

The benefits of nature-based therapy for the individual and the environment: an integrative review

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Abstract

Purpose – This review aims to identify the commonly used nature-based therapies, the cohorts that benefit from these interventions, and the potential environmental impact of nature-based therapies.

Design/methodology/approach – An integrative review methodology was taken. The literature was analysed and synthesised through thematic analysis.

Findings – Three themes emerged from the analysis: categories of nature-based therapies; benefits of nature-based therapies; and the gains from nature-based therapies are not universal. Evidence of physiological, psychological, social, vocational and quality of life benefits from participation in nature-based therapies was evident in the literature. However, there was insufficient empirical evidence of the benefits for the environment.

Practical implications – Occupational therapists assist populations across the life course. Consequentially, they can be found working in a diverse range of clinical contexts. This review asserts that nature-based therapies could be a positive addition in many of these contexts. Further, while engagement in activities in natural environments is frequently used by occupational therapists practicing within institution environments, there is evidence to support its use in community service models and potentially in public health strategies.

Originality/value – This integrative review brings together evidence on a diverse range of nature-based therapies, cohorts, associated benefits and factors that influence these. The lack of empirical evidence on the benefits of nature-based therapies for the environment is acknowledged as a gap in the literature

Keywords Review, Sustainability, Environment, Nature, Occupational therapy, Nature-based treatment

Paper type General review

Introduction

Nature-based therapy is an approach to interventions that use the natural environment as a facilitator during the therapeutic process (Corazon *et al.*, 2010). Nature-based therapy, which can also be referred to as green care, nature-assisted therapy, nature therapy or animal-assisted therapy (Annerstedt and Währborg, 2011; Fieldhouse and Sempik, 2014; Lee *et al.*, 2012), incorporates horticulture-based activities, being in natural environments and engaging in nature-related crafts or green exercise.

Previous occupational therapy literature elucidated the following meaning and benefits behind nature-based

occupations – enhanced well-being, social connectedness or belongingness, identity, connection to nature and a sense of challenge and achievement (Feighan and Roberts, 2017; Jeffery and Wilson, 2017; Wensley and Slade, 2012). Occupational therapy and nature-based therapy share some theoretical underpinnings such as therapeutic use of occupation, or being occupation-based, and the therapeutic use of environment

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(Jeffery and Wilson, 2017). This synergy provides occupational therapists the opportunity to integrate nature-based activities into their practice (Jeffery and Wilson, 2017).

Nature-based therapies have been shown to benefit the psychological, physical and social well-being of different patient cohorts (Annerstedt and Währborg, 2011). The diversity of the populations amongst the reviewed studies indicates the potential of nature-based therapies as a resource for public health (Annerstedt and Währborg, 2011). With this supporting research, occupational therapists can advocate for the provision of opportunities for the public to have access to engage in purposeful occupation within a variety of natural environments (Genter et al., 2015; Wensley and Slade, 2012).

However, it must be acknowledged that human occupation is also at the root of the current environmental crisis. On the other hand, it is also the way towards sustainability (Ung et al., 2020). An occupational lens offers insight into how some occupational behaviours negatively impact the environment, which, in turn, poses a threat to global health (Dieterle, 2020). The impact of the environment on health is widely recognised and forms part of many health-enhancing policies, such as Healthy Ireland (Department of Health, 2013) and Ireland 2040 (Department of Health, 2013; Government of Ireland, 2020). The World Federation of Occupational Therapists (2012, 2018) emphasises the role of occupational therapy in promoting sustainability within practice through a list of guiding principles for the profession and a position statement on global climate change (World Federation of Occupational Therapists, 2012, 2018).

Past literature reviews, such as that conducted by Chavaly and Naachimuthu (2020), state that there is scope to use nature-based therapies to benefit the general population and their mental health. However, it remains unclear whether nature-based therapies could potentially benefit both the individual and the natural environment. When conducting preliminary searches, we identified a gap in the knowledge surrounding nature-based therapies and their application to occupational therapy practice. Rather, previous reviews focused on specific areas or cohorts for nature-based therapies, such as outdoor pursuits or older adults (Gagliardi and Piccinini, 2019; Feighan and Roberts, 2017). The purpose of this review is to bring together research and knowledge on the commonly used nature-based therapies, evidence on the benefits reported from these interventions with various cohorts and the potential impact of nature-based therapies on the natural environment. We used an occupational performance lens when conducting this review to identify the practical implications of nature-based therapies for clinical practice within occupational therapy.

Methods

The four key features of an integrative review, which are regarded as – to generate/refine a theory; combine empirical and theoretical research; examine research on a health phenomenon; and inform health-care policy and practice – most closely aligned with our ambition for the review (www.guides.library.duq.edu; accessed 1st November 2021; Coughlan et al., 2013; Whitemore and Knaf, 2005). Ethical approval was not sought for this study as no additional data was being collected. The information used is already in the public domain and

therefore available for inclusion. Using the review methodology, we systematically gathered published research on this topic, selected the relevant works and summarised what we determined through our analysis. This is the essence of a good review (Grant and Booth, 2009).

Literature search strategy

With support from a librarian, the third and fourth authors conducted a literature search using 18 databases. The databases were accessed through EMBASE and EBSCOhost and included MEDLINE, APA PsycInfo, Academic Search Complete, CINAHL Complete, OmniFile Full-Text Mega (H.W. Wilson), Regional Business News, UK & Ireland Reference Centre, AMED, Social Sciences Full Text (H.W. Wilson), Business Source Complete, Education Full Text (H.W. Wilson), ERIC, General Science Full Text (H.W. Wilson), Health Source: Nursing/Academic Edition, British Education Index, Business Abstracts with Full Text (H.W. Wilson) and Readers' Guide Full-Text Mega (H.W. Wilson). These databases were selected based on accessibility, relevance to the topic and the allied health-care literature. The following search terms were used: “green” or “sustainab*” or “environment*” or “eco friendly” or “eco-friendly” or “environmentally friendly” in the title or abstract and “horticulture therap*” or “horticultural therap*” or “nature based therap*” or “nature-based therap*” or “nature therap*” or “ecotherap*” or “eco-therap*” or “forest therap*” in the title or abstract. Additional search strategies included reviewing reference lists of included papers and relevant literature reviews identified during the search.

