

**Exploring Transformative Elements of Nature Experiences and the Role of Reflection in
fostering Pro-environmental Intentions and Behaviors**

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Abstract

Given the urgency of current environmental challenges and the need for more pro-environmental behavior, nature experiences are often suggested to foster pro-environmental behavior. Yet there is less scientific evidence about which elements are perceived as most transformative, the emotional mechanisms they evoke, and the role of reflection in this process. Moreover, existing literature is predominately quantitative, giving limited insights about individuals subjective interpretation of nature experiences and the psychological processes through which these experiences translate into pro-environmental behaviors and intentions. (PEBI). This qualitative study aimed to fill this gap in literature by exploring (1) which elements of nature experiences are perceived as transformative and which feelings they evoke, and (2) how reflection contributes to translating these experiences into (PEBI). Semi-structured interviews with twenty participants, aged above 18, who have had a nature experience within the last six months, were analyzed using thematic analysis. The findings indicate that transformative elements such as wildlife encounter, sensory immersion, silence and confronting environmental contrast evoke clusters of interconnected emotions (both positive and negative). In addition, reflection emerged as a key process in translating the experience into PEBI by reactivating emotions and clarifying values and behavioral options. Limitations include reliance on retrospective self-reports and the sample consisted of participants with relatively strong pro-environmental values. The findings suggest that nature-based programs, such as outdoor education, eco-tourism or conservation-oriented programs aiming to foster PEBI may benefit from incorporating both transformative elements in the nature experience and reflective practices.

Keywords: Nature experiences, transformative elements, reflection, pro-environmental behaviors and intentions

Exploring Transformative Elements of Nature Experiences and the Role of Reflection in fostering Pro-environmental Intentions and Behaviors

Climate change and the need for pro-environmental behavior

Our climate is changing, and scientists agree that human activity is a major cause (IPCC, 2023). Since the 1800s, the earth's temperature has risen about 1.2 degrees, leading to serious consequences, such as more extreme weather, rising sea levels, and loss of biodiversity and crucial ecosystems. To keep the earth livable for future generations, a shift toward more pro-environmental behaviors (PEBs) and a more harmonious relationship with nature is needed. PEBs are actions aimed at minimizing negative and maximizing positive impacts on the environment (Pruneau et al, 2006). PEBs in the private sphere are actions performed by individuals in their personal or household lives to reduce environmental impact, such as recycling, sustainable transport, energy and water conservation, and buying more environmentally friendly products (Kaiser, 1998; Gifford, 1997; Stern, 2000). In the public sphere these actions are aimed at influencing or supporting environmental policies, communities or collective efforts (Stern, 2000). The present study focuses on both pro-environmental behavior and pro-environmental intentions (PEBI), as intentions are considered an important precursor of actual behavior (Ajzen, 1991).

Relationship between nature experiences and PEB

A growing body of research shows that nature experiences can increase PEBs (Larson et al, 2011; Otto and Pensini, 2017; DeVille et al, 2021), with emotional processes often acting as important mediators. One frequently studied mediator is nature connectedness, the felt sense of closeness and relationship with the natural world, which has been consistently linked to PEB (Mayer & Frantz, 2004; Mackay & Schmitt, 2019; Whitburn et al., 2020).

However, existing research has primarily focused on what changes because of nature experiences, such as increased nature connectedness, rather than how these changes take place

at a personal and psychological level. There is less scientific evidence about why some nature experiences are perceived as transformative, while others are not, and how such experiences are translated into changes of PEBI.

Transformative elements of nature experiences

Importantly, not all nature experiences are equally transformative. Their impact may depend on specific elements of the natural environment to which people are exposed to. In this study, *transformative elements* refer to the features of a nature experience that contribute to enduring value shifts and sustained motivation for pro-environmental behavioral change.

Previous research suggests that some elements may be more transformative compared to others. For example, experiences in highly biodiverse environments tend to be associated with stronger effects on nature connectedness, than urban or less biodiverse environments (Hatty et al., 2022; Wyles et al., 2019). Similarly, immersive activities such as hiking or engaging multiple senses in nature appear to have stronger impacts on nature connectedness than more superficial forms of exposure (Lumber et al., 2017; De Ville et al., 2021).

Qualitative research further suggests that specific elements within nature experiences may be particularly meaningful. Mathers and Brymer (2022), for instance, found that participants described encounters with wildlife, observing natural beauty, sleeping outdoors, learning about species, and witnessing environmental destruction.

Most existing studies focus on general exposure to nature or predefined environmental characteristics. However, these offer limited understanding of which specific elements individuals personally perceive and identify as most transformative and what emotions they evoke. Moreover, the psychological processes through which transformative elements and the emotions they evoke are translated into PEBI remain largely unexplored.

The role of reflection

One possible explanation for how nature experiences may lead to changes in PEBI lies in the process of reflection. Reflection plays an important role in processing experiences and can foster learning and behavioral change (Kolb, 1984; Walker, 1985). It involves thinking back on an experience, evaluating it, and making meaning from it (Boud et al., 1985; Kolb, 1984). Reflection can take different forms, such as thinking, talking, writing or creative expression (Boud, 1985). Through reflection, individuals may connect the emotions and insights that arise during an experience to their personal values and beliefs, which could lead to new perspectives or actions (Kolb, 1984).

In the context of nature experiences, reflection may help people interpret what they have seen and felt in nature and relate it to their everyday lives. For example, reflecting on feelings of awe, connection, or peace may prompt individuals to reconsider their relationship with nature and strengthen motivation of PEBI. Although reflection is well studied in educational and learning research, its role in nature experiences and PEBI remains unexplored. There is no scientific evidence about whether and how reflection contributes to translating nature experiences into changes in PEBI.

Research Gap

Taken together, previous research shows that nature experiences can increase PEBI, but important gaps remain. There is limited understanding of (1) which elements of nature experiences are perceived as most transformative, what feelings or emotions they evoke and (2) how reflection helps translating these experiences into PEBI. Besides, most existing studies are quantitative and focuses on statistical associations between nature experiences and PEBI. While these studies provide valuable information about general patterns, they often fail to capture personal meaning and the psychological processes behind these changes. To address these gaps, the present study uses a qualitative approach. In depth interviews allows

participants to share their thoughts and emotions during the experience and reflection that might help explain how and why certain nature experiences affected PEBI.

