Implementation Science Communications

SYSTEMATIC REVIEW

Open Access

The essential elements for successful implementation of nature therapy programs in mental health services: a systematic review with narrative synthesis

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Abstract

Background The potential of nature-based interventions (NBIs) for improving mental health is gaining interest worldwide. However, the elements for successful implementation of nature therapy programs by mental health service providers have not been clearly identified. The review question was, what elements are essential to successfully implement nature therapy programs in mental health services?

Methods The study was carried out as per the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria. Four electronic databases including Scopus, Web of Science, PubMed, and PsycINFO were searched to identify eligible studies. Studies were assessed for eligibility based on predefined inclusion criteria, and data were extracted in line with the review question. Two reviewers independently used the Mixed Methods Appraisal Tool (MMAT) to assess the quality of the articles.

Results Out of 1663 articles, 38 met the inclusion criteria, with 10 found to have a high or moderate risk of bias. Sample sizes ranged from 8–781. The findings revealed that structured programs, guidance from trained multidisciplinary practitioners, and opportunities for participants to connect socially are key elements of successful implementation of nature-based therapy programs. Challenges to implementation were identified as logistical constraints, unfavourable external conditions, insufficient guidelines, and limited availability of resources.

Conclusion This systematic review identifies essential elements of successful implementation of nature-based therapy programs in mental health services. Although implementation strategies are rarely reported, a preliminary implementation framework derived from indirect evidence offers practical guidance for NBIs design, while highlighting the need for further research on implementation processes and sustainability.

Trial registration The protocol of this review was registered in the Prospective Register of Systematic Reviews (PROSPERO), under the identification number CRD42024562262.

Keywords Nature-based interventions, Mental health services, Implementation, Systematic review, Multidisciplinary care

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Contributions to the literature

- Introduces a preliminary implementation framework to guide NBI delivery in mental health services.
- Highlights the need for better reporting of implementation strategies, fidelity, and contextual factors in NBI studies to support replication and scale-up.
- Emphasises the importance of multidisciplinary teams, facilitator training, and social connection in effective delivery.
- Underscores the need for stable funding, leadership support, and systems-level planning for sustainability.
- Suggests that flexible, evidence-informed models with core components may be more feasible than rigid protocols in real-world settings.
- Shows that useful implementation insights can be drawn from indirect data such as program descriptions and study limitations.

Introduction

Mental health conditions are a major public health problem globally, accounting for at least 18% of the world's burden of the disease [1]. From 1990 to 2019, the overall number of disability-adjusted life years (DALYs) associated with mental diseases climbed from 80.8 million to 125.3 million, while the percentage of DALYs linked to mental health issues escalated from 3.1% to 4.9% [2]. Furthermore, the recent Coronavirus Disease 2019 (COVID-19) pandemic caused a 25% increase in the global prevalence of depression and anxiety [3]. An expert panel on international mental health and sustainable development underscored the recognition of "mental health as a fundamental human right" and a critical component of national and global development [2], yet individuals with a mental illness often encounter adverse health and social outcomes linked to cognitive and functional impairments recurrent hospitalizations, and an ongoing requirement for support from community-based mental health services [4]. Considering the widespread prevalence and significant societal and financial burdens of mental health problems, it is essential to prioritize the availability, efficacy, and cost-effectiveness of mental health interventions.

According to a previous study, NBIs are programs or activities that are conducted in natural settings, such as exercising in green areas, with the aim of improving people's health and well-being by combining the benefits of being in nature with positive behaviour [5]. Notably, NBIs offer opportunities for enhancing mental health treatment. NBIs have been shown to reduce negative mental health symptoms such as stress, anxiety and depression [6–8]. Studies also revealed that NBIs can improve memory, cognition, and attention [9, 10]. Different NBIs including forest bathing [11], and community gardening [12] have been associated with increased levels of confidence, feeling of safety, and an overwhelming sense of empowerment and purpose [13–16]. Nature exposure can also reduce feelings of loneliness [17] and facilitate social relationships and connections, including engaging in conversation via participating in collaborative activities [18]. As Hippocrates, the father of Medicine, stated thousands of years ago: ""Nature is the best physician" and "nature is the healer of disease" [19]. However, how to apply this adage systematically within modern health systems is a challenge.

