Stockholm Resilience Centre
Sustainability Science for Biosphere Stewardship

Stockholm University

Master's Thesis, 60 ECTS
Social-ecological Resilience for Sustainable Development
Master's programme 2019/21, 120 ECTS

Coming back to our senses:

Exploring the potential of guided forest bathing as an intervention for human-nature connection

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“The land is the real teacher. All we need as students is mindfulness. Paying attention is a form of reciprocity with the living world, receiving the gifts with open eyes and open heart.”

— Robin Wall Kimmerer

ABSTRACT

Fostering human-nature connection (HNC) relates to the inner worlds of humans as a realm of influence for sustainability and is considered a deep leverage point for system transformation. Both direct nature experiences and states of mindfulness are significant for influencing the development of HNC. Therefore, in this thesis, I explore the potential of guided forest bathing – an originally Japanese practice of mindfully immersing one's senses in the atmosphere of a forest – as an intervention for HNC. I do so by applying a mixed methods approach and a relational, multidimensional assessment of the qualities and effects of a guided forest bathing session, as conducted in the methodology of the Scandinavian Nature and Forest Therapy Institute. While not able to establish causality, the study results suggest that participation in just one guided forest bathing session may positively influence the development of HNC, primarily in participants new to the experience. The results also suggest that several qualities of guided forest bating are important for influencing HNC, including mindfulness, engagement of senses, and self-restoration. These qualities and others related to the specific structure and social setting of the experience can provoke thoughts that meaningfully shift how individuals perceive and interact with nature. This leads the thesis to conclude that guided forest bathing represents a novel nature experience with promising potential as an intervention for HNC.

Keywords:

Human-nature connection, guided forest bathing, assessment, mindfulness in nature, interventions, sustainability transformation, deep leverage point

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ACKNOWLEDGEMENTS

I wish to express huge gratitude to all the study participants who answered the two online surveys and especially to those who took the time to be interviewed. Your eloquent, rich responses to my interview questions and your admirable openness about your thoughts and experiences are what gave additional life and richness to this thesis.

Many persons contributed greatly to making this thesis project possible. A massive thanks to my external supervisor and collaborator ***Petra Ellora Cau Wetterholm*** for the support, long discussions and for granting me access to the SNFTI methodology, internal network of guides, and your immense wisdom about guided forest bathing. A particular thank you to the ten amazing forest bathing guides who joined the study and made data collection possible:

- Petra Ellora Cau Wetterholm, Scandinavian Nature & Forest Therapy Institute and Shinrin-Yoku Sweden, https://www.scandinaviannatureandforesttherapyinstitute.com/
- Annette Öhrn, SaktaIn, http://www.saktain.se
- Kerstin Ulbing Ponnert, Shinrin-Yoku Lund/Ängelholm
- Kristina Olsson, Gröna samtal, http://gronasamtal.se/
- Lotta Ihse, Urban Balance club, http://www.urbanbalanceclub.se
- Margit Melin, Melins Ord, http://www.melinsord.se
- Maria Moody Källberg, Nätverkskompaniet MMK AB Skogsvaro, https://natverkskompaniet.se/skogsvaro/
- Marie Rosén, NaturStark AB, https://www.naturstark.se/
- Peter Amling, MindChange, https://www.facebook.com/mindchangesweden/
- Susanna Bävertoft, True by You, https://truebyyou.se/

Of course, a warm thank you to my supervisors ***Matteo Giusti*** at Gävle University and ***Vanessa Masterson*** at Stockholm Resilience Center for believing in me and this thesis idea. You both provided invaluable feedback and support, particularly when we were faced with having to pause the thesis due to the COVID-19 pandemic and then quickly recoup a few months later. Last but not least, I want to say thank you to my thesis group classmates for the feedback and encouragement in the writing process, and to my beloved friends and family for cheering me on.

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ACRONYMS

ACHUNAS – Assessment framework for Children's Human Nature Situations

HNC – Human-Nature Connection

SNS – Significant Nature Situation

NEP – New Environmental Paradigm

SNFTI – Scandinavian Nature and Forest Therapy Institute

Word count: 9 948 words

(Including footnotes, excluding tables, figures, and appendices)

1. INTRODUCTION

Humanity is facing great social and environmental challenges. These challenges are part of the same social-ecological system that has kept us on a trajectory of unsustainability during the past decades (Steffen et al. 2011). A commonly argued cause of today's unsustainability is the dominant Western paradigm of anthropocentrism – a human-centered environmental ethic and worldview of separation that places only instrumental value on nature[1] (Katz 1999). This way of thinking has been suggested as a driver for the current economic growth model that frames negative environmental impacts as externalities and nature as solely a never-ending resource from which to exploit and profit (Katz 1999; Strang 2017). Scholars suggest that the cognitive disconnection and lack of understanding of the interdependence between humans and nature is not just a cause of unsustainability but a symptom of the larger changes in society (Seppelt & Cumming 2016; Pyle 2003), such as urbanization (Cumming et al. 2014; Giusti 2019) and a general "extinction" of direct nature experiences (Soga & Gaston 2016; Giusti et al. 2014).

The call for humanity to "reconnect with nature" is growing stronger among both citizens and scholars (e.g. Folke et al. 2011; Zylstra et al. 2014). Reconnecting with nature is about shifting the relationship between humans and the rest of nature. It is a shift away from the current unsustainable use of natural resources for short-term benefit, to a relationship in which there is a mutually beneficial co-evolution and an acknowledgment of the interconnectedness of people and nature (Abson et al. 2017). An umbrella term for the characterization and analysis of people's connection with nature is "human-nature connection" (HNC). Interventions focused on fostering individuals' HNC may contribute to sustainability transformation. For example, Ives et al (2018) argue that interventions that develop individuals' HNC can act as deep leverage points with potential to transform the underlying values, worldviews, and overall direction of the current societal system. There is also growing evidence and consensus that strengthened HNC in individuals is linked to pro-environmental concern and sustainable behaviors (e.g. Geng et al. 2015; Kals et al. 1999; Zaradic et al. 2009; Conrad & Hilchey 2011). Fostering HNC is thus related to the "inner worlds" of people as a realm of influence for sustainability.

[1] The word *nature* here and throughout this thesis is conceptualized and defined as formulated by Lumber (2016, p.8), i.e. *nature* is the phenomena of the physical world, including plants, animals (including humans), the landscape, and other features of the earth and cosmos. These phenomena exist in all environments and include phenomena shaped or managed by humanity. The creations and artefacts of humans that fall outside of the remit of natural phenomena are not considered to be nature.

Acknowledging the potential of the inner dimensions of people, scholars are increasingly discussing and exploring the potential of contemplative practices for sustainability such as mindfulness (e.g. Wamsler 2018; Ericson et al. 2014). Mindfulness is the intentional non-judgmental attentiveness to the present moment and is believed to be an inherent human capacity that can be trained and developed (Buss 1980; Condon et al. 2013; Baer 2003; Kabat-Zinn 1990). In addition to improvements in qualities such as awareness and pro-sociality, it is theorized that mindfulness as a state and contemplative practice has the potential to positively influence the development of individuals' HNC (Thiermann & Sheate 2020), particularly when performed and practiced in nature (Unsworth et al. 2016). One such mindfulness-based nature experience that is becoming popular in Europe and the US is the Japanese therapeutic practice of 'shinrin-yoku', literally translated to 'forest bathing' (Li 2010). It typically entails a slow walk in a forested area where the senses are mindfully allowed to "bathe" in the forest atmosphere. Forest bathing has since the 1980's been a big part of the national health programme in Japan (Li 2010) and currently 62 certified forest therapy bases with guided forest bathing activities have been established in Japan with the purpose to promote wellbeing and protect forests (Farkic et al. 2021).

In Western contexts, a key idea of guided forest bathing sessions is that the mindful, sensory contact with nature enables a reciprocal relationship and healing process to develop between the person being guided and the surrounding environment (SH 2019). This emphasis on fostering mindfulness and reciprocal human-nature relationships has led several scholars to suggest that forest bathing may affect people's connection to nature (Lumber et al. 2017; Kotera et al. 2020; Clarke et al. 2021). To my knowledge, however, only one study has experimentally assessed the effects of guided forest bathing on a measure of HNC (McEwan et al. 2021). These authors found indicatory evidence of a significant influence on nature connection but could not draw firm conclusions. Therefore, the potentially significant effect of guided forest bathing on individuals' HNC warrants further investigation. Indeed, increased scientific understanding of this effect can provide valuable insight into what qualities of the nature experience are significant for HNC, and thus for interventions aimed at cultivating HNC at large. In fact, the most recent review of forest bathing literature explicitly calls for future research on the link between forest bathing and HNC (Kotera et al. 2020). This thesis seeks to answer that call.

1.1. Research questions

The purpose of this thesis is to explore the potential of guided forest bathing as an intervention for HNC. I do this by using a mixed methods approach to investigate how guided forest bathing may influence HNC. My exploration is therefore guided by the following research questions:

> **RQ 1:** How does participation in guided forest bathing influence individuals' HNC?
> **RQ 2:** Which qualities of guided forest bathing influence HNC?

2. THEORETICAL FRAMEWORK

2.1. Human-Nature Connection (HNC)

Research on the relationship between humans and nature is a large field of study with a diversity of disciplinary perspectives, research approaches, and conceptualizations. To consolidate, Ives et al (2017) conducted a systematic review of the literature and found that HNC is often approached from one of three dimensions: HNC as mind, HNC as experience, or HNC as place. Research from the first dimension understands HNC as a psychological entity and tends to use an objectivist epistemology and quantitative methods such as psychometric scales (e.g. Nisbet et al. 2009; Mayer & Franz 2004). HNC as experience uses more qualitative and subjectivist approaches to describe individuals' unique interactions and relationships with nature (e.g. Cosquer et al. 2012). Finally, HNC as place looks at human-nature relationships as primarily contextual using a constructionist epistemology and tries to understand the interactions of people and specific places or landscapes (e.g. Clan et al. 2016).

To bridge these disciplinary differences, Ives et al (2017) suggest an interdisciplinary lens for future HNC research where several of these dimensions are integrated rather than explored in isolation. As a response to this call, Giusti et al (2018) adopted an embodied ontological approach when exploring children's HNC. Instead of viewing HNC as only a psychological entity, the authors drew inspiration from the relational ontology of 'embodied ecosystems' (Raymond et al. 2018), which highlights the dynamic and relational values that emerge between humans and nature. Nature experiences and the relationship humans have with their surrounding environments are, in this view, in dynamic co-creation. The interactions between mind, body, culture, and the environment create over time a pathway of HNC development for the individual that has either sustainable or unsustainable properties (Giusti et al. 2019). For the current thesis, I follow this embodied ontological approach to HNC by applying the "Assessment framework for children's human nature situations" (ACHUNAS).