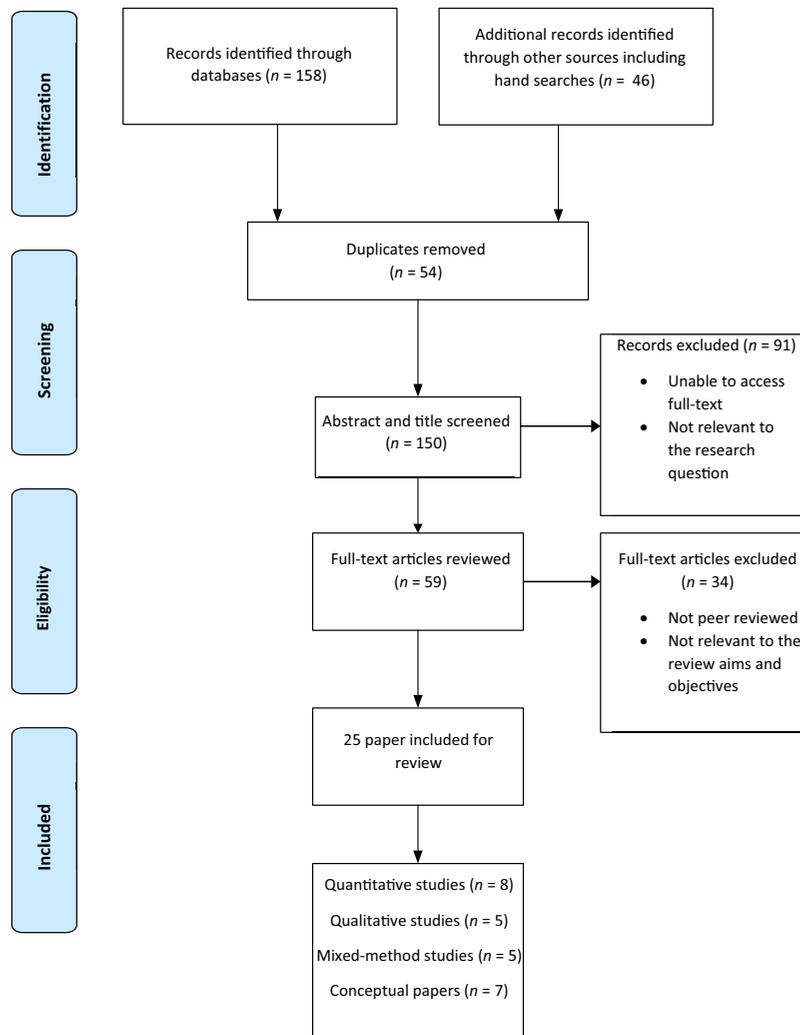
Inclusion/exclusion criteria

To determine relevant primary sources, qualitative, quantitative and mixed-method research; theoretical and opinion pieces; and programme descriptions or evaluations were reviewed. Studies published between 2011 and 2021 in full, in English and in peer-reviewed journals were included. The primary focus of the search was on nature-based therapies and their benefits for the individual and the environment. Studies that met the inclusion criteria were included regardless of evidence level or study design as this provided a holistic review of the concept. The search was not limited to papers pertinent to occupational therapy because of the paucity of such specific literature. Literature reviews were excluded from the search as they may be re-iterating findings from papers that were already included.

Analysis

As presented in Figure 1, the search provided 158 records and a further 46 were discovered through hand searches. Duplicates ($n = 54$) were removed, resulting in 150 articles being processed with an initial screen. A further 91 articles were excluded following this, primarily because of a lack of relevance to the research question. Full texts of 59 articles were reviewed by the second and third authors which resulted in 25 papers progressing to full review by all authors.

The third and fourth authors critically appraised each of the identified studies. Thematic analysis, as outlined by Braun and Clarke (2014), was then used to enable the authors to analyse a wide range of literature and to synthesise a variety of study methods (Braun and Clarke, 2014). The selected articles were read by the authors in dyads, and emergent themes were given initial codes.

Figure 1 Stepwise process of literature search and selection for inclusion

These codes emerged based on patterns in reported findings which appeared relevant or specifically addressed the aims of this review. Earlier themes were refined as the process of reviewing and discussing papers continued. Codes were developed manually, and included, for example, “physiological effects of nature-based therapy”. Throughout the coding process, a difficulty emerged in addressing the research question concerned with the impact of nature-based therapy on the environment. There was a notable paucity of data in the identified studies concerning this topic, and thus there was insufficient detail with which codes and themes could be developed. The codes were subsequently refined as themes. These were further reviewed in collaboration with all authors, before being finally defined as follows:

- categories of nature-based therapies;
- benefits of nature-based therapies; and
- the gains from nature-based therapies are not universal.

Results

As previously stated, the initial search of the databases yielded 204 papers, with a total of 25 papers included for the final

review. [Table 1](#) summarises the details of these studies. These 25 papers consisted of eight quantitative studies, six qualitative studies, five mixed-method studies and seven theoretical and opinion papers ([Figure 1](#)).

The thematic analysis yielded three themes:

- 1 categories of nature-based therapies;
- 2 benefits of nature-based therapies; and
- 3 the gains from nature-based therapies are not universal.