Research questions and practical relevance

Based on the literature discussed, this study addresses the following research questions:

1. Which elements of a nature experience are perceived as most transformative in fostering PEBI and what feelings or emotions do they evoke?
2. What role does reflection play in translating a nature experience into PEBI?

By identifying transformative elements and the role of reflection this study aims to contribute to a deeper understanding of the mechanisms underlying PEBI. These insights may inform the design of nature-based programs such as environmental education, eco-tourism and conservation initiatives, by informing them which elements and reflective practices are most effective in fostering PEBI. Ultimately, this knowledge may help create more meaningful and transformative encounters with nature that motivate people to behave more pro-environmentally.

Method

Participants

The sample consisted of 20 people. The selection criteria were a minimum age of 18 years, having Dutch nationality and having participated in a nature-based travel experience within the past six months. Participants were recruited through purposive sampling. The sample included 7 male and 12 female, aged between 26 to 82 years ($M= 50.1$). Most participants have obtained an undergraduate degree. At the time of the interview, 1 participant was a student, 2 were retired, and 16 were employed. All participants were living in the Netherlands.

Procedure

Based on the ethics checklist of the EC-BSS at the university of Groningen, the study qualified for exemption from full ethical review. Data were collected between late October and early November 2025. Participation was voluntary and no compensation was provided. Prior to the interviews, participants signed an informed consent form confirming that they had been informed about the study purpose, voluntary participation, confidentiality, and their right to withdraw. A pilot interview was conducted with a person from the researchers' social network. In total 20 semi-structured interviews were conducted in Dutch by both researchers together. One participant was excluded due to no perceived change in PEBI. All interviews were conducted by both researchers together. Responses were documented through notetaking during the interview on a laptop. To protect accuracy and loss of meaning, the notes were written down as extensively as possible, aiming to capture the exact quotes of the participants. Afterwards, the responses were translated into English manually before conducting the thematic analysis.

Interview outline

The following interview guide was used, see below.

Interview guide

Section A Background and Travel experience

1) Can you tell me about a recent trip you took in a natural setting (*hiking, camping, visiting a park, etc.*)?

- Where did you go?
- How long was the trip?
- Who did you travel with?

2) Since that trip, have you noticed any changes in your behaviors that you feel are more environmentally friendly?

- If yes: Can you describe what specific actions you've taken? How often do you do them?
- If no: What do you think has prevented any change?

Section B Nature experience elements

3) Thinking back to your trip, were there specific aspects/elements that felt especially powerful or transformative for you? (*Prompts: remoteness, peacefulness, scenic beauty, connection to nature, wildlife encounters, group exercise*).

4) How did these experiences make you feel at that time?
(*Prompts: awe, calm, gratitude, fear, connection, responsibility*).

5) Looking back, how do you think these experiences have influenced your attitudes or behaviors toward the environment?
(*Prompt for depth: Did they change how you see your role in protecting nature?*)

Section C Reflective practices

6) After your trip, did you take any time to reflect on your experience? How did you do this? (*e.g., journaling, conversations, photography, creative activities, quiet thinking*).

7) Can you describe what kinds of thoughts or feelings came up during this reflection?

8) Do you think these reflections help motivate you to act more sustainably? Why or why not? (*Prompt: Do you think reflection is important for turning nature experiences into lasting behavior change?*)

Importantly, PEBI were explored through participants' self-reported PEBI following nature experiences and is not measured objectively. Additional gathered information can be found in Appendix 1. Following each interview, the notes were organized and compiled into a shared document to prepare the dataset for analysis. Data collection continued until thematic saturation was reached, meaning in the last few interviews participants repeated ideas already identified and no new themes appeared (Braun & Clarke, 2006).

Data Analyses

The interviews were analyzed using an inductive thematic analysis approach (Braun & Clarke, 2006). First, the interview notes were read and reread to become familiar with the data, while attending to emerging ideas and patterns without formal coding (Busetto et al., 2020). Next, the notes were organized per interview question. This structuring served an organizational rather than theoretical purpose. Meaningful units (segments of quotes) relevant to the research questions were then identified. To support this process, these units were visually organized using hand-drawn mind maps (see Appendix 2), which helped the

identification of recurring patterns and contrasts across participants. Based on this process, three main themes were developed in direct relation to the research questions. Within each main theme, the researcher identified patterns of shared meaning. Units that expressed similar underlying ideas were clustered together and developed into subthemes. Throughout this process, subthemes were refined to ensure they were coherent, distinct from each other, and together captured the main patterns in the data. After forming the sub-themes, each sub theme was clearly defined and named.

Results

From the results, three main themes derived. The first two give answer to the first research question: Which elements of a nature experience are perceived as most transformative in fostering PEBI and what feelings or emotions do they evoke? (see table 1). The third one gives answer to the second research question: What role does reflection play in translating a nature experience into sustainable behavioral change? (see table 2). For every main theme, different subthemes derived which are being illustrated by selected quotes. The most important subthemes are shown in this chapter. The remaining ones, together with results of additional information are provided in Appendix 3.

Table 1

Sub themes derived from the two main themes: impactful elements and feelings and emotions evoked by these elements

Main Theme	Sub Themes	Example quote
Transformative elements of nature experience	Encounters with wildlife/animals	<p>“Seeing thousands of birds and hundreds of seals”.</p> <p>“Wild animals, like deer, foxes and hares”</p>

Appreciation of Scenery and Vegetation	“Huge palm trees unique in the world”. “A very authentic environment with cultural landscapes”.
Experiencing restorative quietness and remoteness	“No phone, no bad news, just silence”. “Thoughts don’t get confused by sounds of traffic and people, you hear nothing, only nature.”
Engaging in sensory immersion	“The smell of wet moss sounds of a stream, the texture of a rock”. “ The sound of the sea, the smell, all your senses become sharper”.
Experiencing nature in a social context	“Conversation with the guide in amazon talking about effects of climate change on people, animals and nature”. “Being together with people that appreciate nature & have knowledge of nature”.

	Confrontation with disturbing elements in nature because of human impact and climate change	“Seeing the drought”. “Silence, the beauty of nature & the chainsaw”.
Feelings and emotions evoked by the elements	Experiencing nature connectedness	“Connection with nature and all its inhabitants”. “It feels like coming home, when in nature”.
	Experiencing positive emotional responses	“Wonder and respect too. Full of admiration and respect”. “That nature is so beautiful, that you do not need anything more: that makes you really happy”.
	Experiencing restorative emotional states	“Calmness, Zenn, just very peaceful”. “I felt empty, free of thoughts, worries and free of images”.
	Experiencing moral emotions and personal responsibility	“Anger, sadness and guilt, like I am part of this society too”.