2.1.1. ACHUNAS – An embodied approach to human-nature connection

The ACHUNAS framework (Giusti et al. 2018) was designed as a tool to assess where and how children connect to nature. It uses two lists of criteria. The first set of 16 criteria qualifies the kind of nature experiences people have (table 1). These criteria aim to understand how nature experiences significantly impact the development of HNC. This serves the purpose of understanding if a nature experience is a significant nature situation (SNS) for HNC or not.

The second set of criteria characterizes individuals' HNC. In the framework, ten cognitive, affective, and behavioral abilities define the depth and breadth of people's HNC (table 2). The development of these ten abilities follows a natural progression of three phases, from being comfortable and curious in nature ("being *in* nature"), to being able to act in nature ("being *with* nature"), to being able to care and act for nature ("being *for* nature"). This embodied approach to HNC recognizes that people's HNC is a complex set of learned abilities that develops over time through routinization in a specific socio-cultural context (Giusti et al. 2014, Giusti 2019).

2.1.2. New Ecological Paradigm (NEP)

A conceptually related construct commonly studied together with HNC within environmental psychology is environmental attitude. One of the most widely used instruments for measuring people's environmental attitude is the New Ecological Paradigm scale (Dunlap et al. 2000).

TABLE 1 | The 16 qualities of significant nature situations of the ACHUNAS, as described in Giusti et al (2018).

Quality of SNS	**Description of quality**
Entertainment	Nature situations that are fun, joyful, amusing, or enjoyable.
Thought provocation	Nature situations that create new ways of conceiving human-nature interaction.
Intimacy	Nature situations that feel private or intimate and allow a personal experience with nature.
Awe	Nature situations that are amazing, of overwhelming attraction, or mesmerizing, that create a "wow effect."
Mindfulness	Nature situations that grasp children's focus and alertness, that make the child "be in the flow".
Surprise	Nature situations that are unpredictable or unexpected. In these situations children's line of thought is interrupted and nature draws their attention.
Creative expression	Nature situations that involve arts, myths, stories, music, or role-play.
Physical activity	Nature situations that require body movement or any form of physical activity.
Engagement of senses	Nature situations that activate children's senses (smell, touch, hearing, etc)
Involvement of mentors	Nature situations that involve persons, such as teachers, experts, or relatives, who are capable of inspiring, encouraging, or leading the nature experience for the child.
Involvement of animals	Nature situations that involve interaction with animals.
Social/cultural endorsement	Nature situations that involve positive peer pressure, support from significant others, social acceptance, or cultural reinforcement.
Structure/instructions	Nature situations characterized by a set of rules that define the frame within which the child can act.
Self-driven	Nature situations that are chosen by the child, child-initiated (children autonomously decide when to begin the nature activity), and open-ended (children autonomously decide when to conclude the nature activity).
Challenge	Nature situations in which children overcome challenges psychologically or physically adverse conditions, such as fear or cold.
Self-restoration	Nature situations of psychological, physical, or social relief. For example, relief from stress, fatigue, or gender stereotypes.

TABLE 2 | The ten abilities of human-nature connection and three phases of progression in the ACHUNAS as described in Giusti et al (2018). Original descriptions are changed from "The child" to "The person".

Phases of HNC	Abilities of HNC	Description of ability
Being in nature	Feeling comfortable in natural spaces	The person demonstrates ease in natural spaces and feels comfortable with natural elements in the outdoors (e.g. dirt, mud, rain, or the sun).
	Being curious about nature	The person shows interest and motivation in exploring nature.
Being with nature	Reading natural spaces	The person is able to see the possibilities for action in natural spaces that are not purposefully designed by man.
	Acting in natural spaces	The person is able to perform activities in nature, for example, nature playing, camping, or outdoor sports in nature.
	Feeling attached to natural spaces	The person shows a sense of belonging to specific natural spaces, to which they feel part of.
	Knowing about nature	The person demonstrates knowledge of animals, plants, and ecological dynamics.
	Recalling memories about nature	The person is able to recall past nature experiences and tell stories of lived life with nature.
Being for nature	Taking care of nature	The person is able to be responsible for nature and feels empowered to act for the wellbeing of nature.
	Caring about nature	The person is able to feel care, concern, sensitivity, empathy, and respect for nature.
	Being one with nature	The person is able to identify with nature and has a sense of profound personal attachment to nature that can be described as spiritual. Love for nature, humbleness in relation to nature, and assuming to be a small part of the immensity of nature are manifestations of this ability.

The NEP scale is designed to measure the person's held beliefs about humanity's relationship with nature in order to reflect endorsement of an ecological worldview. Although both HNC and NEP positively influence ecological behavior (e.g. Dunlap et al. 2000; Derdowski et al. 2020; Geng et al. 2015; Kals et al. 1999), the two are considered distinctly different in that NEP is a knowledge-based cognitive construct (Mayer & Franz 2004).

2.2. Mindfulness and sustainability

Traditional mindfulness is an ancient Buddhist practice or state of being in which one is "paying attention in a particular way: on purpose, in the present moment, and non-judgementally" (Kabat-Zinn 1994, p.4). When being mindful, "thoughts and feelings are observed as events in the mind, without over-identifying with them and without reacting to them in an automatic, habitual pattern of reactivity" (Bishop et al. 2004, p.232). In Buddhist psychology, cultivation of mindfulness is known to nurture qualities such as kindness and compassion, as well as the development of an ethical stance toward both the animate and inanimate world (Grossman 2015). Mindfulness is also related to reduced anxiety and stress, combined with the potential for greater awareness of one's thoughts, emotions, and actions

(Chambers et al. 2009). For these reasons, many scholars are discussing and exploring the potential of mindfulness for sustainability (e.g. Wamsler 2018; Ericson et al. 2014). Thiermann & Sheate (2020) recently conducted an extensive review of the literature and could find six main theoretical arguments with backing in empirical work for the benefits of mindfulness on sustainability: 1) increased awareness and reduced automaticity in behavior, 2) enhanced personal health and subjective well-being, 3) improved pro-social tendencies such as compassion for others and the environment, 4) stronger intrinsic and transcendental values (altruistic and biospheric) combined with moral decision-making, 5) increased openness to new ideas, experiences and behavior-changes, and finally 6) stronger HNC.

2.2.1. Mindfulness and HNC

There is considerable literature confirming the correlational effects between various measurements of HNC and mindfulness. Howell et al (2011) found that mindfulness was significantly correlated with HNC and that observing and having an attentive mind were the strongest predictors of HNC. This suggests that mindfulness activities that involve slowing down and actively paying attention might play an important role in the development of HNC. The significant associations between HNC and mindfulness have also been consolidated by a recent meta-analytic investigation including 2435 individuals by Schutte & Malouff (2018). The authors suggest that the non-judgmental and present-moment awareness qualities of mindfulness may "encourage individuals to more fully engage with nature experiences and develop a sense of connectedness to nature" (Schutte & Malouff 2018, p.13).

2.2.2. Mindfulness in nature and HNC

Although studies on mindfulness in nature are quite scarce, there are indications of the benefits. Unsworth et al (2016) recruited students to participate in a 3-day nature trip where they were randomly assigned to either a treatment that included formal meditation and informal mindfulness practice or a non-meditation control condition. The study results showed that meditating and being mindful in nature had larger significant effects on HNC than simply being in nature. Djernis et al (2019) suggest from their systematic review of nature-based mindfulness that the significance of nature as context may be explained by the Attention Restoration Theory's concept of 'soft fascination' (Kaplan & Kaplan 1989). The effortless attention cultivated in nature thus encourages a "letting go" and disengagement from thoughts and compulsions, which is a common aim in mindfulness practice. However,

the authors conclude by stating that although nature-based mindfulness appears superior to mindfulness in non-natural contexts, there is still a need for more research to understand what constitutes a mindfulness intervention in nature and how to best design such interventions.

2.3. Forest Bathing

2.3.1. Origin

'*Shinrin-yoku*', literally translated to 'forest bathing', is a Japanese mindfulness-based practice where people "immerse themselves in nature, while mindfully paying attention to their senses" (Kotera et al. 2020, p.1). The concept was originally coined and implemented by the Japanese Ministry of Agriculture, Forestry and Fisheries in the early 1980s, in an attempt to encourage the Japanese people to use forests for improved wellbeing and to regulate work-related stress (Li 2010). It has since become a big part of the national health programme in Japan where it is also referred to as 'forest therapy', or '*shinrin-ryoho*' in Japanese. Today, the Japanese Forest Therapy Association has established 62 certified forest therapy bases and trails where guided forest bathing is offered to promote wellbeing while also protecting the forests and revitalizing rural tourism (Farkic et al. 2021). The concept and popularity of forest bathing by Japanese people is said to have its roots in the animistic beliefs and reverence for nature that is part of the Shinto and Buddhist tradition (Li 2018). Thus, recognizing the forest as a source of wellbeing and a place of connecting with the spirits of nature made sense in the local cultural context, and the practice was quickly embraced by Japan and surrounding countries such as China.

2.3.2. Guided forest bathing in the West

In recent years, the practice of forest bathing has spread to the Western world, primarily the U.S. and Europe, where it has inspired independent frameworks and methodologies for guided forest bathing sessions adapted for Western contexts. The way guided forest bathing is conducted varies, but a key idea in many Westernized forest bathing frameworks is that a deepened relationship and reciprocal healing process develops between the person and the environment (SH 2019). Indeed, in Sweden, a framework for guided forest bathing sessions has been developed by the Scandinavian Nature and Forest Therapy Institute (SNFTI) with the purpose of promoting increased well-being and a deepened connection and relationship to nature. A guided session by SNFTI consists of a 2 to 3-hour slow forest walk with a certified forest bathing guide. The structure of the session follows a process of four distinct phases that

aims to move the participant from separation to a state of deepened connection through invitations to sensory opening activities and ends with integration (Petra Ellora Cau Wetterholm, personal communication, November 12, 2021).

2.3.3. Guided forest bathing and mindfulness

A fundamental concept within the methodology of guided forest bathing by SNFTI is *Naturvaro*®[2]. The word, loosely translated from Swedish to "natural presence", describes a form of natural mindfulness; a mindful state of being that is believed to arise and deepen progressively during a guided forest bathing session (Petra Ellora Cau Wetterholm, personal communication, November 12, 2021). According to Wetterholm (ibid), the state and practice of *naturvaro* differ from traditional mindfulness in that it does not use any specific approach or technique to felt sensations, emotions, or thoughts. Instead, the participants are invited and encouraged by the guide during the session, yet free to follow and allow what feels right and comfortable or natural to them. Indeed, this adaptability was also noticed by Clarke et al (2021) when comparing the practices of forest bathing and mindfulness in their recent paper. The authors found that while mindfulness emphasizes focused awareness and acceptance of the internal environment, forest bathing may be more accessible by shifting the attentional focus to the external environment. In this way, forest bathing may suit and benefit a broader range of people through its gentle and accommodating approach to mindfulness.