We have organised the results by these themes and the previously mentioned four key features of an integrative review.

Categories of nature-based therapies

Refining the theory of nature-based therapy

Categories of nature-based therapies ranged from forest therapy to maintaining and cultivating a garden bowl in the home environment. The most common forms of nature-based therapies were identified as horticulture therapy and forest therapy, appearing in 12 of the 25 studies reviewed ([Christie et al., 2016](#); [Kusumawaty and Yunike, 2020](#); [Lee et al., 2021](#); [Lee et al., 2014](#); [Lim et al., 2020](#); [Masel et al., 2018](#); [Oh et al., 2020](#); [Seifert, 2014](#); [Song et al., 2013](#); [Sung et al., 2012](#); [Vujcic et al., 2017](#); [Zeng et al., 2020](#)). Two studies

Table 1 Summarised details of 25 papers retained following selection process

Author(s)	Title	Country	Participants	Type of nature-based therapy	Purpose of study	Study design	Core findings
Chatalos (2013)	Sustainability: ecopsychological insights and person-centred contributions	United Kingdom	N/A	N/A	To propose a person-centred approach in ecopsychology to address the psychological roots of the ecological crisis	Theoretical	Through facilitating an individual's realisation of one's embeddedness within the larger ecosystem, ecopsychology aims to increase awareness of sustainability and connectedness to the non-human world
Christie et al. (2016)	Personality disorder and intellectual disability: The impacts of horticultural therapy within a medium-secure unit	United Kingdom	Male residents of a medium secure unit with a dual diagnosis of personality disorder and intellectual disability ($n = 7$)	Horticulture therapy	To explore the efficacy of HT for enhancement of subjective health and well-being	Qualitative; focus groups 12-month gardening group; designing, creating and maintaining a garden on the in-patient unit site	Participants identified enhanced gardening knowledge, employability skills, personal development, reduced stress, positive changes in behaviour towards self and others and improved life-satisfaction because of interaction with the natural environment, intrinsic motivation and opportunities to develop horticultural skills
Corazon et al. (2011)	Developing the therapeutic potential of embodied cognition and metaphors in nature-based therapy: Lessons from theory to practice	Denmark	N/A	N/A	To examine the interplay between cognition and bodily involvement in relation to nature-based therapy	Theoretical	NBT is a therapeutic tool, not the goal itself. Using NBT metaphors to bring the learning beyond the therapeutic setting and into everyday life. NBT has shown psychological benefits through the use of meaningful, pleasurable and rewarding occupations, thus enhancing an individual's self-concept, self-esteem and empowerment
Kucher et al. (2020)	3-Dimensional nature-based therapeutics in paediatric patients with total pancreatectomy and islet auto-transplant	USA	Paediatric patients (8–18 years) scheduled for total pancreatectomy and islet auto-transplant (TPIAT) ($n = 6$)	Use of NBT through virtual reality	To demonstrate that the use of 3-D nature-based therapy (NBT) glasses will lead to a reduction in pain, nausea and anxiety in children and adolescents undergoing TPIAT	Mixed methods; interviews/scoring pre and post (Wong-Baker FACES, BARF scales and a novel nature-based anxiety scale)	Pre- and post-intervention scores showed a reduction in pain, stress and anxiety because of virtual reality NBT use. Proposed as a tool for those that cannot access NBT (non-mobile patients)
Kusumawaty and Yunike (2020)	The complexity of caring for people with mental disorders: family challenges in contributing to horticultural therapy	Indonesia	Female family caregivers of persons with mental health conditions ($n = 5$)	Horticultural therapy	To explore: –family caregivers' experience of accompanying their family members to HT –family caregivers' perception of their family members' participation in HT	Qualitative; interviews	To encourage service users to engage with HT, family caregivers must have strong motivation, patience, sincerity and confidence. Family caregivers identified the following benefits of HT: enhanced self-confidence, communication and social skills
Lee et al. (2021)	Horticultural therapy program for mental health of prisoners: Case report	Korea	Male prisoners at risk of developing mental health conditions ($n = 5$)	12-Week horticultural therapy programme, once per week for 90 min	To develop a horticultural therapy programme and to determine the association of 12 sessions with participants' psychological health using case analysis	Mixed methods; Beck Depression Inventory, State-Trait Anger Expression Inventory, Rosenberg Self-esteem Scale and Satisfaction with Life Scale. Interviews, workbooks and emotional change checklists that were recorded in each session	Post-programme resulted in a decrease of depressive symptoms, and an increase in self-esteem and life satisfaction. Prisoners reported feelings of peacefulness, rejuvenation, sense of freedom and warmth, post-intervention
Lee et al. (2014)	Influence of forest therapy on cardiovascular relaxation in young adults	Japan	Young Japanese male adults ($n = 48$)	2 days of forest walking and urban walking	To evaluate the short-term effects of forest walking on cardiovascular reactivity	Quantitative; comparative study of urban vs forest walking; measured data included heart rate variability, heart rate, blood pressure and psychological state	Forest walking resulted in significantly decreased values of sympathetic nervous activity and increased values of parasympathetic nervous activity, and significantly decreased heart rate, negative mood states and anxiety levels. No significant change in blood pressure was noted

Singapore

(continued)