	“Responsibility: I am that Western person who eats avocados”.
Negative emotional responses to environmental harm	“It was very frustrating, I felt powerless”.
	“Really sad. Makes me unhappy, even depressed”.
	“Worried; will this still exist in hundred years?”.

Table 2

Sub themes derived from the main theme: importance of reflection in translating the experience into PEBI

Main Theme	Sub Theme	Example quote
Importance of reflection in translating the experience into PEBI	Re-experiencing emotions through reflection	“What nature evokes in me. That wonder, gratitude”.
		“When I reflect on moments in nature, it easily brings me back to that moment and that feeling. I then feel calm and happy again”.
		“Certain feelings remain when they talked about the effects of climate change, I was really shocked”.
	Connecting nature experiences to personal values	“That I would like to live in such an authentic way again, where everything is produced locally, with respect for nature”.

“Yes, I think so, because through reflection you become aware of what nature does to you and that it is important to you”.

Sustaining the emotional and motivational impact “Yes absolutely, because if you have been in nature and do not reflect on it afterwards, it fades faster. In the moment you might feel connected, but once you return to your daily life, you can quickly forget. So, you have to reflect otherwise it does not stick, and you will also not change anything in your behavior I think”.

“Especially with painting. I am constantly in the feeling that nature gave me when I was actually there. So, I definitely think reflecting afterwards helps me to make the behavior long lasting. The more it is my head, the more I act on it”.

Clarify sustainable behavioral options in line with newly or reactivated values “You look and think about options, what can I do to contribute”.

“Yes, I think so, because an experience is just an experience in itself, but with reflection you translate the experience into societal context. If you do that, you can turn your experiences into actions on how you want to see or change that societal context”

Discussion

From the results, three main themes were identified that help answer the two research questions: 1) transformative elements of the nature experience and the feelings evoked by

these elements and 2) the importance of reflection in translating the experience into changes in PEBI. For each main theme, the most important subthemes will be summarized and discussed in this chapter.

Transformative elements of nature experiences

This study identified several key elements that participants perceived as particularly transformative during their nature experience. The most important ones will be summarized and discussed: encounters with wildlife and appreciation of natural beauty and biodiversity, sensory immersion and silence, and confronting contrasts between natural beauty and environmental degradation. Importantly, participants rarely mentioned just one single element. Instead, impact often arose from combinations of elements.

Wildlife encounters and beauty of natural landscapes and biodiversity

Encounters with wildlife and the appreciation of natural landscapes and (unique) biodiversity were the most frequently mentioned transformative elements. Participants described both large and small animals, as well as diverse vegetation, authentic or untouched landscapes. As participants illustrated: “The calm and untouched nature, and the thousands of birds and hundreds of seals” and “especially the moments where I saw wild animals, like deer, foxes, wild boars and hares made a big impression”.

The results are in line with previous studies that highlight the importance of biodiversity and seeing beauty in the natural world during a nature experience, as they correlate positively with feelings of nature connectedness (e.g., Lumber et al, 2017; Wyles et al., 2019; Hatty et al., 2022). These elements might be transformative as they offer rich sensory and aesthetic stimulation, which can draw attention and make the experience more vivid and engaging.

Sensory immersion and experiencing silence

Besides, participants emphasized the importance of sensory immersion: engaging

multiple senses, such as smell, sound, touch, and sight. As one participant reported “The smell of wet moss sounds of a stream, the texture of a rock”. More attention is given to the environment with the senses, which may foster a sense of presence and immersion in the environment. This is rather different passively observing nature. This aligns with work suggesting that sensory engagement deepens contact with nature (Lumber et al., 2017).

Closely related to sensory immersion was the experience of silence often in combination with noticing beauty in nature. Quiet, undisturbed environments may support attentional openness (Kaplan & Kaplan, 1989) and allowing participants to fully take in their surroundings as the following quote illustrates “Especially with tall trees, and connected to that silence, it has something overwhelming about it, it drowns out everything else. You really get caught up in the moment” and “you can't hear anything except the birds”. While silence has received little direct attention in research on PEBI, participants repeatedly emphasized this element as transformative. This result suggests that silence may be a key, yet underexplored, condition that enhances the impact of nature experiences by fostering receptivity and presence.

Noticing environmental harm (and the contrast between this and beauty of natural world)

Finally, noticing environmental degradation and confronting contrasts between natural beauty and environmental harm were experienced as particularly transformative. As one participant explained that he became aware of deforestation, whilst he first enjoyed the silence and beautiful trees around him “It was a moment when I really noticed that conflict. You hear the silence, the beauty of nature, and then that chainsaw in the distance”. This contrast also arose through information provided by the social context, such as guides about human impact on the natural area one is visiting, as the following quote illustrates: “It was mainly that conversation with the guide in the Amazon, when he said that they can no longer predict when the dry season or rainy season will be, and that this has such an impact on the animals

and nature, and on humans too, of course.” These moments disrupted the positive experience and drew attention to environmental vulnerability, increasing awareness about human impact and environmental problems.

It may be that seeing the results of human impact on the environment and climate change in a lived experience, reduces the psychological distance. This idea refers to perceiving climate change as something distant, that will happen to other people, at different places somewhere far in the future (McDonald et al, 2016). Even though the results are contrary, some studies have shown that lower psychological distance has been associated with higher concern and higher willingness to engage in PEBI (Maiella et al, 2020).

Whereas previous research often examined predefined environmental characteristics (e.g., biodiversity levels), in relation to specific outcomes, a key contribution of this study is the identification of elements individuals themselves experienced as transformative. The results suggest that combinations of key experiential elements may create conditions for deeper physical and emotional engagement. These elements may work by capturing attention, fostering immersion, and enabling openness to the natural environment. Together, this may increase the likelihood that nature experiences evoke emotions relevant for PEBI, thereby enhancing its transformative impact.

