% are not all required to engage with effective coping through similar programs as BeChange – rather, participants of such programs will influence their social networks: family, friends, colleagues and workplace, policymakers, and businesses, as was the case for BeChange (see section 5.2). Such ripple effects can potentially allow for rapid growth in people who engage in effective coping. Therefore, reaching 25% of the population is less daunting for the sake of both time and money. When these ripple effects happen in high-emission countries, like Sweden, the increased sustainability will have profound effects on climate change globally. It is therefore important to devote more resources to understand and implement effective coping strategies for climate emotions into sustainability efforts

6.7 Practice recommendations

Since the most effective strategies for effective coping involve some form of meaning-focused coping, this should be a focus in sustainability efforts. The meaning-focused coping mechanism allows room for complex and contradictory emotions on the climate crisis, and it engages values and positive emotions through for example hope and trust. To allow for meaning-focused perspectives, communication about climate change should aim to foster emotional wellbeing and pro-

environmental engagement, for example in education, media, and government. While coping is context-dependent, some general practices for effective coping can include reflections regarding climate emotions, practicing recognition of positive climate aspects, and spending leisure-time in nature. These practices can support long-lasting engagement with the climate crisis, like communicating about it, joining environmental organizations, or engaging in sustainability politics.

7. Conclusion

This thesis aimed to contribute to sustainability science by providing insights into what role climate emotions play in achieving sustainability transformations. For this purpose, I conducted one systematic literature review and one systematic document review to identify effective ways to cope with climate emotions. The insights from the reviews were applied to the three spheres of transformation framework to explore the potential for generating transformations for sustainability.

I found potential pathways for effective coping strategies that impact all three spheres of transformation and can thus bring about profound sustainability transformations. I have defined effective coping as the cognitive and behavioral efforts for managing psychological stress that result in improved emotional wellbeing and increased pro-environmental behavior. I argue that effective coping must involve aspects of meaning-focused coping because it generates positive emotions and leads to higher climate engagement. Meaning-focused coping is also found to compliment problem-focused coping in a way that improves wellbeing and sustains the high climate engagement that problem-focused coping offers. This sort of combination was successful in the case study of the BeChange programs, where combining meaning-focused and problem-focused coping strategies resulted in increased pro-environmental behavior and improved emotional wellbeing.

In applying the theoretical framework of the three spheres, the effective coping strategies were found to impact all three spheres of transformation. Effective coping is therefore considered to bring transformative changes in the realm of societal structures and systems, to what sustainability efforts and climate solutions are implementable, and in how people individually and collectively relate to the climate crisis and sustainability issues.

Because of its influence across the three spheres, effective coping holds potential to galvanise sustainability transformations and should be considered in sustainability efforts, such as climate politics, social movements and environmental education. Effective coping can be encouraged through educating people on climate emotions and how to cope effectively with them. Doing so can be especially important in vulnerable populations, such as children, indigenous and marginalized groups, and people who work with climate change, like scientists and activists. Coping strategies that are identified as effective can be applied individually or in groups, through for example practicing communicating about climate, incorporating low-emission diets and transportation modes into everyday life, engaging in climate activism, spending time in nature, and holding hope and trust in finding solutions.

This thesis contributes insights to the study of sustainability transformations, by suggesting how climate emotions can be coped with effectively and applying a theoretical framework that situates effective coping beyond the individual level. My research offers practice recommendations on how to implement effective coping with climate emotions for various sustainability initiatives and actors, in order to galvanize transformational changes towards sustainability.

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9. Appendix A

List of Search Words

Cop* AND

"ecoanxiety"

"eco-anxiety" AND

"inner world*"

"inner transform*"

transform*

belief*

value*

mindset*

worldview*

"ecological anxiety"

"environmental anxiety"

"climate change anxiety"

"climate anxiety" AND

inner world*

"inner transform*"

transform*

belief*

value*

mindset*

worldview*

Global warming AND

"distress"

"worry"

"anxiety"

"emotion"

"wellbeing"

"mental health"

Sustainab* AND

"worry"

"anxiety"

emotion*

wellbeing*

"existential anxiety"

"positive psychology" AND "anxiety"

"Emotion regulation" AND

"eco-anxiety"

"ecoanxiety"

"ecological anxiety"

"environmental anxiety"

"climate anxiety"

"climate change anxiety"

Scale AND

eco-anxiety

ecoanxiety
ecological anxiety
environmental anxiety
climate anxiety
climate change anxiety

Intervent* AND

eco-anxiety
ecoanxiety
ecological anxiety
environmental anxiety
climate anxiety
climate change anxiety
"climate change" AND emotion*

Threat* AND

"climate anxiety"
eco-anxiety

Eco-anxiety

"Climate anxiety"

"emotional responses to climate change"
coping self-efficacy" AND eco*