Table 1

Author(s)	Title	Country	Participants	Type of nature-based therapy	Purpose of study	Study design	Core findings
Lim et al. (2020)	A guide to nature immersion: psychological and physiological benefits		Students of the Singapore University and community residents of Singapore ($n = 51$)	Participation in guided/unguided nature immersion forest walks	To compare the efficacy of guided versus unguided nature immersion, upon three dependent variables of mood, nature connectedness and heart rate	Mixed methods; pre- and post-test: Connectedness to Nature Scale, Environmental Identity Scale (short form) and Positive and Negative Affect Scale. Heart rate was tracked continuously by a wristwatch heart rate tracker throughout the 2-h experience	Participants' experienced an increase in their mood, nature connectedness and positive affect scores. No significant change in heart rate was reported. Participants reported feeling more relaxed, happy and refreshed after the nature immersion. The guided versus unguided groups did not differ in the results
Masel et al. (2018)	Vitamin "G"arden: a qualitative study exploring perception/s of horticultural therapy on a palliative care ward	Austria	Palliative care patients ($n = 17$) and health-care team members ($n = 5$)	1–3 HT sessions that involved nature-related crafts	To explore the effects of HT on patients and team members on a palliative care ward	Qualitative; semi-structured interviews with pre-determined open-ended questions	Palliative care patients identified improved well-being, variation of clinical routine, creation and relationship building. Palliative care members identified improved mood and relationships with patients. High dropout rate (45%) was evident because of worsening of participants' condition
Nakau et al. (2013)	Spiritual care of cancer patients by integrated medicine in urban green space: a pilot study	Japan	4 Male and 18 Female oncology patients ($n = 22$)	Integrated forest therapy (FT), HT, yoga meditation, support group therapy; sessions once a week for 12 weeks	To examine the effect of spiritual care of cancer patients by integrated medicine in a green environment	Quantitative; measured data included: spirituality, quality of life (QoL), fatigue, psychological state and natural killer cell activity	Significant positive changes were noted in: spiritual and functional well-being, QoL, anxiety and cancer-associated fatigue. Significantly increased natural killer cell activity and improvement in psychological state were also identified
Oh et al. (2020)	Six-step model of nature-based therapy process	Korea	General public ($n = 180$)	Self-reported essays on forest therapy experiences	To develop a theoretical model of the nature-based therapy process	Theoretical	Six-step model of nature-based therapy process: Stimulation, Acceptance, Purification, Insight, Recharging, Change. Each of these steps is categorised into three aspects: emotional change (1–3), cognitive change (3–4) and behaviour change (5–6)
Phelps et al. (2015)	Sowing the seeds or failing to blossom? A feasibility study of a simple ecotherapy-based intervention in women affected by breast cancer	United Kingdom	Females at different stages of breast cancer ($n = 7$)	Cultivating, customising and nurturing a garden bowl at home for three months	To explore the acceptability and potential psychological benefits of a simple ecotherapy-based intervention for individuals affected by cancer	Qualitative; written diaries and focus group	The participants found the intervention therapeutic on a number of levels: reflecting cancer journeys; a source of positivity; making meaning through memories; and a sense of control
Pretty et al. (2017)	Green mind theory: how brain–body–behaviour links into natural and social environments for healthy habits	United Kingdom	N/A	N/A	To propose a green mind theory to link the human mind with the brain and body, and connect the body into natural and social environments	Theoretical	NBT facilitates immersive-attention through engagement with one's environment. Behaviour change and habit formation are required for changes to be made in infrastructure, policies and resourcing
Sahlin et al. (2012)	How do participants in nature-based therapy experience and evaluate their rehabilitation?	Sweden	Females ($n = 8$) and males ($n = 3$) with stress-related mental disorders (depression, exhaustion disorder, Post Traumatic Stress Disorder)	Nature-based rehabilitation programme with MDT input; 3 h four times per week for 28 weeks	To explore how the participants experienced, explained and evaluated their rehabilitation to inform development of effective rehabilitation programmes for individuals suffering from stress-related mental disorders	Qualitative; semi-structured interviews	Three themes emerged: being in the right or wrong phase; experiencing existential dimensions; and changing dysfunctional patterns of thoughts/behaviours. Nature facilitated existential reflections and was experienced as a supportive environment
Seifert (2014)	Cultivating new lives: An ethnographic pilot study of eco-therapy provision for people with alcohol-related problems in Northern Ireland	United Kingdom	Staff and service users with alcohol problems	39 various eco-therapy projects	A pilot study to establish the relevance and effectiveness of eco-therapy as a public health intervention	Opinion/pilot study	Community gardens and rehabilitation centres were the two key eco-therapy projects identified. Community gardens were less formal, inclusive and

(continued)