2.3.4. Guided forest bathing and HNC

Most existing research on forest bathing has focused on the health benefits (Kotera et al. 2020), which include therapeutic effects on the cardiovascular, immune, and respiratory system, as well as increased mental relaxation, reduced anxiety, and feeling of selflessness and gratitude (Hansen et al. 2017). More recently, the potential influence of guided forest bathing on HNC has received attention among scholars (e.g. Lumber et al. 2017; Kotera et al. 2020; Clarke et al. 2021). To my knowledge, only McEwan et al (2021) have included a measure on HNC in their recent pilot study investigating the effects of guided forest bathing on wellbeing measures on participants in the UK. The authors used the Inclusion of Nature with Self scale (INS; Schultz 2001), a single-item measure assessing the level of inclusion of nature in a person's self-concept, to measure HNC and found a significant increase after guided forest bathing. This evidence is indicative of a possible effect on HNC. However,

[2] The word and methodology of *Naturvaro* is trademarked by SNFTI-founder Petra Ellora Cau Wetterholm.

given the methodological limitations of single-item measures (Diamantopoulos et al. 2012) and the call for a multidimensional approach to HNC (Ives et al. 2017), additional research is important to validate this potentially significant effect.

3. METHODOLOGY

3.1. Ontological position

My methodological approach in this thesis is grounded in the relational ontology of embodied ecosystems as operationalized in the ACHUNAS framework (Giusti et al. 2018). Through this lens, HNC is understood as a dynamic outcome of an interaction between mind, body, culture, and environment – encompassing all three dimensions of HNC: psychological, experiential, and contextual (Ives et al. 2017; Giusti et al. 2019).

3.2. Mixed-methods research design

This study employed a sequential mixed methods design (figure 1). Chronologically, the study began with quantitative surveys that all participants answered before and after attending a guided forest bathing session. Afterward, I conducted semi-structured interviews with a random selection of the participants to explain and triangulate the survey results. The quantitative and qualitative data sets were then analyzed separately, and their insights were combined during interpretation. This research design allowed me to compare quantitative and qualitative results and to qualitatively deepen the meaning and understanding of the variables being studied quantitatively (Creswell & Clark 2006). This design is also compliant with the multidimensional conceptualization of HNC and produced a nuanced understanding of how guided forest bathing influences participants' HNC.

3.3. Guided forest bathing sessions

The guided forest bathing sessions in this study were conducted in collaboration with the Scandinavian Nature and Forest Therapy Institute (SNFTI). In Sweden, SNFTI is the main structural platform for standardizing guided forest bathing in the region and its research-based methodology is taught to certify new forest bathing guides through the institute. The SNFTI methodology is thus considered the most consistent, repeatable, and controlled and was for this reason chosen for the study.

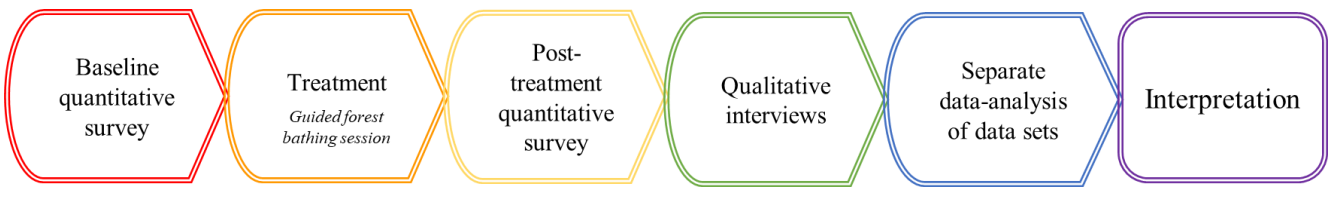

FIGURE 1 | Illustration of the sequential mixed methods research design used for this study.

All data collection took place in Sweden during a nationwide guided forest bathing day organized by the SNFTI on March 20th, 2021, with ten certified guides leading guided sessions in nine different forest locations. The ten locations were mixed forests and situated around the cities Stockholm, Malmö, Lund, or Västerås (figure 2). The forest environments differed in characteristics (see summary in table 3). All sessions allowed a maximum of 5 participants excluding the guide, were two to three hours long, and took place between 9am and 2pm. The sessions followed the confidential SNFTI methodology and a specific routine consisting of invitations including slow walking, guided sensory-activating exercises, short group sharings, and a closing tea ceremony.

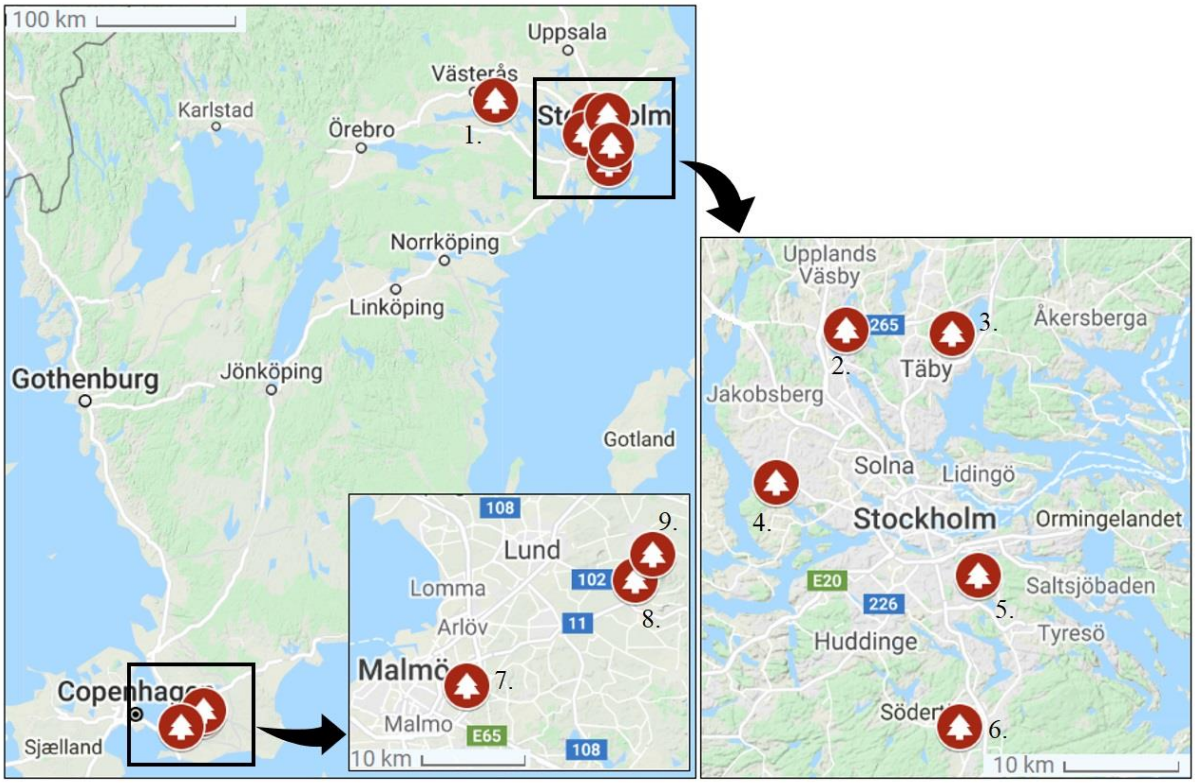

FIGURE 2 | Map of southern Sweden showing the nine locations of where the guided forest bathing sessions took place (Google, n.d.). Two of the sessions took place in Törnskogen nature reserve (location number 2).

TABLE 3 | Names and descriptions of the nine forest locations used for the guided forest bathing sessions. The list numbers correspond to the numbers in figure 2.

Locations	Characteristics of forest
1. Solviksskogen nature reserve	Urban nature reserve located 15 km southeast of city Västerås, about 100 km west of the capital Stockholm. Hilly landscape dominated by older pine and spruce forest.
2. Törnskogen nature reserve	Nature reserve close to the northern Stockholm suburb Sollentuna. Hilly landscape with a lot of pine and wetlands, elements of deciduous forest and some open cultivated land.
3. Skavlöten outdoor courtyard	Recreational area within a nature reserve, close to the northern Stockholm suburb Täby. Areas with older pine forests, some mixed forest and open land. Next to a lake.
4. Grimstaskogen nature reserve	Nature reserve close to the western Stockholm district Hässelby. Mostly mixed and deciduous forests, with small patches of pine and rocky ground.
5. Nacka nature reserve	Nature reserve close to the southern Stockholm district Bagarmossen. Varied area with open ground, some mixed forest, pine trees, rocky outcrops, and wetlands with small brooks.
6. Rudan nature reserve	Nature reserve with recreational area close to Stockholm, located next to a train station. Forested parts with coniferous trees, deciduous and wetland forest elements. Previously used for mowing and as pasture.
7. Gyllins garden	Urban nature park in the Husie district of the city Malmö in southern Sweden. Was formerly used as commercial garden. Mix of open land with forested areas of beech, coniferous and oak trees.
8. Dalby Norreskog nature reserve	Semi-urban nature reserve close to the suburb Dalby, located about 10 km east of the city Lund in southern Sweden. Mix of young and old oak forest, beech forest, wetlands, and pastures.
9. Måryds nature reserve	Rural nature reserve located about 14 km east of the city Lund in southern Sweden. Mostly open heathland and pastures with smaller patches of deciduous forest.

3.4. Quantitative surveys

3.4.1. Participant selection method

The study employed convenience sampling by recruiting participants from the public who had already signed up to join the ten guided forest bathing sessions included in the study. Interested persons applied by filling out a screening survey with a plain language statement (see appendix 1). Only persons over 18 years were accepted as study participants and so persons who fulfilled this criterion were contacted and asked to give consent for participation before finally being accepted as study participants (see appendix 2). In the end, a total of 26 participants completed both surveys. The incentive to participate in the study was a 50 SEK discount on the guided forest bathing session fee (original value 350 SEK).