Feelings evoked by the transformative elements

The findings show that transformative elements of nature experiences evoked a broad range of emotional responses. The most important ones will be discussed in this chapter. Importantly, even though discussed separately these emotions rarely emerged in isolation. Instead, participants consistently described experiencing multiple emotions simultaneously. This suggests that nature experiences may evoke clusters of interconnected emotions, rather than a single feeling, which together may contribute to PEBI.

Positive emotional responses

Participants frequently reported clusters of positive emotions such as awe, wonder, respect, happiness, and gratitude, particularly when encountering wildlife or noticing the beauty of landscapes and biodiversity. Some even described moments of profound fulfilment or surrender, as illustrated by these quotes “I was simply impressed, amazed even,” and “If I die now, I would be happy”.

These findings align with research suggesting that nature can elicit self-transcendent emotions such as awe and wonder (Keltner & Haidt, 2003) as well as with the biophilia hypothesis, which proposes that humans have an innate tendency to affiliate with nature, and fulfilling this tendency elicits positive emotional states (Wilson, 1984; Kellert, 1997).

Restorative emotional states

In addition, participants frequently described restorative states such as calmness, peace, and mental clarity. Being in nature seemed to induce a different mental state in which everyday worries faded into the background, creating a sense of mental relief, as the following quote shows “I felt empty, free of thoughts, worries and free of images” and “relieved, a sense of relief, that I felt a little lighter. From heavy to light”.

This aligns with attention restoration theory, which proposes that natural environments with certain components (being away, extent, fascination and compatibility) can restore depleted attention creating a feeling of restoration (Kaplan & Kaplan, 1989). Several of these components were reflected in the elements that participants described as most transformative. For instance, the environment offering fascinating elements that captured attention, such as encounters with wildlife and scenic landscapes. Feeling of being away from daily life were frequently mentioned, particularly in relation with quiet and undisturbed places. Although not mentioned explicitly, the environments participants spoke about seemed to meet with the criteria of extent, that they felt large and immersive enough. Lastly, the compatibility was

often met as well, that the environment matched with the needs and intentions of the participants (e.g. rest, observing, hiking).

Notably, restorative states were always mentioned together with positive emotions such as happiness, gratitude, and connection with nature. It may be that restoration plays an important role in enabling emotional openness and receptivity by providing the mental space that allows other emotion to arise more fully (Kaplan & Kaplan, 1989; Brown & Ryan, 2003).

Experiencing negative emotional responses

Besides, participants reported clusters of distressing emotions, including unhappiness, sadness, anger, frustration, worry, and feeling powerlessness when confronted with environmental harm such as drought, deforestation or pollution. These emotions are being described in literature as ecological grief: emotional distress arising from witnessing the loss or degradation of valued natural environment (Albrecht et al, 2007; Cunsolo & Ellis, 2018).

Feeling connected with nature

Another emotion that was frequently mentioned was a sense of connection or oneness with nature. Participants described feeling closely related to the natural environment, as the following quote illustrates “these stays brought me even closer to nature”. This aligns with Lumber et al (2017), stating that certain elements of the natural environment can enhance feelings of connection with nature, such as beauty in nature and sensory immersion. Moreover, this feeling often arose together with positive or restorative emotions, supporting existing literature that nature connectedness is closely interconnected with positive emotional experiences in nature (Mayer & Frantz, 2004; Nisbet et al., 2011). As previous studies have shown that nature connectedness is a strong predictor of PEBI (Whitburn et al., 2020), it may be that these emotionally rich responses together may intensify this feeling. Subsequently, enhancing the overall impact of the experience on PEBI.

Experiencing moral emotions

Lastly, moral emotions such as guilt, shame and responsibility were felt, especially when confronted with environmental degradation. As one participant mentioned “Yes, a lot of amazement and responsibility, because I am that Western person who eats so many avocados. Then I think: oh shit, I'm contributing to this too, and I feel guilty”

Previous studies show that learning about environmental harm can evoke moral emotions, especially when people feel personally responsible (Kals et al., 1999; Clayton, 2012). When this learning takes place within a lived nature experience, these emotions may be intensified, as the environmental harm feels more concrete and personal (Clayton, 2017).

Emotions and PEBI

Previous research has often examined emotions in isolation, linking individual emotions such as awe, happiness, restorative feelings, moral emotions, or nature connectedness to PEBI (Bamberg & Möser, 2007; Byrka et al, 2010; Brosch, 2021; Hartig et al., 2007; Kaplan et al, 2024; Mayer & Frantz, 2004; Tam, 2022; Whitburn et al, 2020). The present study nuances this literature by suggesting that nature experiences evoke clusters of interconnected emotions that may reinforce one another, rather than operating independently. Therefore, the transformative impact of nature experiences may lie in the combined emotional responses evoked by specific elements.

The importance of reflection in translating an experience into pro-environmental intentions and behavioral change

Participants mentioned various PEBI following their nature experience. While some participants described change after one single experience, most reported that change developed gradually because of repeated nature experiences. Across both pathways similar PEBI were mentioned such as more conscious food choices (local, organic, less meat),

reduced resource use (e.g. water), litter clean up, and more sustainable transport (see Appendix 3).

This study proposes reflection as potential mechanism of translating the experience into PEBI. All participants described reflecting afterwards and many stressed its importance in fostering PEBI. The findings suggest that reflection following a nature experience appears to unfold as a multi-stage process. Participants described different phases, from re-experiencing emotions to clarifying values, keeping these values and emotions alive, increased awareness of pro-environmental problems and considering behavioral implications.

This pattern bears similarities with existing reflective models, such as Gibb's Reflective Cycle (1988). This model was designed to give structure to learning from experiences and conceptualizes reflection as a process with six different stages. These stages range from recalling and reconnecting with the thoughts and feelings about the experience, to evaluating it, analyzing its meaning and eventually considering implications for future behavior. While such models are often prescriptive, the findings of this study show that a similar process of reflection may emerge naturally following nature experiences. The different phases will be discussed in this chapter.

By reflection, participants re-felt what the experience did to them emotionally

In the first phase of reflection feelings that the nature experience had evoked returned. Participants mentally revisited the experience, allowing them to re-feel the emotions. This helped reminding them of what the experience meant for them emotionally. As illustrated by these quotes:

“When I reflect on moments in nature, it easily brings me back to that moment and that feeling. I then feel calm and happy again.” and

“Feelings like; almost panic, like jeez, shit this island could burn down, that cannot happen!”