Table 1

Author(s)	Title	Country	Participants	Type of nature-based therapy	Purpose of study	Study design	Core findings
Sidenius et al. (2020)	A new approach to nature consumption post-nature-based therapy	Denmark	Persons with a diagnosis of adjustment disorder, reaction to severe stress and an incapacity to work ($n = 43$)	NBT	To examine whether participants of a NBT intervention in the therapy garden Nacadia have changed their nature consumption one-year post-intervention compared with one year pre-intervention	Mixed methods; questionnaires and interviews	provided a connection to the local community. These projects were described as a preventive activity for participants. Rehabilitation centres were more formal, with the length of stay ranging from six weeks to six months. The eco-therapies were viewed as a de-institutionalising activity. Four themes emerged of the participants nature consumption post-intervention: New approach to green spaces; Awareness of self and environments; New attitudes to everyday tasks; and Maintaining beneficial mind-sets. Post-intervention, participants reported maintaining a beneficial state of mind, thus enhancing mood and quality of life. Proposed that NBT could be an accessible tool to enhance health
Sidenius et al. (2015)	A year in the therapy forest garden Nacadia®- participants' use and preferred locations in the garden during a nature-based treatment program	Denmark	Persons who are severely stressed and unable to work because of stress-related symptoms ($n = 27$)	NBT programme for 10 weeks	To investigate participants' use, preferred locations, experiences and seasonal influences during NBT in the nature-like settings of Nacadia	Qualitative; behaviour mapping and semi-structured interviews	General preference for locations with enclosed proportions, while sensing expanses and feeling safe to relax or interact with components of nature-like environments were identified. Seasonal factors did not affect use and preference of locations, while weather conditions affected use and choice of nature-based activities, particularly for participants with a low level of mental capacity
Song et al. (2013)	Individual differences in the physiological effects of forest therapy based on Type A and Type B behavior patterns	Japan	Male college students with no history of physical or psychiatric disorders ($n = 485$)	Viewing forest or urban environments for 15 min	To explain individual differences in physiological responses to forest environments based on Type A and B behavioural patterns	Quantitative; physiological measurements	The significantly decreased heart rate following exposure to forest areas was only evident in the Type B group. Heart rate and diastolic blood pressure were significantly lower in the low-scoring Type B group
Stigsdotter (2015)	Nature, health and design	Denmark	N/A	N/A	To argue that not all nature environments support positive health outcomes	Theoretical	Not all nature environments support health and well-being. Through evidence-based design, nature designs can be an inclusive environment, closely aligning it with universal design principles
Sung et al. (2012)	The effect of cognitive behavior therapy-based 'forest therapy' program on blood pressure, salivary cortisol level, and quality of life in elderly hypertensive patients	Korea	Elderly patients with mild hypertension ($n = 56$)	Three-day CBT-based FT intervention targeting hypertension management education, self-efficacy, motivation and relaxation techniques	To develop the CBT-based FT programme and investigate its effects on blood pressure, salivary cortisol and QoL measures	Quantitative; physiological and QoL measurements, pre- and post-programme	There was no difference in overall long-term blood pressure between the study and control groups. Study group demonstrated a significantly increased total score of QoL measures and decreased salivary cortisol level
Vujcic et al. (2017)	Nature based solution for improving mental health and well-being in urban areas	Serbia	Psychiatric day hospital users ($n = 30$)	HT 1 h/day three days per week for four weeks	To understand how spending time and performing HT in specially designed urban green environments can improve mental health	Quantitative; RCT; pre- and post-intervention assessment using DASS21 scale	A significant decrease on the stress subscale was noted, while no change was noted on the depression and anxiety subscales following HT. Gender and education did not change the effects of

(continued)

Table 1

Author(s)	Title	Country	Participants	Type of nature-based therapy	Purpose of study	Study design	Core findings
Wang et al. (2019)	The influence of forest resting environments on stress using virtual reality	China	University students and social workers (total $n = 96$) aged 18–35 years	Exposure to virtual reality through images of seven forest resting environments	To explore the effects of different types of forest resting environments, using virtual reality, on stress, blood pressure, heart rate and salivary amylase	Quantitative; independent group design; data included physiological, stress and mood measurements	HT. Male participants experienced larger change on the anxiety subscale between the study and control groups. No such difference was noted in females All seven forest resting environments were shown to decrease stress to some extent. The more natural environments were more effective in relieving stress. The most natural environment did not show outstanding results in terms of stress relief. Natural environments with some man-made components or structure demonstrated significant physiological stress relief. A dynamic water landscape was effective at stress relief, both physiologically and psychologically Significant increase in all nature-related measures. Increased change scores on exposure to nature were correlated with improvement in social well-being. Increased nature connection was associated with decreased perceived stress. No change shown in physical activity and psychological measures
Warber et al. (2015)	Addressing 'nature-deficit disorder': a mixed methods pilot study of young adults attending a wilderness camp	USA	Staff and students ($n = 36$)	4-Week-long wilderness camp	To investigate whether nature-based camp experiences would increase connection to nature and promote multiple dimensions of well-being	Mixed methods; pre-camp and post-camp online questionnaires, interviews	Proposed three student-nature affiliation strategies: Raising awareness of local natural environments; Creating natural settings indoors; and Using nature-based therapies
Windhorst and Williams (2016)	Bleeding at the roots: Post-secondary student mental health and nature affiliation	Canada	Post-secondary stakeholders/ university students	N/A	To present and evaluate three ways in which universities may foster student-nature relationships, both on their campuses and in their surrounding communities	Opinion piece	Following the FT, blood pressure and heart rate decreased, and peripheral oxygen saturation increased. The viewing activities had a more pronounced effect on decreased heart rate
Zeng et al. (2020)	Benefits of a three-day bamboo forest therapy session on the physiological responses of university students	China	University students ($n = 120$)	Three-day bamboo forest therapy (FT) that involved 15 min of viewing of forest landscape and 15 min of walking in the bamboo forest	To investigate the effects of bamboo FT on physiological responses, namely, blood pressure, heart rate and peripheral oxygen saturation	Quantitative; RCT; physiological measurements and semantic differential method questionnaire	

used forest therapy and nature-related images as a form of nature-based therapy however, this was provided through virtual reality (Kucher et al., 2020; Wang et al., 2019). Some studies took an *in vivo* approach to nature-based therapy (Nakau et al., 2013; Sahlin et al., 2012; Sidenius et al., 2020; Sidenius et al., 2015; Phelps et al., 2015). These included horticultural-based activities, forest therapy, yoga, meditation and mindfulness, creating a garden bowl in the home environment and the use of support groups. The remaining studies included a wilderness camp (Warber et al., 2015), nature-based crafts (Masel et al., 2018), and incorporating natural environments indoors, such as a living wall within the university setting (Windhorst and Williams, 2016).