3.4.2. Data collection procedure

Study participants were asked to answer two online surveys created using Google Forms. The pre-treatment survey was sent out via email to the study participants one day before the guided forest bathing sessions and the post-treatment survey was sent out on the day of the sessions. Participants were asked to answer the surveys as soon as possible before and after the session to reduce potential limitations to internal validity. Both surveys were available in two language versions (English and Swedish) to ease comprehension.

3.4.3. Survey measures

HNC was assessed using a scale composed of ten items (table 4). Each item corresponded to one of the ten abilities of HNC as formulated in the ACHUNAS framework (Giusti et al. 2018). The surveys also included the shorter, 8-item version of the New Ecological Paradigm (NEP) scale (table 5; Zhu & Lu 2017) to measure the effect on environmental attitude in order to compare with the HNC results. Lastly, the qualities of guided forest bathing affecting HNC were assessed in the post-treatment survey using a scale with the list of 16 qualities of significant nature situations as developed in the ACHUNAS (Giusti et al. 2018). The original descriptions of the qualities were slightly modified to fit adults and the context of guided forest bathing. Each quality was represented by one item (table 6). All measures employed 10-point Likert scales, ranging from 1 ("Do not agree at all") to 10 ("Agree completely").

TABLE 4 | The survey items used for each of the ten abilities of HNC.

Ability of HNC	Survey item
Feeling comfortable in natural spaces	1. I am comfortable being outdoors, even in unpleasant weather.
Being curious about nature	2. I am curious about how different plants, animals, and ecosystems look and work.
Reading natural spaces	3. I can find something to do everywhere in nature.
Acting in natural spaces	4. There is an infinite number of activities that I can do in or with nature.
Feeling attached to natural spaces	5. I feel attached to certain places in nature as they are special to me.
Knowing about nature	6. I can tell if plants, animals, and ecosystems surrounding me are healthy or not.
Recalling memories about nature	7. I have vivid memories in or with nature that have shaped who I am.
Taking care of nature	8. I know how to take care of plants, animals, and ecosystems around me.
Caring about nature	9. I am concerned, care profoundly, and respect all plants, animals, and ecosystems around me.
Being one with nature	10. I feel a deep connection and love for the plants, animals, and ecosystems around me.

TABLE 5 | The 8-item version of the New Ecological Paradigm Scale as by Zhu & Lu (2017).

New Ecological Paradigm Scale items
1. We are approaching the limit of the number of people the Earth can support
2. When humans interfere with nature it often produces disastrous consequences
3. Humans are seriously abusing the environment.
4. Plants and animals have as much right as humans to exist.
5. Despite our special abilities, humans are still subject to the laws of nature
6. The Earth is like a spaceship with very limited room and resources.
7. The balance of nature is very delicate and easily upset.
8. If things continue on their present course, we will soon experience a major ecological catastrophe.

TABLE 6 | The survey items used for each of the 16 qualities of significant nature situations, with adapted descriptions to fit the context of the study.

Quality of SNS	Description	Survey items
Entertainment	The guided forest bathing experience felt fun, joyful, amusing, or enjoyable.	1. I had a lot of fun during the session.
Thought provocation	The guided forest bathing experience provoked thoughts and new ways of conceiving human-nature interaction.	2. The session made me think about nature in a new way.
Intimacy	The guided forest bathing experience felt private or intimate and allowed a personal experience with nature.	3. The session felt intimate, it was a very personal experience with nature.
Awe	The guided forest bathing experience felt amazing or mesmerizing, created a "wow effect."	4. The session was amazing and mesmerizing.
Mindfulness	The guided forest bathing experience grasped my focus and alertness and made me feel present and "in the flow".	5. The session grasped my focus and made me feel present "in the moment".
Surprise	The guided forest bathing experience interrupted my line of thought and drew my attention to nature.	6. The session was surprising.
Creative expression	The guided forest bathing experience involved arts, myths, stories, music, or role-play.	7. The session involved stories, music, and other art forms.
Physical activity	The guided forest bathing experience included some body movement or physical activity.	8. The session involved physical activity.
Engagement of senses	The guided forest bathing experience activated my senses (smell, touch, hearing, etc).	9. The session engaged all my senses.
Involvement of mentors	The guided forest bathing experience involved a person who inspired, encouraged, or led me through the experience.	10. The session was together with people who inspired, encouraged, or led me through the experience.
Involvement of animals	The guided forest bathing experience included physical or non-physical interaction with animals.	11. The presence of and/or interaction with animals was a central part of the session.
Social/cultural endorsement	The guided forest bathing experience involved positive peer pressure, support from significant others, social acceptance, or cultural reinforcement.	12. My surrounding social community of people was central to making this session memorable.
Structure/instructions	The guided forest bathing experience was characterized by a set of rules or instructions that formed the structure of the experience.	13. The session was structured by a clear set of instructions and guidelines.
Self-driven	The guided forest bathing experience was self-initiated and open-ended (I autonomously decided when to begin and conclude the nature experience).	14. I decided when to start and when to finish the session.
Challenge	The guided forest bathing experience challenged me or made me overcome psychologically or physically adverse conditions, such as fear or cold.	15. The session was challenging for me physically and/or mentally.
Self-restoration	The guided forest bathing experience gave me psychological, physical, or social relief. For example, relief from stress, fatigue, or gender stereotypes.	16. The session was relaxing or restorative for me both physically and mentally.

3.4.4. Quantitative data analysis

The quantitative data analyses tested the hypotheses that the guided forest bathing sessions positively influenced HNC and NEP scores. Descriptive statistical analysis was conducted using Excel and all statistical tests were conducted using IBM SPSS Statistics version 27. Independent samples t-tests were used to test baseline differences in the abilities of HNC. NEP, and the 16 qualities of SNS within the sample between participants with and without previous experience of guided forest bathing. Paired-samples t-tests were then conducted to determine significant differences before and after in 1) HNC, 2) each of the three phases of HNC, 3) each of the ten abilities of HNC, and 4) NEP. The scores for each quality of SNS were analyzed descriptively. Stepwise multiple regression analysis was then used to determine which quality of guided forest bathing had the highest predictive power to change HNC.

3.5. Qualitative semi-structured interviews

3.5.1. Sampling and data collection procedure

A random selection of the study participants was invited to be interviewed post-treatment, resulting in a total of 16 interviews. The interviews were semi-structured and took place within one week following the guided forest bathing sessions. A set of open-ended interviewing questions were formulated in advance to guide the conversation and covered two main areas: 1) questions about the interviewee's subjective experience of the guided forest bathing session, and 2) questions about thought-provocation and if insights and learnings were derived from the experience (see interview guide in appendix 3). Participants were given the choice to conduct the interview in Swedish or English and to be interviewed via Zoom (with or without video) or via telephone call. All interviews ended up being conducted in Swedish, were 45 to 60 minutes in length, and recorded with consent. As compensation for participating, each interviewee received 200 SEK.

3.5.2. Qualitative analysis strategy

All interviews were transcribed manually and then coded and analyzed using MAXQDA Plus 2020. Analysis followed the 6-phase process of thematic analysis as described by Braun & Clarke (2006). Analysis began with phase 1: becoming familiar with the data, through the transcribing and then re-reading of the transcripts several times and taking notes on the way. This was followed by an iterative cycle of phase 2: inductively generating initial codes and

phase 3: searching for themes. The analysis then moved into a new iterative cycle consisting of phase 3: searching for themes, and phase 4: reviewing themes, where relevant candidate themes were identified and the codes and each data segment were reviewed, refined, and collated several times, checking for consistency and aiming for internal homogeneity and external heterogeneity. Here, the themes were organized and placed into one of three broad categories: the first containing the 16 qualities of SNS as overarching themes, the second containing themes relating specifically to the quality thought provocation, and the third containing aspects expressed or interpreted as negative or having a negative influence. Lastly, the analysis moved into phase 5: defining and naming the themes within the broad categories, which included translating the themes, codes, and quotes from Swedish to English, before the last phase where the results are reported.

4. RESULTS

4.1. Descriptive and statistical survey results

4.1.1. Sample description

Within the sample (n=26), there were 24 females and 2 males. More than half (56%) were between the age of 46-65 years old, followed by an age group of 30-45 years old (31%). All participants reported living in or near urban environments. 17 participants did not have previous experience of guided forest bathing and both males belonged to this group. The pre-treatment survey suggests that the study sample had a relatively high baseline HNC (M=8.2 of max 10). When analyzing differences within the sample, independent samples t-tests suggest that the participants without previous experience of guided forest bathing had significantly higher baseline HNC than those with previous experience (t(9.565)=-.995, p=.002, d=.515). There was no significant difference in baseline NEP score between the two groups (p=.81).

4.1.2. Validity and reliability of ACHUNAS

The 10-item HNC measure and the subscale with the 16 qualities of SNS developed for this study both had high internal consistency (Cronbach's α=0.9 and 0.84, respectively), suggesting high reliability of the scales.

4.1.3. HNC scores

When analyzing the entire sample, a paired-samples t-test suggests that HNC after guided forest bathing is significantly higher than the score before the session (t(25)=-3.521, p=.002). The effect size of the difference is medium to large (d=.69). However, this result is misleading in the light of the results from separately analyzing the participants with and without previous experience of guided forest bathing. For the participants with previous experience in guided forest bathing, there are no significant increases for neither HNC (p>.1), its phases (p>.05), or any of the abilities of HNC (p>.05). For participants without previous experience in guided forest bathing, a paired-samples t-test suggests that their HNC significantly increased after the session (t(16)=-3.417, p=.0035) and the effect size here is large (d=.829). Specifically, the increase was in the second and third phase of HNC: "being with nature" (t(16)=-3.558, p=.003, d=.863) and "being for nature" (t(16)=-2.167, p= .046, d=.526). For these participants, the abilities of HNC affected by guided forest bathing were: "recalling memories about nature" (t(16)=-2.864, p=.011, d=.695), "reading natural spaces" (t(16)=-1.426, p=.027, d=.588) and "being one with nature" (t(16)=-2.293, p=.029, d=.580).

4.1.4. NEP scores

Paired samples t-tests suggest that NEP was not affected by guided forest bathing (p>.1). This is true both for participants with and without previous experience of guided forest bathing (p>.1).

4.1.5. Qualities of SNS

The survey result for the qualities of guided forest bathing is presented in figure 3 and shows that engagement of senses, self-restoration, and mindfulness were especially important for the participants (M>9 of max 10). The group of participants without previous experience of guided forest bathing rated the quality "challenge" significantly higher than those with previous experience (t(24)= -2.208, p=.001, d=.91). The final model from the stepwise multiple regression analysis suggests that the qualities of SNS reported by the participants predict 25% of the variance in HNC (F(1.24)=7.961, p=.009, R^2=.249). Yet, only one predictor variable, *mindfulness*, contributes significantly to the model (B=.26, t=2.82, p=.009). This means that HNC increased with 0,26 units for each unit increase in the quality mindfulness.