The findings show that reflection does not only involve remembering what happened. Rather, it actively brings back the emotional component of the experience. The re-feeling phase was often followed directly by an evaluation process, explicitly or sometimes implicitly. Positive evaluations were common, when participants thought back on the beauty of landscapes, forest, wildlife or the calmness of nature, as the following quotes show “How beautiful it all is.” or “Blissful, this was great, this was good”.

Notably, all participants reported that they reflected on the nature experience afterwards. This may indicate, since all these experiences did evoke certain emotional responses, that these are an important first step for further reflection. It might even be that without this emotional component further reflection would not have taken place. This aligns with previous research suggesting that emotionally salient experiences are more likely to be revisited cognitively, as they invite meaning making (Boud et al., 1985; However, it is unclear in how far this point can be made, since no comparison could be made between participants that experienced emotions and participants that did not feel any emotions during the nature experience.

Reflection connects nature experiences to personal values

The findings suggest that reflection may play an important role in linking the emotional impact of a nature experience to personal values. Reflection helped participants to interpret their emotional responses and translate these into insights about what they value. As one participant mentioned “Through reflection you become aware of what nature does to you and that it is important to you”. Reflection often led to a renewed awareness of pro-environmental values, such as importance of nature, care for nature, simplicity, and a desire for a more authentic and nature-connected lifestyle “I realized that I would like to live in such an authentic way again, where everything is produced locally, with respect for nature”.

This process did not only involve the formation of entirely new values. Often it seemed to reactivate existing values that had become less salient in daily life, as one interviewee described explicitly “Actually, I always had these principles in me, they were just reactivated”. This might suggest that the effect of reflection depends on the baseline presence of such values: if participants already held pro-environmental values, the nature experience most often increased their salience rather creating new ones.

Reflection increases awareness of environmental problems

For a small number of participants, reflection increased awareness of environmental problems. While the nature experience itself evoked strong emotional responses, reflection helped participants to further process what they had observed. It seemed to help participants to interpret what they had seen as part of broader environmental issues, such as climate change and human impact. As one participant, who witnessed the extreme drought and its effects on vegetation, explained “Yes, to really let the urgency sink in it is important that you first think about it. By reflecting on the problem, it becomes clearer”. Reflection thus, for a few participants supported the transition from emotional reactions to increasing awareness of environmental urgency, which is an important step towards more pro-environmental behavior (Kollmuss & Agyeman, 2002).

Reflection sustains emotions and values, supporting long-term behavioral change

Moreover, the findings suggest that reflection can function as an ongoing process that sustains the emotional and value-related impact of a nature experience over time. Participants described how repeatedly returning to the feelings and values evoked by the experience helped keep these values alive during the day. This makes it easier to act in line with them as one participant described “Yes, I really think so. I just maintain my simple lifestyle, by reminding myself often that I want this slow living”.

Another participant illustrated how creative reflection helps her to sustain the emotional impact and increases the motivation to act up on them:

“I think so, because the feeling that nature gave me lasts longer and I am more active with it. That makes it bigger in my mind. Especially with painting. I am constantly in the feeling that nature gave me when I was there. The more it is in my head, the more I act on it.”

According to Verplanken and Holland (2002), values that are frequently activated and therefore more salient, as the examples above show, are more likely to guide behavior. Thus, by maintaining emotional and value salience, reflection in this later phase may seem to help translate moments in nature into more sustained PEBI.

Reflection helps to clarify sustainable behavioral options in line with newly or reactivated values

In the final stage of reflection, many participants looked at how they could translate the new or re-activated values into concrete PEBI. Here, reflection supported the exploration of different options of PEBI, and whether they are feasible. According to Ajzen’s theory of planned behavior this makes behavioral change more likely. As the quote below illustrates “You look and think about options, what can I do to contribute.” and “During the reflection you think a little bit about whether it is feasible or not to start a vegetable garden, for instance”.

However, since changes in PEBI were often linked to multiple nature experiences rather than one single event by many participants, this may suggest that PEBI develop cumulatively over time. As one of the participants mentioned “ Not specifically because of this one trip, but I notice that being in nature structurally makes me think about my impact. Because of that I make more conscious choices in general.” Therefore, the impact of nature

experiences may lie in repeated exposure to transformative elements, emotions and cycles of reflection.

Conclusion

This qualitative study explored which elements of nature experiences are perceived as most transformative in fostering PEBI, which emotions they evoke and how reflection contributes to translating these experiences into PEBI. Participants identified different transformative elements, including beauty of landscape and biodiversity, sensory immersion, silence and noticing environmental degradation as particularly transformative. These may be transformative as they appear to create conditions for deeper engagement by fostering immersion, attention and openness to the experience. Subsequently, these elements have the capacity to evoke emotionally rich responses. These responses occurred as clusters of interconnected emotions, strengthening impact. Lastly, reflection appeared to be an important mechanism in translating the experience into PEBI. This reflection appeared to unfold as a multistage process in which participants; re-experienced the emotions, clarified their values, sustained the emotional impact over time, and translate insights into concrete pro-environmental behavioral action.

Limitations

The present study has several limitations. First, it relied on participants' retrospective self-reports of nature experiences, sometimes weeks or months later, that may have been influenced by memory bias or later interpretation. Future research could address this by capturing emotions and reflections closer to the moment of the experience. Second, the use of detailed notetaking instead of audio recordings may have resulted in paraphrasing bias, reduced quote accuracy, or loss of nuance or meaning, potentially reinforced by translation. For future studies it could be wise to use audio recordings, full transcriptions, and procedures such as back-translation. Besides, the small sample size ($N=19$) limits generalizability. In

addition, participants were recruited through the researchers' personal networks, increasing the likelihood of a sample with similar values and attitudes. This may have led to a selection bias, and it may be that nature experiences and reflection processes operates differently in the general population. Future research could use a larger more diverse sample size. Fourth, exact contribution of transformative elements, emotions and reflection on PEBI was difficult to determine because PEBI were measured objectively through self-report and the fact many participants reported that PEBI emerged gradually because of multiple experiences.

Implications

The findings of this study have several practical implications for the design of nature based programs. Nature-based programs, such as outdoor education, eco-tourism or conservation-oriented programs aimed at fostering PEBI may benefit from incorporating transformative elements identified in this study. This includes amongst others wildlife encounters, high biodiversity and scenic landscapes. As well as opportunities for silence as well as education about or direct confrontation with effect of human impact or climate change on the environment. In addition, offering opportunities to reflect after the experience in nature that might help people to translate the experience into PEBI. For instance by guided questions, group conversations or journalling. These practices may help participants to become more aware of the emotions evoked, connect these emotions to personal values towards nature and translating these into PEBI in everyday life.