Empirical and theoretical research

The reviewed studies demonstrated that nature-based therapy interventions were used with a wide variety of cohorts. These included individuals with mental health conditions ($n = 6$) (Christie et al., 2016; Kusumawaty and Yunike, 2020; Oh et al.,

2020; Sidenius et al., 2020; Sidenius et al., 2015; Vujcic et al., 2017), specifically those with stress-related mental health conditions ($n = 4$) (Oh et al., 2020; Sahlin et al., 2012; Sidenius et al., 2020; Sidenius et al., 2015), university students ($n = 4$) (Song et al., 2013; Wang et al., 2019; Windhorst and Williams, 2016; Zeng et al., 2020), those belonging to no specific clinical group ($n = 3$) (Lee et al., 2014; Oh et al., 2020; Warber et al., 2015), oncology patients ($n = 2$) (Nakau et al., 2013; Phelps et al., 2015), elderly adults with mild hypertension (Sung et al., 2012), children with pancreatic conditions (Kucher et al., 2020), prisoners (Lee et al., 2021), palliative care patients (Masel et al., 2018), those suffering from alcoholism (Seifert, 2014) and those with a diagnosis of intellectual disability (Christie et al., 2016).

Benefits of nature-based therapies

Examining research on a health phenomenon

In spite of the heterogeneity of the studied cohorts, the benefits of nature-based therapies for the participating individuals

remained relatively consistent across the reviewed studies. In terms of physiological benefits, a decrease in heart rate, blood pressure and salivary cortisol level was reported by five studies (Lee *et al.*, 2014; Song *et al.*, 2013; Sung *et al.*, 2012; Zeng *et al.*, 2020; Wang *et al.*, 2019). The findings from these studies are in accordance with the finding of Lee and colleagues that forest walking significantly decreased the mean value of sympathetic nervous system activity ($p < 0.01$) and correspondingly significantly increased the mean value of parasympathetic nervous system activity ($p < 0.01$) (Lee *et al.*, 2014). Zeng *et al.*, (2020) also reported that bamboo forest therapy increases peripheral oxygen saturation. The study by Nakau *et al.* (2013) reported that an integrated nature-based therapy approach increased natural killer cell activity. Two studies found a change in physical well-being and fitness (Christie *et al.*, 2016; Oh *et al.*, 2020). However, several papers did not find any significant changes in physical well-being (Nakau *et al.*, 2013), physical activity or physiological change (Warber *et al.*, 2015), or cardiac health (Lee *et al.*, 2014; Sung *et al.*, 2012; Lim *et al.*, 2020).

Notably, decreased stress and increased relaxation, both physiologically and psychologically, were reported in nine studies (Christie *et al.*, 2016; Kucher *et al.*, 2020; Lim *et al.*, 2020; Masel *et al.*, 2018; Pretty *et al.*, 2017; Seifert, 2014; Vujcic *et al.*, 2017; Wang *et al.*, 2019; Warber *et al.*, 2015). In terms of improvements in mental health for the individual, a decrease in depression, anxiety, tension, pain and fatigue was reported by a significant number of studies (Kucher *et al.*, 2020; Lee *et al.*, 2021; Nakau *et al.*, 2013; Wang *et al.*, 2019). Furthermore, engagement in nature-based therapies resulted in psychological benefits, such as enhanced self-concept, self-esteem, positive identity, confidence, emotional stability, motivation, self-reflection, and a sense of achievement and responsibility for the participants (Christie *et al.*, 2016; Kusumawaty and Yunike, 2020; Lee *et al.*, 2021; Masel *et al.*, 2018; Oh *et al.*, 2020; Phelps *et al.*, 2015; Sahlin *et al.*, 2012; Seifert, 2014; Warber *et al.*, 2015; Corazon *et al.*, 2011). Other improvements reported within cohorts include decreases in negative feelings and dysfunctional thinking patterns, increases in positive feelings and mood, the attainment of a general sense of happiness and joy and positive changes in behaviour towards self and others (Christie *et al.*, 2016; Lee *et al.*, 2021; Lee *et al.*, 2014; Lim *et al.*, 2020; Masel *et al.*, 2018; Oh *et al.*, 2020; Phelps *et al.*, 2015; Sahlin *et al.*, 2012; Sidenius *et al.*, 2020; Wang *et al.*, 2019; Warber *et al.*, 2015). Participants referred to experiencing feelings of empowerment, transcendence, hope, trust, courage, the will to live, rejuvenation and mindfulness (Christie *et al.*, 2016; Lim *et al.*, 2020; Oh *et al.*, 2020; Phelps *et al.*, 2015; Sahlin *et al.*, 2012; Warber *et al.*, 2015).

Engagement in nature-based therapies promoted social well-being and relationship development between participants, as well as between patients and staff (Christie *et al.*, 2016; Kusumawaty and Yunike, 2020; Masel *et al.*, 2018; Warber *et al.*, 2015). For those suffering from alcohol addiction, participation in nature-based therapy acted as a preventative factor against adverse peer groups and participants reported a sense of belonging and connectedness to the group or wider community during nature-based therapy (Sahlin *et al.*, 2012; Seifert, 2014). However, Nakau *et al.* (2013) did not find any significant changes in emotional or social well-being and

research by Vujcic *et al.* (2017) found no significant difference in anxiety and depression subscales.

Participants in several studies reported an increase in their skills and knowledge following nature-based therapy (Christie *et al.*, 2016; Seifert, 2014; Warber *et al.*, 2015) and enhanced employability and productivity were also noted among some cohorts (Christie *et al.*, 2016; Sahlin *et al.*, 2012; Seifert, 2014). Two studies highlight participants developing new interests and hobbies as a result of their taking part in nature-based therapy (Phelps *et al.*, 2015; Sahlin *et al.*, 2012).