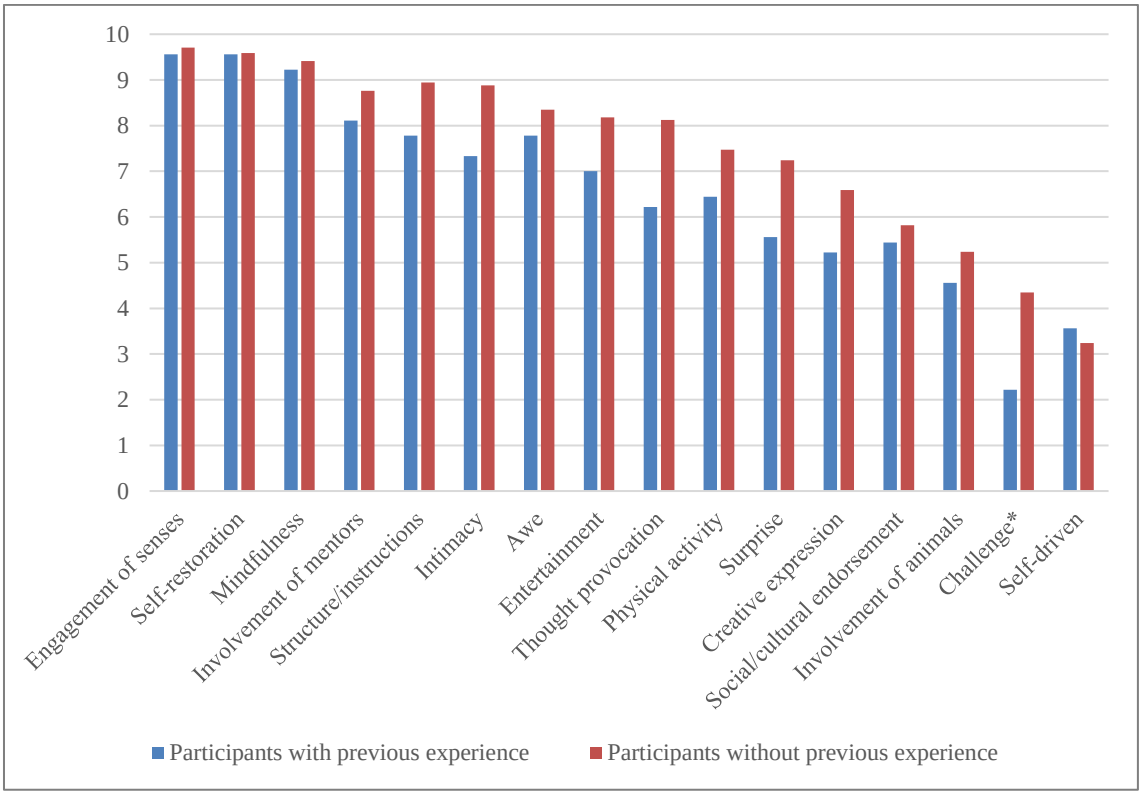

FIGURE 3 | Graph showing the survey results of the mean scores for each of the 16 qualities of SNS, comparing the participants with and without previous experience of guided forest bathing. There is only a significant difference between the two groups of participants in the quality *challenge* (p=.001, marked with *).

4.2. Explanatory insights from interviews

The results from thematic analysis of the interview data are presented here in three broad categories: 1) Guided forest bathing as significant nature situation, 2) Thought provocations, and 3) Negative aspects. All interviewees expressed a pre-existing affinity for spending time in nature. Of the 16 conducted interviews, ten interviewees did not have experience of guided forest bathing prior to the study. To maintain anonymity, all exemplar quotes are labeled P.01- P.16 to represent the 16 interviewees and the label ends with either "n" for persons new to guided forest bathing or "e" for those with previous experience.

4.2.1. Guided forest bathing as significant nature situation

This category contains the qualities of SNS as overarching themes, except for the quality thought provocation which is presented separately in 4.2.2. Each quality has several subthemes with mentions by interviewees either interpreted or expressed as having a positive influence on their experience. A complete list of subthemes for all SNS qualities is available in appendix 4. Subthemes were found for all qualities of SNS except for the quality "self-driven", which also had the lowest rating in the survey results. Other qualities less commonly mentioned in the interviews were "involvement of animals", "creative expression", and "challenge", thus also consistent with the ratings in the survey results. No distinction could however be found in the interview data between participants with and without previous experience of guided forest bathing for the quality "challenge". This is contradictory to the significant difference found in the rating of this quality in the survey.

Qualities that were frequently expressed by the interviewees as important to their guided forest bathing experience were primarily "engagement of senses", "self-restoration", "mindfulness", "structure/instructions" and "involvement of mentors". Again, this aligns with the findings in the quantitative survey and the interview data help explain how these qualities were expressed in the nature experience.

4.2.1.1. Engagement of senses

The quality of engagement of senses was rated among the most important in the survey and was also continually mentioned by all interviewees, regardless of previous guided forest bathing experience or not. Interviewees said that engagement of the senses contributed to feelings of calm, relaxation, mindfulness, and a deeper experience of the forest compared to other nature experiences. Some interviewees expressed it as:

"You take in the forest in a better way, by engaging all the senses… not just by looking for mushrooms!" [P.08n]

"With the sense of hearing we had one [invitation] where we sat still … I thought that was … that was very calming and relaxing." [P.14n]

Being guided into activating and using one sense at a time was especially impactful for the interviewees: "*It created a sense of security to check in with the sense of sight first, like, well now it is safe so I feel ready to close my eyes*" [P.13e]. The other subthemes for engagement of senses include being quiet in order to listen better, developing specific senses (for example by smelling moss and touching tree bark), and activating a wide-angle perspective to take in the whole forest in sight.

4.2.1.2. Self-restoration

Related to the previously presented quality, the guided forest bathing experience felt restorative to all the interviewees mainly by taking in the forest with all the senses. For example, one interviewee again compared it to mushroom-picking: "*When you pick mushrooms, you are not relaxed with all your senses. Instead you are very extremely focused with your vision and perhaps sense of smell, to find that mushroom*" [P.16e]. Interviewees linked the calming effect to aspects related to the structure of the session, such as the slow pace, being guided, and closing of the eyes. One interviewee expressed being so relaxed that they "*ended up in microsleep for a while*" [P.06n]. The self-restorative quality was also expressed as being related to social relief, where feelings of not having to perform and getting alone-time were frequently mentioned:

"I did not feel that I was supposed to accomplish anything … It makes you calm and able to focus on being here and now. There were no demands. That was nice." [P.04n]

"It was very relaxing and wonderful to take these moments to lie down or sit ... and be in silence in solitude for a while. You were not supposed to talk to each other … I think that was good and helped me see nature in a different way." [P.15n]

4.2.1.3. Mindfulness

Mindfulness was indicated by the statistical analysis to be the quality significantly predicting the positive influence on HNC. In the interviews, the quality was mainly conveyed as different expressions of being present in the moment and as a consequence of taking in the forest with all the senses. For example, some interviewees explained how the sensory activation took away focus from thoughts about work, the past or the future. Another

highlighted being in nature in a way not usually practiced: "*When you go for a walk in nature, you might listen to a podcast… But here your mobile was turned off and you were just being here, in nature*" [P.11n]. There was a noticeable emphasis among many of the interviewees that the guided forest bathing session helped them become mindful in a way that is reminiscent yet different from other mindfulness and meditation practices, as illustrated in these quotes:

> *"You have thoughts that come and go, but you were allowed to have that."* [P.08n]
>
> *"It was good that I got to try walking and being mindful. Because meditation for me can be a bit challenging, when you have to sit for a long time and observe the breath … It was nice to like, yes now I will observe how that leaf moves in the wind and then just stand and look at it for 10 seconds [laughs]"* [P.11n]
>
> *"To be in the present moment can also be to actually notice a much larger part of the stimulus that your mind gets from the environment you are in … To stop and let the impressions come just as they are and open up to all impressions."* [P.12e]

4.2.1.4. Structure and involvement of mentors

Aspects related to the structure of the guided forest bathing session were often mentioned by the interviewees as having a meaningful impact on their experience. For the interviewees who were new to the experience of guided forest bathing, the group setting was particularly impactful as it created a safe space where unusual activities are acceptable. One interviewee shared: "*Lying down in the woods… you don't do that otherwise. And above all not in a smaller area like this where people run past you, then they would think you are crazy"* [P.09n]. They continued by saying: *"It is easier to do it in a group, because then [people running by] understand that there is a purpose to lying there"*.

Having a guide and being guided enhanced the qualities of self-restoration and mindfulness by making the interviewees feel taken care of and not having to be in control: *"I think it's so nice that somewhere in the corner of my eye I can see the guide … oh there she goes so I'll just follow. I do not have to think so much… I think it is absolutely wonderful"* [P.02e]. Importantly, the involvement of a guide appears to have triggered significant thought provocations for the interviewees who were new to the experience, particularly the symbolism and terminology used by the guide: *"What gave the biggest impression on me really, was that [our guide] said … that we should think of the trees as living beings… they are still growing. It is easy to not think of them as living beings"* [P.06n].

4.2.1.5. Social-cultural endorsement

Although the quality social-cultural endorsement was not among the highest rated qualities in the survey, the interviewees without previous experience commonly mentioned the importance of the short group sharings. These created a socially supporting and allowing setting where "*if there was something you wanted to share you could say it, but it did not feel forced to do it"* [P.04n]. Hearing the other participants share their perspectives enriched the experience and also triggered thought provocation, as illustrated by this interviewee:

> "*It's always cool to like… Someone discovers this and someone else thought about this and a third think like this. To take part in other people's thoughts and reflections that I do not think about at all."* [P.06n]

4.2.2. Thought provocations

Thought provocation is presented as its own broad category although it was not among the highest rated qualities of SNS in the survey results. This is due to the depth and breadth of thought provocations mentioned by the interviewees when asked about it during the interviews. Six overarching themes were identified for this quality (see table 7 and appendix 4). Many of the thought provocations also enable valuable comparison and potential explanation of the survey results, as further described for each theme below.

4.2.2.1. Connectedness with nature

This theme reveals how interviewees thought about the impact of the guided forest bathing experience on their own perceived feeling of HNC. It is interesting to note that the clear distinction in baseline HNC and in the effect of guided forest bathing on HNC found in the survey results between participants with and without previous experience of the practice is not evident in the interview data. Instead, three subthemes of responses were identified. The first illustrates how about half of the interviewees, including persons new to the experience, perceive that their relationship or connection with nature has not changed. Instead, they explain how just one session is not enough to change how they feel and highlight that they already felt strongly about nature before: "*Since the forest bathing, you mean? No, I can't say that… I feel the same as before, for nature. There's no difference*" [P.04n].