Since 2001, research on the adoption and implementation of evidence-based therapies in clinical and community practice has grown rapidly, especially in the field of mental health [20]. Implementation science focuses on the adoption, execution, and sustainability of evidence-based interventions, as well as the application of implementation strategies to promote their translation into practice [21]. Implementation research is crucial to global health, as it addresses the practical challenges of achieving national and international health objectives which connect practice and research to expedite the creation and application of public health strategies [22]. The successful implementation of NBIs depends on organizational and contextual factors. Different studies revealed that the NBIs can improve mental health outcomes. However, integration of NBIs into treatment programs remains inconsistent. Understanding the key elements for successful implementation is essential for the effectiveness of NBIs. Therefore, this systematic review aims to fill this gap by determining the key components of nature-based therapy programs that are necessary for mental health service providers to effectively implement them. The review question was, what elements are essential to successfully implement nature therapy programs in mental health services?

Method

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA; [23]) standards were followed to carry out this systematic review (Fig. 1). The systematic review protocol was registered on PROSPERO, under identification number CRD42024562262.

Search strategy

The systematic search was carried out in Scopus, Web of Science, PubMed and PsycINFO limited to English and Spanish language up to June 2024. The search strategy was developed by the investigators (J.A., N.S., and Z.A.R) and later finalised by the expert librarian from University of Wollongong. Search terms included: "nature therap*"