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Appendix AI Use Summary

Option 2&3

- AI system: ChatGPT.
- Final prompts used: “ Is this paragraph written clearly and in proper academic English?” “ Can you show me how I can reduce the wordcount of this paragraph” “Can you search for studies that say something about this topic”
- Use case: The prompts about proper academic English helped me to write clearly and comprehensive, I always used my own input, while ChatGPT only checked whether I used correct words and grammar, without changing the content. This eventually really improved my English writing skills as well. Moreover, I had way to many words +3000 therefore ChatGPT helped me by giving feedback/suggestions about how I could write down certain paragraphs more concisely, without losing its meaning. Also, I sometimes asked ChatGPT if he could search for certain studies about a specific topic. This helped me, since I noticed that ChatGPT often found more studies than I could find myself via SmartCat.
- Modifications: After ChatGPT gave me feedback, about my writing style (grammar, spelling, proper Academical English, reduced wordcount) I always modified this feedback myself in the text that I wrote. I did not copy and paste things directly that ChatGPT wrote for me. I kept using my own writing style as much as possible, sometimes adding some new words, where I was not familiar with yet (since they were not part of my English vocabulary yet). Lastly, when asking ChatGPT for certain articles about specific topics, I always read the articles myself, and searched for meaningful information that I could use for my thesis. I never relied on ChatGPT when it speaks about the content of certain articles, as I am very aware of the fact that he is not very precise of this and therefore not reliable at all. Altogether, I have only used ChatGPT for language and writing improvements, as well as providing me certain informational sources.

Appendix 1

Other information collected from the participants

Collect some demographics

Age:

With which gender do you identify? *Male / female / nonbinary / third gender / prefer not to say*

Nationality:

What is the highest educational qualification you have personally obtained?

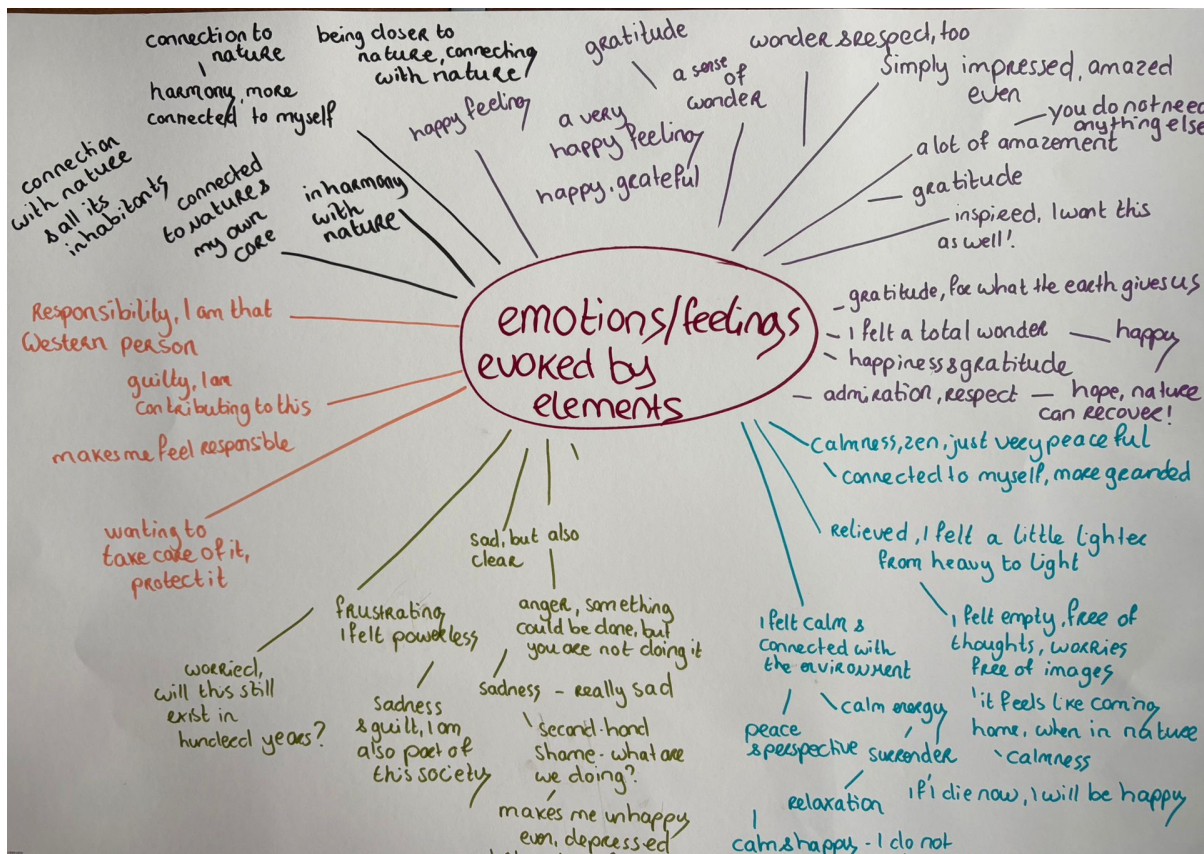
Did not complete high school / High school / Vocational qualification / Undergraduate degree / Graduate degree