TABLE 7 | Summary of the six themes for the SNS quality thought provocation. A complete list of subthemes for these themes is available in appendix 4.

Theme	Brief description	Exemplar quotes
Connectedness with nature	Participants' perceived connectedness with nature.	*"To be a little more in harmony with nature instead of… that the forest is something you just walk in and have coffee in and then leave. That this became a new experience in itself, to sit in the forest and just breathe."* [P.11n]
Guided forest bathing as a method and experience	Experience and methodology of guided forest bathing.	*"It's like something you did when you were younger, playing in the forest… I have not done it in many years, but it is clear that it… you get closer to nature."* [P.05e]
Shifts in perception of nature	Shifts and changes in the perception of nature.	*"That before drinking the tea you pour a little bit back to nature. So it is an insight that we are dependent on each other; if I take something, I must also give something back, so I think there is a great symbolism in that."* [P.13e]
Rediscovery of nature	Rediscovery of nature and forests.	*"You are reminded of … the importance of the forest. It's not like every time I go into the forest, I think about all these things. But maybe I will do next time I go to the forest."* [P.06n]
Human impact on nature	Noticing environmental issues or human's negative impact on nature and forests.	*"I felt sad to see that there was a lot of littering in some places. People had pulled out carpets, thrown beer cans, yes lots of plastic items…"* [P.11n]
Self-inquiry & personal changes	Changes or inquiry about the self.	*"I was actually reminded that... being in the forest gives… That it gives me something. And that I should prioritize it [being in the forest]."* [P.14n]

The second subtheme captures the response from one interviewee with previous experience of the practice who emphasized that the guided forest bathing session is more about connecting to the self: *"Forest bathing is more something that is inward than outward for me. Not in relation to nature perhaps but more into myself"* [P.12e]. The third subtheme however illustrates that several interviewees, regardless of previous experience of guided forest bathing, did indeed express that the session influenced their relationship to nature, especially in terms of feeling *closer* to nature:

> *"You feel extra closeness with nature and how important nature is and how can I nurture it, and so on. And what can it give me and what should I give it? It [the guided forest bathing session] definitely reinforces that."* [P.03e]

> *"It has become… closer to me, through this forest bathing session. Nature has come closer, the forest has come closer... It's weird that it can be like that but… yes, it actually has. It has become a stronger love in some way."* [P.10n]

4.2.2.2. Guided forest bathing as a method and experience

This theme captures thought provocation about guided forest bathing. This includes insights about the restorative benefits, the need to attend guided forest bathing regularly to "refill" before "*the hamster wheel starts spinning again*" [P.12e], and wanting to share about guided forest bathing with others: "*I think I will actually mention it during the parent/teacher meeting next week*" [P.10n]. The most prevalent comment among interviewees new to the guided forest bathing experience was however related to learning new activities to do when visiting a forest next time, such as moving at a slower pace, stopping occasionally, and using more senses. One interviewee shared: "*I was thinking that this,* this *[activity] I want to do when we are out and about on our hikes. To stop and… just close the eyes and feel the moment and the surroundings*" [P.04n]. This thought provocation indicates a developed ability to see possibilities for action in nature and could thus explain the significant increase in the ability of HNC "reading natural spaces" found in the survey results. The experience also seemed to provoke thoughts about past memories for the interviewees without previous experience of guided forest bathing, especially from childhood where they remember spending time in nature in a similar way, as illustrated by this interviewee:

> *"When I was out with my mother or maybe with older relatives… you were out in nature and you kind of sat by a stream and looked at the stream or you felt the moss and how different mosses felt and so on. So it was a bit like that… something that you may have done as a child and that you have forgotten a bit and lost in general society as well, this type of contact with nature."* [P.14n]

Similarly, this could explain the significant increase in the ability of HNC "recalling memories about nature" found in the survey results for these participants.

4.2.2.3. Shifts in perception of nature

This theme shows how the guided forest bathing session provoked shifts in perception of nature and specifically of trees. This was primarily among interviewees without previous experience in guided forest bathing. The shift was attributed to the symbolism and terminology used by the guide which contributed to seeing the animateness of the forest. As one interviewee put it: "*I think I will look at the trees more like … Look up at their canopy, put on a smile and take my hat off to them… when I go by on my walk in the forest*" [P.07n]. In general, hearing the guide and interacting with trees as living beings rather than just objects seemed to trigger feelings of awe and respect and new perspectives on HNC in the interviewees:

"*It gives a perspective that there is a life cycle going on, which is separate from my job and everyday life. It is there no matter what I do. I think there is a humility in that, somehow. To have contact with that part that I do not have contact with on a daily basis in the same way*" [P.12e].

"*I think [guided forest bathing] can help me to feel less like a stranger… and instead to feel more* with *the forest, in a way. Like, I'm an animal too.*" [P.10n]

This thought provocation and subtle shift in perception of nature may therefore explain the significant increase in the ability of HNC "being one with nature" found in the survey results.

4.2.2.4. Rediscovery of nature

The interviewees, especially those with previous experience, expressed that the guided forest bathing session became a rediscovery of nature rather than a discovery of something completely new. The session made them realize how much being in nature positively affects them both physically and mentally, and how they wish to spend more time in nature: "M*y God, how nice that I spent time in the forest this weekend. I want to do it again. I want more*" [P.16e]. A revived awe and fascination for nature was evident by several interviewees with previous experience of guided forest bathing who eagerly highlighted features and details that they remember from the session, for example: "*I found a mountain that had this amazing moss! … It was a fantastic moss that you could kind of pat on that was a bit like… hairy … with a cool sound when you hit it. God, I would never have discovered that if I had not been to a guided forest bathing session*" [P.16e].

4.2.2.5. Human impact on nature

Several interviewees, regardless of previous experience of guided forest bathing, mentioned noticing impacts on the forests by human activity, primarily littering and very trampled paths. In most cases, this was not due to the guide making them aware of it. However, in general, the interviewees expressed that the session had not impacted how they think or feel about environmental issues or human impact on nature. Rather, responses reveal a clear pre-existing environmental concern, as illustrated by these quotes:

"*Sometimes I wish it was untouched. I mean, if I go to Tyresö National Park, it's so badly trampled… I can almost get a little angry, because it has almost been destroyed just because the availability is too high*." [P.16e]

"*We talked about the spruce bark beetle and of course it is a bit scary if we have a climate that gets warmer which means that we get more spruce bark beetle outbreaks that destroy forests. I thought about that a bit."* [P.05e]

A few interviewees did however acknowledge that they did not think about environmental issues at all during the session and rather focused on the experience itself: "*I was more just in the here and now… To get the experience and the guidance*" [P.09n]. Together, the mentions in this theme may explain why NEP was not significantly increased in the survey.

4.2.2.6. Self-inquiry & personal changes

This theme captures mentions from interviewees that have to do with self-oriented thought provocation, such as being reminded of one's priorities in life and feelings of being more open after the session. An openness was even by interviewees who had a less positive experience of the session, saying that it generated "*an acceptance of what may appeal to different people*" [P.14n]. The forest environment itself also provoked thoughts in some interviewees. For example, one interviewee shared how seeing trees with different growing conditions helped her gain perspective on her own life:

> *"I saw this one tree that grew right by a rock that had to adapt enormously to this rock. Bend and make the trunk almost flat … And so I thought, yes, it's not like I should stop doing what I do … it's never always easy … I saw other trees that were a few meters away from this stone that could grow as trees normally grow and I realized, some simply have to fight more because there is a boulder in the way of one's life."* [P.12e]

4.2.3. Negative aspects

The final broad category contains eight overarching themes with mentions that were interpreted or expressed by the interviewees as being neutral, negative, or having a negative influence on their guided forest bathing experience (see summary in table 8). This demonstrates that although all participants joined the session of their own accord, there is a range in how it was experienced. For example, one interviewee who was new to guided forest bathing simply expressed that "*it was a pleasant experience, not much more than that*" [P.04]. Some of the themes are structural and relates to the choice of location for the session, such as proximity to traffic noise and forest trails busy with external people walking by: "*A family with children came walking right past ... you know, you lose focus a bit*" [P.06n]. Other themes are more personal, for example not feeling comfortable with the invitation to give

thanks to nature or the way the guide is referring to trees as living. The interviewees who expressed this were all new to guided forest bathing and some of them explained that it had made them hesitant to attend a session again. In contrast, all interviewees with previous experience of the practice expressed a wish to attend again in the future.

TABLE 8 | Summary of themes for the category "Negative aspects"

Theme	**Brief description**	**Exemplar quotes**
Urban noise	Hearing noise, e.g. traffic, shooting.	*"You could hear the road and a shooting range nearby that was also a bit disturbing when we were trying to listen for sounds."* [P.09n]
External people	Being disturbed by other external people walking by or making sounds.	*"I personally was disturbed because it was a group nearby that had a party going on and I thought it was a bit annoying with the music."* [P.12e]
Social pressure	Feelings of negative social influence or peer pressure.	*"At the tea ceremony at the end … it felt like there was more pressure to share something."* [P.14n]
Aspects of the guide	Disliking aspects of the guide.	*"As a guide myself, I usually always have a garbage bag with me and urge participants to pick it any rubbish or tell me to pick it up. I would have appreciated it if she had done that."* [P.13e]
Uncomfortable	Feeling uncomfortable or silly with parts of the session.	*"I felt a little bit silly in some of the exercises, especially those that do not appeal to me that much, like sense of touch for example."* [P.14n]
Ailments	Feeling pain or other physical ailments.	*"I have had huge back problems and I could feel that also now when we were out in the forest."* [P.09n]
Feeling cold	Disturbed by cold temperatures.	*"You got very cold at the end and when that happens it is easy to get caught up in your thoughts and long to go inside into the warmth instead."* [P.14n]
Neutral experience	Experience felt neutral, basic or nothing special.	*"This was just so basic to me. I do not know… Running your hands over the moss. I have already done that before."* [P.08n]

5. DISCUSSION

5.1. Effect of guided forest bathing on HNC

While not able to establish causality, the results of this study suggest that participation in just one session of guided forest bathing may positively influence the development of HNC, primarily in participants new to the experience and in relation to reading natural spaces, recalling memories about nature, and being one with nature. Statistically, this positive influence is noteworthy considering the relatively high baseline HNC and the expressed pre-existing affinity for being in nature in the interviews. This might suggest that guided forest bathing has potential to influence persons already relatively connected to nature, despite individual differences visible in the interviews. The current study results add support to the positive effect on HNC by guided forest bathing previously found by McEwan et al (2021). The results also add additional insight by demonstrating what specific abilities of HNC may develop by the experience. This enhanced understanding is valuable since analyzing HNC as embodied abilities align with the call to use a multidimensional conceptualization in HNC research in order to integrate disciplinary perspectives (Ives et al. 2017). The study results are also consistent with previous literature showing a positive influence on HNC by nature exposure in general (e.g. Giusti et al. 2014; Nisbet et al. 2009; Mayer & Franz. 2004), and mindfulness-based experiences in nature in particular (Unsworth et al. 2016).