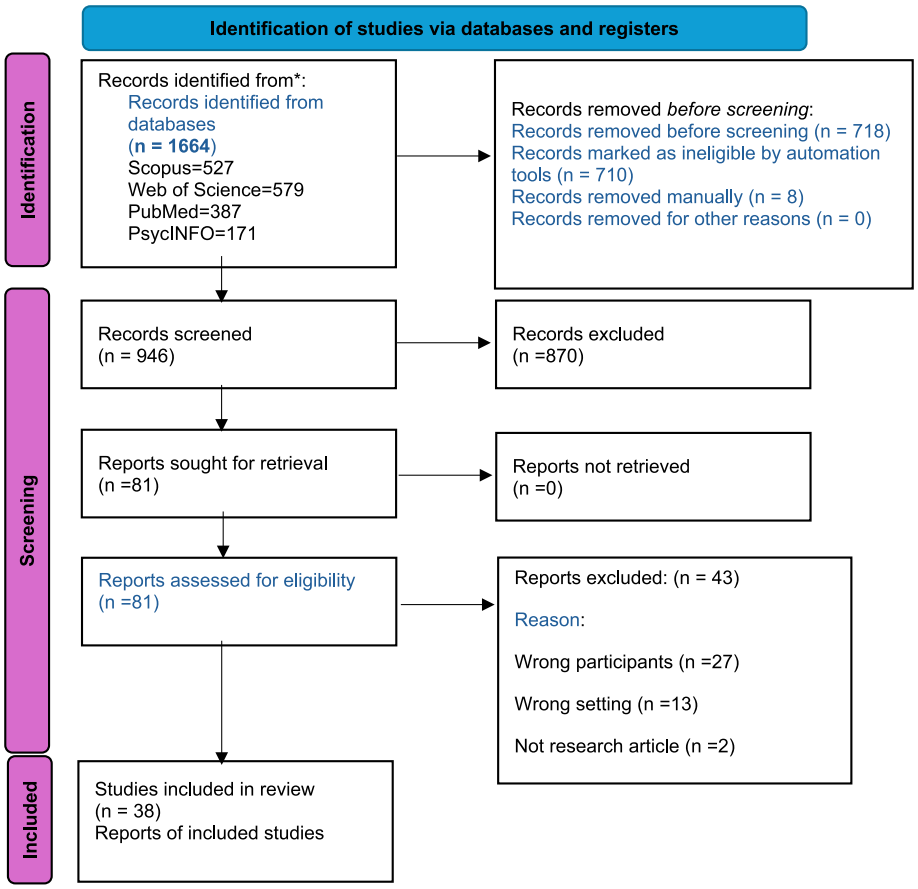

Fig. 1 PRISMA flow chart for search results

OR "nature prescribing" OR "nature based" OR "nature spaces" OR "green exercise*" OR "forest therap*" OR NBI*AND program* OR intervention OR model AND "mental health" OR "mental illness" OR "mental disorders" OR depression OR anxiety OR "Psychiatric Illness". The inclusion and exclusion criteria are detailed in Table 1 and bibliographic data base searches are displayed in Supplementary Table 1.

Study selection and quality assessment

This review encompassed randomized controlled trials, non-randomized pre/post-test studies, observational studies, and pilot studies excluding reviews. Retrieved articles were transferred to Covidence and duplications were removed automatically. The title and abstract screening were completed by ZAR and OG with JA or NS resolving conflicts. Subsequently, full texts were evaluated according to the inclusion criteria to assess their relevance to the study. As different types of studies (e.g., quantitative, qualitative, and mixed-methods studies) were included in this systematic review, we employed the Mixed Methods Appraisal Tool (MMAT, 2018) to assess the quality of the articles. MMAT is applicable for evaluating five distinct categories of studies: (a) qualitative, (b) randomized controlled trial, (c) non-randomized study, (d) quantitative descriptive research, and (e) mixed method research and each criterion was evaluated as "yes," "no," or "unsure" [24]. Two researchers (ZAR, OG) independently completed the MMAT. If any discrepancies arose, they were discussed until a consensus was reached. Although it is discouraged to compute a total score from the ratings of each MMAT criterion because a single value does not accurately inform what aspects of studies are at an increased risk of bias [25], in the present work we report a traffic light system as an intuitive way of reporting the overall quality of the included studies (Supplementary Table 2).

Outcome measure

Main outcomes

The main outcome of the NBI is measured by efficacy and feasibility of interventions, patient satisfaction, adverse consequences, and accessibility of NBI. Provider outcomes are assessed based on implementation ease,

Table 1 Inclusion and Exclusion Table: What are the essential elements for successful implementation of nature therapy programs in mental health services?

Criteria	Relevant/Inclusion Criteria	Irrelevant/Exclusion Criteria	Exclusion criteria for full text
Study focus	• Papers referring to nature therapy, nature connection, green prescription, horticulture therapy, forest bathing • Focus on mental health of participants • Papers in English	• Animal-assisted therapies • virtual nature	• Wrong study focus (e.g., not a nature intervention)
Data	• Empirical studies • Quantitative studies • Qualitative studies	• Prevalence studies • Epidemiology/epidemiological studies	• Wrong study data (e.g., prevalence study)
Participants	• People with mental health conditions, mental illness	• People without mental health condition, • population studies, • people with dementia, Alzheimer's, autism • Students	• Wrong participants (e.g., no mental health condition, not human, animal)
Interventions	• Treatment programs with therapeutic intent where at least half the treatment consists of nature-based intervention defined as an activity including specific contact with nature (i.e., outdoor spaces, garden, parks, wetlands)	• Medical interventions (e.g., symptom tracking, medications) • Mental health measures without an intervention • Virtual nature • Animal assisted therapies	• Wrong interventions (e.g., no interventions or not nature intervention)
Settings	• Mental health services or organisations, community mental health services, mental health clinics, hospital inpatient and outpatient services for patients with diagnosed mental illness	• Schools • Universities • Workplace • General community organisation or program	• Wrong setting (e.g. not a mental health program setting)
Publications	• Research papers	• Protocols • Book reviews • Book chapters • Letters, editorials, news updates, speeches • Case reports • Missing abstracts • Conference abstracts • Systematic reviews	• Wrong publication (e.g. systematic review, book or book chapter)
Outcomes	Patient outcomes – • intervention efficacy/feasibility, patient satisfaction, or adverse outcomes, intervention accessibility Provider outcomes – • ease of implementation, organisational readiness to implement, organisational approach to change, recognition of positive outcomes, benefit to clients, and benefits to clinicians, experience of clinicians	• No reported outcomes • No results	• Wrong outcomes (no data reported)
Language of Publication	• English • Spanish	• Titles and abstracts in a language other than English or Spanish	• Not English or Spanish manuscript
Publication Date	• No limit		