Increased quality of life, life satisfaction, well-being and spirituality were consistently reported across the cohorts (Christie *et al.*, 2016; Kusumawaty and Yunike, 2020; Lee *et al.*, 2021; Nakau *et al.*, 2013; Pretty *et al.*, 2017; Sahlin *et al.*, 2012; Sung *et al.*, 2012; Vujcic *et al.*, 2017; Warber *et al.*, 2015). Among palliative care patients, it was reported that improved quality of daily routine and relief of symptom burden was attained (Masel *et al.*, 2018). Participants in many studies reported that increased connectedness with nature and engagement in “green” activities were perceived as beneficial, enjoyable and meaningful, and as an outcome and reward in themselves (Christie *et al.*, 2016; Lim *et al.*, 2020; Warber *et al.*, 2015; Corazon *et al.*, 2011). Participation in nature-based therapy was reported to facilitate immersive attention and positive stimulation for healing and change (Oh *et al.*, 2020; Pretty *et al.*, 2017), a feeling of being safe and hidden (Sidenius *et al.*, 2015), or an escape (Christie *et al.*, 2016; Seifert, 2014) and a distraction from worries and ruminations (Masel *et al.*, 2018; Oh *et al.*, 2020; Sahlin *et al.*, 2012).

Gains from nature-based therapies are not universal

Relevance to health-care policy and practice

The benefits of nature-based therapies for the natural environment were not largely considered or measured in the reviewed papers. A theoretical paper discussed the use of person-centred approaches to facilitate a realisation of one’s embeddedness in their ecosystems and a subsequent increase in one’s awareness of the environment and sustainability (Chatalos, 2013). Supporting empirical research is scarce; however, participants in the study of Sidenius *et al.*, (2020) reported an increased awareness of self and environment following nature-based therapy.

In spite of the previously discussed research, some studies indicate that not all nature environments support health and well-being (Stigsdotter, 2015). This view is supported by research, which highlighted that although more natural environments were more effective at relieving stress, the most natural environment is not always the most beneficial (Wang *et al.*, 2019). Natural environments with some structure or artificial components can significantly reduce diastolic blood pressure ($p < 0.01$; $p < 0.05$ - depending on the environment), systolic blood pressure ($p < 0.01$; $p < 0.05$) and heart rate ($p < 0.05$) (Wang *et al.*, 2019). Similarly, natural environments with features that facilitate the use of that environment can be preferred by participants (Sidenius *et al.*, 2015). Notably, a dynamic water landscape or feature had a significant effect on decreasing systolic blood pressure ($p < 0.01$) and diastolic pressure ($p < 0.05$) (Wang *et al.*, 2019), and facilitating a feeling of relaxation (Sidenius *et al.*, 2015). Participants generally showed preference for nature-like environments, that

are somewhat enclosed, with the possibility to sense expanses while still feeling safe to relax or interact with the environment, for example, through scent, sounds and sights (Sidenius *et al.*, 2015). Seasonal factors did not affect the use of nature-like environments, while weather influenced the choice of nature-based activities (Sidenius *et al.*, 2015).

Factors that influence effectiveness of NBT

The benefits of nature-based therapy depend on individual characteristics, gender and needs (Stigsdotter, 2015; Song *et al.*, 2013). Positive effects of nature-based therapy were subject to participants being at the appropriate phase of their recovery (Sahlin *et al.*, 2012). Male participants experienced a larger change in their anxiety levels as a result of nature-based therapy compared to females; however, a bigger sample is required to verify the significance of this finding (Vujcic *et al.*, 2017). Meanwhile, female participants experienced lower systolic blood pressure and slower heart rate than males in the bamboo forest environment (Zeng *et al.*, 2020). Interestingly, Vujcic *et al.* (2017) found that gender and education did not change the benefits of horticultural therapy. Type A and B behavioural patterns, as proposed by Friedman and Rosenman (1974), affected the benefits of nature-based therapy (Song *et al.*, 2013). The beneficial physiological effect, namely, significantly decreased heart rate ($p < 0.01$), of forest therapy was only present in participants with Type B behavioural pattern, with significantly lower pulse rate ($p < 0.01$) and blood pressure ($p < 0.05$) in low-scoring Type B participants (Song *et al.*, 2013). However, this study was limited to male participants. Decreased mental capacity made participants more susceptible to having their participation influenced by weather conditions (Sidenius *et al.*, 2015). Tolerant and permissive environments, the flexibility of level of engagement with nature-based therapy and continuous admissions of new participants to the programme facilitated participation (Phelps *et al.*, 2015; Sahlin *et al.*, 2012). Conversely, a prison setting restricted engagement in nature-based therapy (Lee *et al.*, 2021). Whether forest walks were guided or unguided did not affect nature immersion and associated benefits (Lim *et al.*, 2020). More frequent trips to local “green” environments were more effective than occasional trips to remote nature environments, such as mountains (Oh *et al.*, 2020). Limited access to phones and the internet in the wilderness camp facilitated the benefits of the natural environment (Warber *et al.*, 2015).

Discussion

The three themes in the current study explored the forms of nature-based therapies, benefits across various cohorts and whether gains from nature-based therapies pertained to the natural environment. The reviewed literature generally aimed to elucidate the physiological and psychological effects of nature-based therapies on individuals (Lee *et al.*, 2021; Zeng *et al.*, 2020). The number of participants in the reviewed papers ranged from $n = 5$ (Kusumawaty and Yunike, 2020) to $n = 485$ (Song *et al.*, 2013). Factors that influenced the effectiveness nature-based therapies have been explored (Lim *et al.*, 2020; Song *et al.*, 2013). Fewer papers attempted to develop a theoretical model (Oh *et al.*, 2020) or approaches (Chatalos, 2013) for nature-based therapies. According to Fieldhouse and

Sempik (2014), the theories, frameworks and principles behind nature-based therapies were derived in some way from occupational therapy.