Although these results are promising, the accounts of unchanged HNC and negative aspects in the qualitative results indicate personal differences in the effect of guided forest bathing. This could be due to individual factors not captured in this study. For example, spatial and contextual relationships may influence participants to hold certain meanings and associations of “nature” (Giusti et al. 2019) which affects how they relate and connect to the natural world. Indeed, by acknowledging HNC as a complex interaction of mind, body, culture, and environment (Giusti et al. 2018, 2019), it is likely that the effect on HNC is shaped by both personal conditioning and cultural norms, beliefs, and worldviews. Therefore, some persons may not be as receptive to the experience and its effects on HNC, as is illustrated by the few interviewees who expressed feeling uncomfortable or silly with parts of the session.

Furthermore, the differences found between participants with and without previous experiences in guided forest bathing suggest that the relationship with nature that people develop is inherently embodied and subjective. This means that when participants self-assess

HNC, inevitably their abilities are in relation to their own previous experience of what constitutes a maximum and minimum standard of HNC. Thus, these different standards may create individual variations in how participants interpret the survey items. This is in line with the Dunning-Kruger effect. This hypothesis suggests that persons with a lower ability in a particular area overestimate their actual abilities (Kruger & Dunning 1999). This cognitive bias would mean that participants who are new to guided forest bathing overrate their abilities to connect with nature whereas the participants with previous forest bathing experience are more cognizant in their self-assessment. The Dunning-Kruger effect could similarly explain why participants new to the experience had significantly higher baseline HNC. The occurrence of this bias is probable since it aligns with the ontological approach of the ACHUNAS, which recognizes the abilities of HNC as embodied and contextual.

5.2. Qualities of guided forest bathing influencing HNC

The quantitative results reveal that several qualities of the guided forest bathing session may influence HNC, with the most important being mindfulness, engagement of senses, and self-restoration. The qualitative results also suggest that structure/instructions, involvement of mentors, social-cultural endorsement, and thought provocation are meaningful qualities in the experience. The qualities appear to work in synergy and form a potential conditional pathway that enables the influence on HNC. Within the nature setting, the sensory focus, the guidance, and the non-performing social context function as preconditions that allow the participants to experience self-restoration, mindfulness, and thought provocation. The influence on HNC by self-restoration and mindfulness, as it is experienced during the guided forest bathing session, is supported in previous literature suggesting that psychological, physical, and social relief (Giusti et al. 2018) as well as an observing and present-moment oriented mind (Schutte & Malouff 2018; Howell et al. 2011) is significant for the development of HNC. Mindfulness especially is also associated with contemplative insights, for example increased compassion for the environment and awareness of habitual behaviors (Ericson et al. 2014; Thiermann & Sheate 2020). This suggests that mindfulness may facilitate the quality thought provocation, which may influence HNC by enabling learning and a shift to new ways of perceiving and interacting with nature. This potential conditional pathway implies that social and contextual qualities play an important role in nature experiences and for HNC.

The qualitative results add nuance to the qualities of guided forest bathing by revealing that there were personal, social, and environmental aspects that participants experienced as

challenging or even negative. These aspects may act as disruptors to the qualities of mindfulness and self-restoration, and therefore hinder the development of HNC. For example, being cold and hearing traffic noise may distract and create feelings of aversion, which is a common obstacle to the cultivation of mindfulness (Yates et al. 2017, p.70). In general, however, the results of this study support previous evidence showing that guided forest bathing is different from traditional mindfulness practice (Clarke et al. 2021). The informal, effortless, and allowing approach and the external attentional focus on nature through the senses, aids facilitation of mindfulness; a quality that can be hard to access in other environments and contexts (Djernis et al. 2019; Clarke et al. 2021).

5.3. Assessing the influence of nature experiences

Guided forest bathing was suggested to significantly influence HNC but not NEP ($p>0,1$). This means that an individual's environmental attitude as measured in the NEP scale may not be affected by personal experiences of nature or mindfulness as experienced during guided forest bathing. Thus, NEP does not seem to develop in the same way as the abilities of HNC, which are more embodied, emotional, and dynamic in nature (Giusti et al. 2014). This aligns with the findings of Mayer & Franz (2004), who argue that the strongly cognitive nature of NEP makes it different from HNC. These results add support for the suitability of ACHUNAS as a framework to assess the influence of nature experiences. It also indicates that the criteria of the ACHUNAS seem appropriate and relevant even for adults, despite being originally designed to assess children's HNC (Giusti et al. 2014).

5.4. Methodological reflections and future directions

The current study benefitted greatly from complementing and triangulating the quantitative surveys with qualitative interviews as it generated a rich and nuanced understanding of the effects on HNC. Using mixed methods to assess and understand HNC enabled the study to comply with the multidimensional conceptualization of HNC. This represents a valuable contribution to the field of HNC research, which has mostly been biased towards using only quantitative data sets and psychometric scales (Ives et al. 2017). However, like quantitative methods, qualitative interviews are also limited by being reliant on language and self-assessment. A recommended addition for future assessments of HNC is therefore to include qualitative methods that are not language-based, such as participant observation (e.g. Vroegop 2014).

While the results of this study are promising, it is important to note that the observed effects and qualities presented are tied to the specific methodology and approach to guided forest bathing of the SNFTI framework. The effect on HNC by other frameworks and of unguided forest bathing experiences thus warrants further investigation. Moreover, the current study design has the methodological limitations of lacking a control group and randomization (see note on methodology in appendix 5). This makes the study unable to properly establish causation between the treatment of guided forest bathing and HNC. The small sample size and the sample characteristics (consisting mostly of white, middle-aged women with preexistent interest in forest bathing) are also limitations to the generalizability of the study findings. The potential influence of guided forest bathing on a bigger and more diverse sample therefore warrants additional research, preferably using true experimental designs. Other interesting areas for future studies include the potential conditional pathway identified between the qualities of SNS in the ACHUNAS, as well as longitudinal studies considering the importance of routinization for HNC (Giusti et al. 2018).

5.5. Implications of study

The results produced and discussed in this study lead me to propose that guided forest bathing, as conducted by the SNFTI, represents an accessible nature experience with promising potential to develop individuals' HNC. As an intervention, it could be especially valuable for persons suffering from nature *dis*connection due to urbanization, stressful lifestyle, or other factors that make HNC and states of mindfulness harder to access (Cumming et al. 2014; Giusti 2019; Djernis et al. 2019). A significant influence on HNC may therefore be added to the long list of potential benefits already associated with forest bathing (Hansen et al. 2017). The current study adds support to existing literature suggesting a link between HNC and forest bathing (Lumber et al. 2017; Kotera et al. 2020; Clarke et al. 2021). It also makes a valuable contribution to research on HNC, mindfulness, and mindfulness in nature, particularly by using a multidimensional conceptualization of HNC which contrasts many previous studies on HNC (Ives et al. 2017).

The promising potential of guided forest bathing may have meaningful larger-scale implications for sustainability, especially since fostering HNC at an individual level is considered a deep leverage point for sustainability transformation (Ives et al. 2018; Abson et al. 2017). This study suggests that the guided forest bathing experience influenced the way individuals perceive and interact with nature. This type of developed "inner" HNC (as

opposed to “outer” material HNC) has been proposed to have strong impact on sustainability outcomes as it relates to the underlying values and goals of the current societal system (Ives et al. 2018). As a deep leverage point, guided forest bathing has particular significance since the emphasis on reciprocal relationships between people and nature is a clear shift away from the current, unsustainable Western paradigm of anthropocentrism (Katz 1999; Steffen et al. 2011). Furthermore, this study presented valuable insight into the qualities of guided forest bathing and how social and contextual aspects can work synergistically to develop HNC. These insights can inform research and policy on how to design effective interventions for HNC in general and how a reconnection of humanity with nature (Folke et al. 2011; Zylstra et al. 2014) might be achieved – one sense and person at a time.

6. CONCLUSIONS

In this thesis, I explored guided forest bathing as an intervention for human-nature connection (HNC), using a mixed methods approach and a multidimensional conceptualization of HNC. The study suggests that the experience of just one guided forest bathing session may significantly and positively influence the development of HNC, primarily in participants new to guided forest bathing. Several qualities were found to be important for influencing HNC, especially the qualities mindfulness, engagement of senses, and self-restoration. The structure and the social setting of the guided session are important preconditions for these qualities to emerge and for thought provocations that can meaningfully shift how individuals perceive and interact with nature. Some inconsistencies in the results and methodological limitations do however warrant further experimental research to verify the effect of the practice on HNC, since causation could not be established. Nevertheless, the results in this thesis suggest that guided forest bathing, as conducted in the study, represents a nature experience with promising potential as an intervention for HNC. With its novel qualities and effects on individuals' HNC, guided forest bathing may exemplify a deep leverage point for sustainability transformation and can help inform research and policy on how effective interventions for HNC can be designed. Perhaps most of all, this thesis illustrates that guided forest bathing supports a significant paradigm shift from the human-centered ethic of anthropocentrism to a way of *being* with nature that is rooted in reciprocity and connection.

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8. APPENDICIES

8.1. Appendix 1: Plain language statement

Dear potential study participant,
Please read this text carefully to learn more about what being a participant in this study is all about. Feel free to email any questions about the information in this document to skogsbadprojekt@gmail.com. Once you send in your application, you will get contacted by me to sign a consent form.

What is this study about?
This research study is part of my master thesis for my studies at Stockholm Resilience Center at Stockholm University. The study is in collaboration with the Scandinavian Nature & Forest Therapy Institute (SNFTI) exploring people's experience of "forest bathing", especially how it affects the individual's relationship with the rest of nature. The aim is to explore the potential of the practice as an intervention for inner and outer sustainability. The principal research and funding body for the project is Stockholm University.