organizational readiness, approach to change, acknowledgment of favourable results, perceived advantages for participants, and benefits for clinicians.

Measures of effect

Types of NBI employed (e.g., surfing, hiking, horticulture), Program structure (e.g., intensive one-week format, weekly sessions over 12 weeks, many sessions per week for a longer duration), Psychometric assessments (i.e., Patient Health Questionnaire, Positive and Negative Affect Scale) and the extent of clinician engagement in the administration of the NBI.

Data extraction

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria has been adhered to for the screening, selection, and inclusion of research. Studies for inclusion were identified through a database

search using the specified search terms. The results were imported into the reference management software EndNote and transferred to Covidence. Two researchers (ZAR, OG) screened titles and abstracts independently utilizing the system established in the extraction tables based on Cochrane (2011). Studies failing to satisfy the inclusion criteria were excluded. Any disagreements were discussed and resolved collaboratively, and the resolution process was documented. When two authors did not agree on the exclusion, the studies were referred to another author (NS).

The primary and secondary investigators (ZAR and OG) thereafter performed a full text review of included studies. Discrepancies were addressed with the study team (JA, NS), and resolutions were noted for each instance. All remaining publications that satisfied the eligibility requirements progressed to the data extraction stage. Two reviewers independently extracted the data using predefined extraction tables. Extracted items included study characteristics (author/s, year, and country of publication), study design, methods, intervention, outcomes, barriers and enablers to implementation.

Results

Overall search findings

A total of 1664 publications were obtained from the included databases. 946 articles were evaluated for eligibility based on title and abstract evaluation after duplicates were eliminated, and finally, 81studies were eligible for full text review and 38 papers satisfied the requirements for inclusion. Lack of a well-defined mental health condition ($n=24$) and unclear mental health services ($n=7$) were the main reasons for exclusion. Of these studies, 10 were identified to be at high risk or moderate risk of bias (Supplementary Table 2). Most of these studies did not clearly state any confounding factors that influenced the research outcome. Although we extracted these articles and have provided their details (Table 2 and Supplementary Table 3), only 28 studies are included in the final outcome and discussion sections. The PRISMA flow diagram displays the search's findings (Fig. 1).

Sample sizes ranged from 8 to 781 people (Table 1). Most of the included studies were conducted in Europe ($n=21$). Six studies were conducted in Sweden, four in the UK, two in Denmark, two in Germany, two in Finland, one in Czech Republic, one in Norway, one in Serbia, one in Ireland, and one in Netherlands. Outside Europe, three studies were conducted in the USA, three in South Korea and one in Australia, and (Fig. 2). In terms of study design, 10 studies were quantitative, 10 studies used qualitative methods, and 8 studies had mixed methods. Most included studies referred to their intervention as a nature-based program or approach or therapy. However, the activities facilitating interaction with nature within each study varied. While many interventions included several components, for example music therapy in a garden as well as gardening activities, studies were grouped according to the focus of the program as described by the authors. Gardening interventions were most common ($n=9$ studies), followed by Nature-Based Therapy (NBT) interventions ($n=5$), nature-based rehabilitation programmes ($n=4$), nature walking interventions ($n=3$), forest-based interventions such as forest therapy and forest healing ($n=3$), physical activity in an outdoor setting ($n=2$), and animal assisted therapy ($n=1$). While this review uses the term nature-based intervention (NBI) to refer collectively to nature focused programs, different studies used a range of acronyms. The author's acronym is used when describing a study and its results.