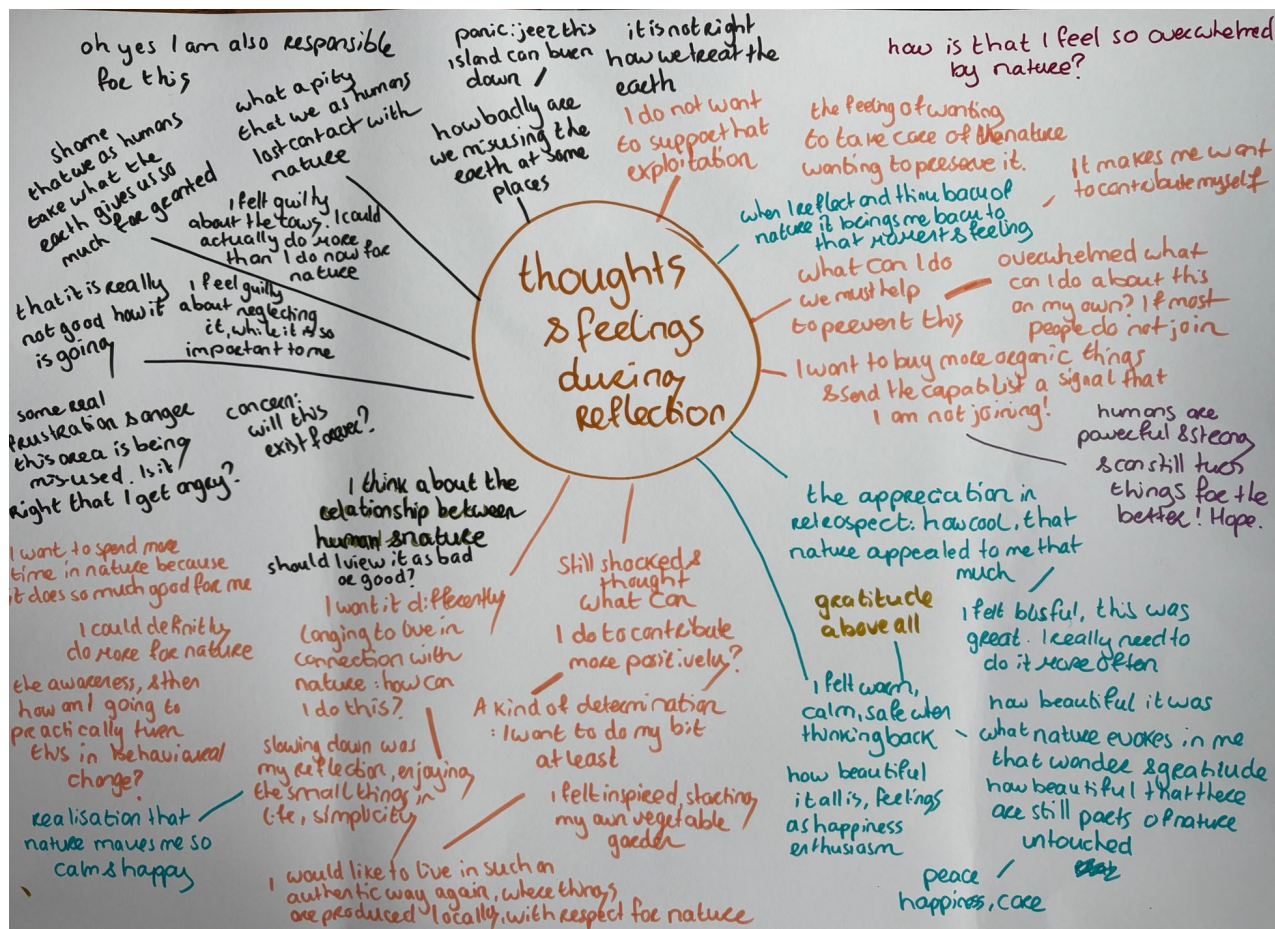
What is your current employment status?

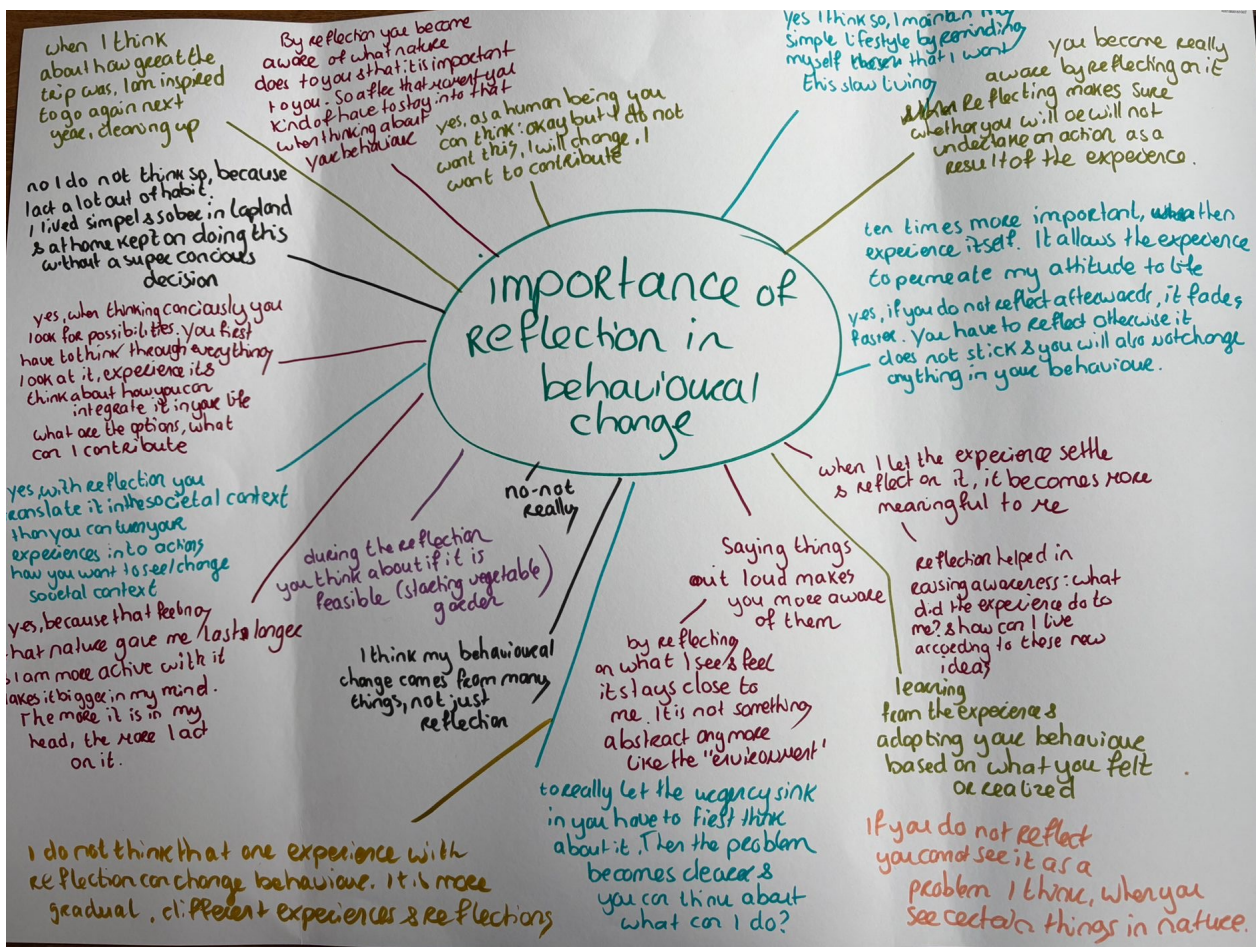
Retired / Full-time employed / Part-time employed / Homemaker / Unemployed / Student / Other

Introduction (2–3 min)

- Introduce yourself and the study: *We are exploring how experiences in nature influence sustainable behaviors.*
- Ensure confidentiality and consent.
- Explain the interview will last 30-40 minutes.