What it means to participate in the study
To be able to be a study participant, you must already have signed up for one of the guided forest bathing sessions being organized during the big forest bathing event that takes place at the spring equinox on March 20, 2021 by SNFTI. As a participant in the study, you will the day before and immediately after the forest bathing session receive a link via email to a digital survey that you fill in. Filling in the surveys is estimated to take about 5-10 minutes and must be completed no earlier than 1 day before the session and no later than the same day after the session is over. It is also possible to complete the surveys in alternative ways, such as orally via phone. If so, please notify me via email (contact details below). You may also be randomly selected to be interviewed by me after the forest bathing session to answer questions about your experience. The interview is estimated to take approximately 60 minutes and will be scheduled in the days after the session. The interview is primarily conducted online via Zoom or phone call. You indicate whether you want to be interviewed or not when filling in the consent form.

Compensation and benefits
As a thank you for your participation, you get a 50 SEK discount on the cost of the guided forest bathing session (ord. value 350 SEK). If you are interviewed, you will also receive 200 SEK extra in compensation that is paid in arrears. For most people, forest bathing is a very relaxing and pleasant experience with many health benefits, and as a participant you get to take part in these and at the same time make a valuable contribution to scientific research on forest bathing, sustainability, and human-nature connection.

Ethics and processing of personal data
Ethics related to this project have been considered and approved by the Stockholm Resilience Center's ethics committee. All personal information you provide in the study remains confidential and is processed in accordance with the General Data Protection Regulation law (GDPR). All survey and interview responses will be coded and anonymized as soon as data collection is complete. After that, all your personal information will be permanently deleted and you will not be identifiable during data analysis or in subsequent publications. Only anonymous information about zip-code, age and gender identity will be included.

*Please note, it is **completely voluntary** to participate in the study. You can choose to withdraw your participation at any time and you do not have to say why. If you no longer wish to participate, you must notify me as lead researcher, see contact information below.*

Any questions?
***Researcher:** Annelie Vårhammar*
***E-mail:** xxxx*

8.2. Appendix 2: Consent form

Consent as study participant in research study

Lead researcher: Annelie Vårhammar, e-mail: xxxx

Institution: Stockholm Resilience Center, Stockholm University

Date: 2021-03-16

- I have read and understood the information about the study given in the plain language statement.
- I have been given the opportunity to ask questions and I have had them answered.
- I understand that the study is for research purposes and that my full participation in the forest bathing session, in filling out the surveys and potentially in answering interview questions is required for results to be viable.
- I am aware that I am free to withdraw from the study at any stage without being subject to any repercussions for doing so. If this is the case, I will immediately contact the lead researcher via e-mail at: xxxx
- I understand that personal information about my first name and e-mail address will only be used to enable data collection (sending out the surveys and potentially conducting the interview). This data is then permanently deleted as soon as the data collection is complete.
- I understand that only coded and anonymized other personal information (age, gender and postal code) will be used in all subsequent data analysis and publications, and I will therefore not be identifiable.
- I understand that all personal information I provide within the framework of the study remains confidential and is processed in accordance with the Data Protection Regulation law (GDPR). All information and data are stored securely on a password-protected external hard drive that only the lead researcher has access to.
- I have been given a copy of the plain language statement and this consent statement to keep.

_____ _____

Signature Date

8.3. Appendix 3: Interview guide

In this interview, I want to hear about your experience of the guided forest bathing session. So of course, there are no right or wrong answers, all your thoughts are interesting and relevant. I'm interested in learning more about how you think and feel after the forest bathing.
The interview should take no more than an hour. This interview is completely voluntary, and you can opt out at any time for any reason. Everything you say will be anonymized so if I
share some quotes from the interview in the final report, no one will know who said them.

Finally, I want to ask if it is OK if I record the audio from our interview? YES / NO
It will not be shared with anyone and it enables me to completely focus on you and our conversation. I will delete the recording as soon as the transcribing is done.
Okay, so first of all:

1. *Tell me, what guided forest bathing session did you attend?*
2. *What made you want to join the guided forest bathing session?*
3. *What were your impressions of the forest bathing session?*

Nature-connecting qualities of the forest bathing experience

4. *What is your strongest memory from the session?*
5. *What did you enjoy most?*
6. *Did something make you uncomfortable? If yes, could you describe the experience?*
7. *What was challenging?*
   → *Why? How did ____ [that aspect] impact you or make you feel?*
8. *You mentioned in the survey that you experienced _____ [this SNS quality]. How did this quality affect your experience?*
   a. *In what way/why?*
   b. *Can you tell me more? How did it make you feel?*

Thought provocations from your guided forest bathing experience

9. *Do you feel as though you learned something through the guided forest bathing experience?*
   → *What did you learn from/through your guided forest bathing experience?*
   a. *Any new skills or techniques? (Awareness)*
   b. *About yourself?*
   c. *About nature?*
10. *What does nature mean to you in your life?*
    a. *In what way/why?*
    b. *Can you tell me more?*
11. *I am interested in understanding if the guided forest bathing session has changed the way you feel and think about nature. (Connectedness with nature)*
    a. *What does connectedness with nature mean to you?*
    b. *What was your relationship with nature before? And has it changed?*
    c. *Has your relationship or connection with nature changed? How/in what way(s)?*
    d. *How is this different than the way you related to nature before?*
    e. *Was there anything in particular during the forest bathing session that caused a change in how connected you feel with nature?*
12. *Have you noticed any changes in yourself after the guided forest bathing session?*
    a. *In how you feel in your body and mind? (Health, well-being)*
    b. *In how you make choices? (Consumption patterns, food habits + Awareness)*
    c. *In how you feel and act towards others and/or nature? (Altruism, pro-sociality)*
    d. *In your values and priorities? (Intrinsic values, ethics)*
    e. *In how willing you feel to act environmentally friendly? (Openness)*
13. *Is there anything else you want me to know about your experience of guided forest bathing that we have not talked about yet?*
14. *Would you be willing to try guided forest bathing again?*

8.4. Appendix 4: Summary of subthemes for each quality of SNS

Qualities of SNS as overarching themes)	Subthemes
Engagement of senses	Experience the forest with all senses Guided activation of one sense at a time Exploring and developing a specific sense Wide-angle perspective Being quiet and listening
Self-restoration	Calming and relaxing nature activity *Sensory immersion* *Slow pace* *Microsleep* *Relaxed in forest environments* *Not afraid of nature* *Being unavailable* *Lying down on the forest floor* *Closing the eyes* Getting social relief *No demands or having to perform* *Alone time* *Silent activity* Sense of safety
Mindfulness	Outward attentional focus Being in the present moment Effortless mindfulness No phone
Involvement of mentors	Feeling safe Calming influence Using symbolism Talking about nature as animate Emphasizing human-nature connection
Structure	Group setting *Being by yourself while in a group setting* *Sharing the experience with others* *Engaging more fully* *Everybody doing the same thing* Sensory activating invitations *Being guided through the senses* *Keeping the focus* *Calming effect*

	Brings attention to features & details in nature *No right or wrong way to do it* Being guided/having a guide *Not having to take responsibility* *Allowed for activities not usually practiced* *Creates sense of safety* Being in a new forest environment Being undisturbed by external people
Intimacy	Looking very closely at things in nature Personal or private experience Being with trees Closeness with nature
Awe	"Consuming" the forest The huge size of trees Details and features in nature Experiencing trees as animate beings Spiritual experience with trees
Entertainment	Being barefoot Finding a tree that is similar to oneself Doing a "moss-splash" Drinking "forest tea"
Thought provocation	Guided forest bathing as a method and experience *Learned the method* *The restorative effect* *Motivated to take action for nature* *Thoughts about guided forest bathing* *Quickly fell back into normal state of being* Perceived connectedness with nature *Unchanged* *Strengthened connection with nature* *More about connecting with myself* Shifts in perception of nature *Seeing nature as animate* *The permanency of nature* *Nature as welcoming and allowing* Rediscovery of nature *Nature's role for wellbeing* *Want to spend more time in nature* *Awe about nature* *Taking nature for granted* *Forests are important*

	Foraging in nature Human impact on nature *Noticing impacts on nature by humans* *Didn't think about impacts on nature by humans* Self-inquiry & personal changes *Relating to aspects of nature* *Reminded of wants, values and priorities* *Listening to one's "inner compass"* *Openness*
Physical activity	Lying down Sitting down
Surprise	Lying down in a forest Hugging a tree Perceiving trees as beings
Creative expression	Poem about nature Guide imitating bird sounds Tea ceremony setup Nature as an artform
Social-cultural endorsement	Social activity Socially supporting group setting *Sharing is optional* *Everyone being serious about it* *Knowing someone in the group* *Being a small, intimate group* *Feeling safe in a group* *Being quiet together* Sharing circles *Reflecting together* *Hearing others share* *Sharing a memory with others* Sharing tea together
Involvement of animals	Close encounter with wild animals
Challenge	Busy mind Walking so slowly Feeling the inner compass Not talking

	Using less-trained senses
Self-driven	*No mentions*

8.5. Appendix 5: Note on methodology

Originally, data collection for this study was intended to take place during late November 2020 by organizing 5-10 guided forest bathing sessions in the Stockholm area in collaboration with the SNFTI. I had planned to recruit up to 50 participants from the general public who had not attended guided forest bathing prior to the study. The sample would be divided equally into one treatment group and one control group who would not attend guided forest bathing. Due to the COVID-19 pandemic and the recommendations of the Swedish government, we decided to not conduct the scheduled sessions and pause the thesis project since it meant gathering many people in person. When cases of COVID-19 decreased in Sweden and the national recommendations changed, we seized the opportunity to collect data during the guided forest bathing event organized by SNFTI on March 20th, 2021.

8.6. Appendix 6: Ethical review – final review

The main ethical concerns of the study design in this thesis pertained to the collection of sensitive information (participants' first names and email addresses) and to the collaboration with the Scandinavian Nature and Forest Therapy Institute (SNFTI). Specific procedures to address these concerns were formulated and approved prior to the start of data collection by the Stockholm Resilience Center's ethics committee.

In hindsight, the research process closely followed the planned procedures and no major ethical dilemmas emerged. I had previously foreseen that study results that could be perceived as negative for guided forest bathing sessions were possible and could cause conflicts with SNFTI and the recruited guides due to their business interest to promote their own brand and commercial forest bathing. Although some results did emerge that could be considered less positive, no conflicts occurred, and all forest bathing guides chose to be credited in the thesis. The established collaboration agreements with the guides were also closely followed without any problems. All sensitive information about the study participants was kept confidential and processed in accordance with the General Data Protection Regulation law. The only exception from the planned ethical procedures was that some interviewees asked at the end of the interviews if they could read the final thesis. These persons gave me verbal consent that I could keep their email addresses to be able to send the thesis to them when it is finalized. All other sensitive data was deleted after data collection was completed.