Aims of the studies

Study aims were diverse, and populations were heterogenous. Forest Therapy, Forest Healing, and mobile based forest therapy program (smartphone-app–guided) explored the psychological impacts of forest environments, particularly on depression, mindfulness, and aggression reduction. For example, one study aimed to use the forest healing program to help adults diagnosed with depressive illnesses reduce anxiety and depression [64]. Nature-Based Therapy (NBT) also known as nature-assisted therapy aimed to explore its therapeutic potential, with one study focusing on the relationships between NBT, mental health, and individuals' connectedness to nature. For example, one study aimed to investigate the effectiveness and feasibility of NBT for communities experiencing psychological distress during the pandemic [65]. Nature-based rehabilitation (NBR) in Sweden was comprised of two main components: (1) traditional medical rehabilitation approaches for stress-related mental disorders (SRMD)—including relaxation techniques, stress management, physiotherapy, body awareness training, therapeutic conversations, and handicraft activities—delivered within a natural setting; and (2) engaging in activities or simply spending time in gardens and natural environments, aimed to assess the effects of NBR in patients with exhaustion disorder or stress-related mental health condition [66]. A study aimed to understand the value of the activities to patients in a psychiatric inpatient setting using grounded theory [67]. Another study applied a program called nature and animal assisted mindfulness (NAM) aimed to evaluate its preventative efficacy over the course of 1 year for unstable or partially remitted depressed patients with a history of early life trauma [68]. One study assessed changes in depression severity, attentional capacity, and rumination (brooding)

Table 2 Details of Included Studies—Authors, aims, methods and key findings

First author (year) Country	Type of therapy	Type of study	Study aims	Methodology	N (n male)	Age; Diagnosis	Findings
Adevi (2018) Sweden [26]	Specially designed healing garden	QUAL	To observe the participants in the rehabilitation program during activities performed in the garden. The aim was to distinguish specific qualities, patterns and/or processes during the participants' stay in the rehabilitation garden. The underlying aim was to gain a deeper understanding of what might be health-promoting and to obtain more knowledge of the healing processes within 'the salutogenic unit' of Alnarp Rehabilitation Garden, comprising the Alnarp model: the environment and the therapists' work	Single-case study	13 (1)	35–65; Stress-related mental disorders	The results showed that patients who underwent Psychotherapy were more open and contact-seeking, and carried out extrovert recreational walks. By contrast, patients who underwent physiotherapy were introverted, emotionally withdrawn and performed introvert recreational walks. Interpretation of the data suggested that treatment combined with activities in certain parts of the rehabilitation garden induced and supported different psycho-physiological processes. The mechanisms and progress of these are discussed from the theory of situated cognition, and how these processes are stimulated and supported by characteristics in the garden. Oxytocin, a hypothalamic peptide which stimulates social interaction, induces anti-stress effects and stimulates growth and healing, may hypothetically be involved in these processes
† Barton (2012) United Kingdom [27]	Green exercise programme	QUAN	To evaluate two existing group-based health promotion initiatives targeting clinical populations and compare these to a new green exercise programme introduced at a third site involving a similar clinical population	Experimental intervention	53 (20)	53.0 (15.4); substance-related disorders, schizophrenia and other psychotic disorders, mood disorders or anxiety disorders	A significant main effect for self-esteem and mood pre and post activity ($p < 0.001$) was reported after participating in a single session. The change in self-esteem was significantly greater in the green exercise group compared with the social activities club ($p < 0.001$). Dose responses showed that both self-esteem and mood levels improved over the six-week period and improvements were related to attendance in the green exercise group