Nature-based therapies could be a pathway for incorporating sustainability into occupational therapy practice. The earlier mentioned World Federation of Occupational Therapists (2012, 2018) Guidelines set clear ambitions for occupational therapists’ role in sustainability and acting against the current environmental crisis. An occupational stewardship perspective within nature-based therapies, where individuals are encouraged to recognise the interconnectedness of their occupational choices and their environment, would be a positive addition in future practice (Rushford and Thomas, 2016). There is a call for occupational therapists to be the agents of change by practicing “environmentally informed occupational therapy”, proposing eco-occupations and educating service users on the benefits and meaning behind those occupations to both the individual and the natural environment (Dieterle, 2020; Ung *et al.*, 2020). However, this review found low levels of empirical evidence to support the view that nature-based therapies benefit the environment and contribute to sustainability. Only one paper (Sidenius *et al.*, 2020) investigated participants’ nature consumption one year following the nature-based intervention. Papers mainly focused on the benefits of various green environments to the individual and how human needs inform the design of green spaces. To explore the effects of human occupation on the natural environment, a different perspective is needed.

The use of community gardens and allotments has the potential to benefit public health and bring the benefits of nature-based therapies beyond clinical cohorts (Genter *et al.*, 2015). The Environmental Protection Agency (EPA) (2020) acknowledges the association between green and blues spaces and public health and well-being (Environmental Protection Agency, 2020). This view is echoed in the Institute for European Environmental Policies Report (ten Brink *et al.*, 2016). The report discusses the effect of nature-based solutions on public health and social well-being, while highlighting how these solutions are a sustainable and affordable option to benefit health and well-being (ten Brink *et al.*, 2016). The Healthy Ireland Strategic Action Plan 2021–2025 identifies 13 priority focus areas for 2021–2023 (Government of Ireland, 2021). Within these areas, there are several that could be linked to nature-based therapies, such as “Keeping active”, “Staying connected” and ‘Eating well’. However, the document does not specifically discuss the use of green and blue spaces to benefit public health and work towards a more sustainable and health-focused Ireland. Stigsdotter (2015) suggests a model for evidence-based health design when creating natural environments for the benefits of public health. Occupational therapists are well-positioned to provide their expertise in and advocate for these developments (Ung *et al.*, 2020).

Practical implications

Occupational therapy is well placed to support the Healthy Ireland Strategic Action Plan 2021–2025 (Government of Ireland, 2021), given the priority focus areas, including “minding your mood”, “minding your body” and “switching off and being creative”. Furthermore, lower socioeconomic status impacts health and well-being in part because of

difficulty accessing health services and green spaces (Environmental Protection Agency, 2020). This social inequity can be viewed as a form of occupational injustice (Ung et al., 2020). Given our remit to tackle this, whenever possible, we have an onus to address this injustice using an eco-social-sustainable approach which takes into account environmental, social, health and economic issues in relation to human occupations (Ung et al., 2020; Simó Algado and Ann Townsend, 2015). Occupational therapists can promote eco-occupations and the creation, use and preservation of green spaces through education, advocacy and community initiatives (Dieterle, 2020; Pollard et al., 2020). Furthermore, the link between ecological devastation and occupational injustices calls for occupational therapy expertise for the populations at risk (Simó Algado and Ann Townsend, 2015). That way, occupational therapists can play a role in public health, specifically through projects like those in Clonakilty, Co Cork (Murphy, 2018), where a community garden was set up for the Direct Provision Centre and the Hardwicke Community Garden (Sheridon, 2017), a Dublin inner city project that provides much needed green space for its residents. Eco-occupations, such as growing one's own food and using active transportation (i.e. cycling or walking), have individual, social, economic and ecological benefits (Ung et al., 2020). On a meso level, when providing nature-based interventions, occupational therapists can explore ecological meaning and value of various occupations as meaning is known to impact participation (Wensley and Slade, 2012).

Occupational therapists assist populations across the life course. Furthermore, they are used in a diverse range of clinical contexts. The findings of this review highlight that nature-based therapies could be put to positive use in many of these contexts and can benefit people of all ages. Engaging in activity in a natural environment was frequently used by occupational therapists practicing within institution environments. This review has presented the evidence to support the use of nature-based therapy in community service models. This has already begun in Ireland, particularly in mental health settings. Furthermore, research has commenced on the efficacy of a gardening and woodwork group on facilitating the achievement of individual recovery goals in a community mental health setting based in County Wexford (Sinnott, 2021). And, two nature-based therapy projects received the Ann Beckett Award in 2010 and 2013 (Association of Occupation Therapists of Ireland).

Limitations

As this review took an integrative approach to ensure a holistic view various methodologies were included. This diversity posed challenges when analysing, synthesising, and summarising data extracted from the individual findings. Only papers published in full and in English were included. The review was limited to a 10-year period; thus, relevant studies may have been missed. PRISMA guidelines were not strictly adhered to which authors recognise, in hindsight, would have strengthened the paper. Even though measures were taken to prevent bias such as using thematic analysis, critical appraisal of the data, and the assistance of a librarian, this type of review may be open to favourable inclusion of data, interpretation of results, or subjectivity of authors' world views because of a preferred

hypothesis (Grant and Booth, 2009). Finally, this type of review may lack the potential to broaden the scope of the topic reviewed (Grant and Booth, 2009). There was a scarcity of literature on the environmental impact of nature-based therapies, leading to an inability to draw any firm conclusions on this issue.

Conclusion

This review identified a wide variety of interventions under the board category of nature-based therapies, the most common being horticultural and forest therapies. It unearthed themes on the benefits of these for individuals but not the government. However, careful consideration is required when planning and implementing nature-based interventions, as benefits were found not to be universal. While nature-based therapies potentially benefits the individual, public health, and the environment, the latter remains understudied. Such work, when undertaken, will inform future policies and provide a rationale for more environmentally conscious occupational therapy practice.

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Further reading

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