Appendix 3

Results additional information

Main Theme	Sub Themes	Example quotes
Transformative elements of the nature experience	Noticing the power and resilience of nature	“The grandeur of it. How everything works together, how innovative it is, such a big power.”
	Experience re-connection with oneself through nature	“Connected to nature and my own core. It felt as if I was more at home within myself”.
	Feeling inspired	“I would love eating from the foods from my surroundings. Inspired, I want this as well, my own vegetable garden”.
Feelings and emotions evoked by the experience	Experiencing hope	“That is gives you hope that nature can recover”.

Main Theme	Sub Theme	Example quote
Forms of reflection	Photos/creativity	“I took a lot of photos, used them as a wallpaper. Poetry. I also take photos of what I see and paint regularly”.

	Thinking	“Beyond that the biggest thing was thinking about it. I thought about it often afterwards, it stayed with me”.
	Writing	“I wrote about it in my travel blog. Sometimes I write something down afterwards”.
	Active reflection (walking)	“Yes naturally, walking is a form of reflection for me. I think, feel, let go”. “I took plenty of time for this by being a lot in nature in my own surroundings and reflecting on all the impressive experiences”.
	Talking with others	“Talk about it with other people”.

Main Theme	Sub Theme	Example quote
Importance of reflection/ functions of reflection	Reflection increases awareness about environmental problems	“If you do not reflect you also cannot see it as a problem I think, if you see something in nature, such as those fires”. “Yes, to really let the urgency sink in it is important that you first think about it. By reflecting on the problem, it becomes clearer”.

	Thinking about the relationship between humans and nature.	<p>“Further thoughts: what a pity that we as humans lost contact with nature so much”.</p> <p>“How beautiful it is that there are still parts that are untouched where nature can take its own course and how badly we are abusing the earth in other places”.</p> <p>“And then I thought is it right that I feel like this, that I get angry? Or is it quite sustainable to grow wood and built with it. So, doubt. For example, with the chainsaw, how should I view that? Is it good or bad?”.</p> <p>“It makes me think about our origins and how humans could live more in harmony with nature”.</p>
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Behavioral change after nature experiences

Main Theme	Sub Theme	Example quote
Behavioral Change after one single experience	Food: More awareness and sustainable choices. Grocery shopping & Diet.	“I have started eating less meat and I try to eat more seasonal food and check where it comes from. I do this every day”.

		<p>“Yes. Where possible, I now buy organic food and try to choose more consciously for products of local origin”.</p> <p>“I never throw away food; I always eat leftovers”.</p> <p>“I’ve really started making more conscious purchases in the supermarket, instead of in winter just buying tomatoes from who knows where, I now think I’ll just buy seasonal vegetables”.</p> <p>“Eating organic meat”.</p>
	<p>Biodiversity-supporting gardening behaviors</p>	<p>“I have now started my own vegetable garden. We practice biodynamic farming here, no artificial fertilizers, everything is natural, organic seeds. I also sow lots of flowers for the bees and butterflies. I have also become very meticulous about waste disposal”.</p> <p>“Really being active in nature, in the garden, planting things for bees for example”</p> <p>“Planted bee-friendly bulbs, made a compost heap”</p>
	<p>Waste disposal</p>	<p>“We separate our waste very carefully every day and use food scraps to make our own compost”</p>

	Transport	“I don’t go on holidays by plane, now I walk more”.
	Consuming less products, only buying what needed.	“No unnecessary purchases, and that I think even better about do I really need it. Basically, I try to consume as little as possible”. “I only buy what I need”.
	Cleaning up trash	“I’ve also started clearing up litter. Whenever I go out on my bicycle, I take a bag with me and collect litter along the way”.
	Use of water, resources	“Showering in a big plastic tub, we catch the water, that shower water we put in buckets and flush the toilet with it”
Behavioral change because of multiple nature experiences.	Cleaning up	“After that, I really started picking up more rubbish in nature”. “I regularly pick things up when I see them”. “When I come across litter, I pick it up”. “Cleaning up trash on the street, if I see something lying around, I always take it with me”.
	Food: More awareness and sustainable choices.	“Eating organic vegetables”. “We grow our own food as much as possible, organically”.

	Grocery shopping & Diet.	<p>“I also take nature into account when making choices about food (our family has become almost fully vegetarian in the last four years; we eat almost everything locally sourced)”.</p> <p>“Appreciation of a product, what value does a bell pepper have; how is it produced. Where does it come from and where does it go. Connecting with that and making choices based on it”.</p>
	Transport	<p>“It also had some influence on my driving”.</p> <p>“I try to combine trips when I take the car, and I choose not to fly at all in principle”.</p>
	Buying less, only what needed	<p>“I buy few things, I hate buying”.</p> <p>“Don’t buy more than we need”.</p> <p>“And in other consumption: buying secondhand or not buying at all because of the impact on the planet”.</p>
	Biodiversity-supporting gardening behaviors	<p>“I started my own vegetable garden”.</p> <p>“We grow our own food as much as possible, organically”.</p>

		<p>“Fewer tiles in the garden, as many plants as possible”.</p> <p>“Cleaning up much more dead wood to reduce change of wood fires”.</p>
	Simple living	“living and dwelling more sustainably and simply”.
	Buying second hand	<p>“I buy lots of second-hand clothes”.</p> <p>“And in other consumption: buying secondhand or not buying at all because of the impact on the planet”.</p>
	Buy higher quality products	“Buy better products”.
	Waste disposal	“I pay close attention to sorting my waste”.
	Use of resources, water,	“We use water sparingly.”