Table 2 (continued)

First author (year) Country	Type of therapy	Type of study	Study aims	Methodology	N (n male)	Age; Diagnosis	Findings
† Benvegnù (2024) Italy [28]	Nature experience	QUAN	To test the effects of exposure to a natural lagoon environment on craving and measures of wellbeing in substance use disorder (SUD) patients in comparison to exposure to an urban environment	Latin square design	24 (NR)	18–65; pathological addiction under treatment	The Nature walk significantly decreased craving in participants compared to their pre-walk values, and compared to craving after the Urban walk, with the latter significantly increased vs. pre-walk values. The Nature walk significantly decreased negative mood and increased wellbeing and agency. Openness to the future and restorativeness measures showed significant improvement after the Nature walk compared to the Urban walk. On the other hand, craving scores after the Urban Walk positively correlated with negative mood and a Sense of Negative Agency values and negatively correlated with wellbeing scores
† Bielinis (2020) Poland [29]	Forest therapy programme	QUAN	To evaluate how 'forest therapy' affects the mental health of people who are treated in a psychiatric hospital for affective or psychotic disorders	Experimental intervention	50 (23)	42.44 (13.23); Psychotic and affective disorders	In the group of patients with affective disorders, forest therapy had a positive effect on nearly all POMS scale subscales (highlighting 'confusion' and 'depression-dejection') and in the level of anxiety measured with the STAI-S scale. In the case of patients with psychotic disorders, the values of the 'confusion' and 'vigour' subscales and the STAI-S scale exhibited the greatest changes. Regarding the 'fatigue' subscale, no significant changes were observed
Carlson (2020) United Sates [30]	Nature-based therapy	QUAL	To understand the processes of maintaining nature-based therapeutic groups and the value of the activities to patients in a psychiatric inpatient setting using grounded theory	Observational study	75 (NR)	19–75; major depression, post-traumatic stress disorder, anxiety disorders, and co-occurring substance use disorders	Findings indicated that the group promoted use of the senses, social interaction, and care of self/others. Perceptions of benefits led to a nuanced understanding of the effects of being in contact with nature
† Frühauf (2016) Austria [31]	Outdoor physical activity	QUAN	To compare the affective experience of an acute outdoor exercise bout with indoor and sedentary equivalents for individuals with clinical depression	Nonrandomized study	14 (6)	32.7 (10.8); mild to moderate depression	Concerning the MSS subscales, whilst patients in the SC exhibited minimal changes, significantly lower "excitement" scores and higher "activation" scores were reported following the OC. Affective activation also differed significantly between OC and IC

Table 2 (continued)

First author (year) Country	Type of therapy	Type of study	Study aims	Methodology	N (n male)	Age; Diagnosis	Findings
Gonzalez (2010) Norway [32]	Therapeutic horticulture	QUAN	To assess change in depression severity, perceived attentional capacity and rumination (brooding) in individuals with clinical depression during aTH programme and to investigate if the changes were mediated by experiences of being away and fascination	Nonrandomized study	28 (7)	25–64; major depression, dysthymia, or depressive phase of bipolar II disorder, BDI score ≥ 15	Mean BDI scores declined by 4·5 points during the intervention. The decline was clinically relevant for 50% of participants. Attentional Function Index scores significantly increased, while Brooding scores significantly decreased The changes in BDI and Attentional Function Index scores were mediated by increases in Being Away and Fascination, and decline in Beck Depression Inventory scores was also mediated by decline in Brooding. Participants maintained their improvements in BDI scores at 3-month follow-up
† Høegmark (2022) Denmark [33]	A nature- based rehabilitation program called the 'Wildman Programme'	QUAN	To assess the implementability and effect of the 'Wildman Programme' on the participants' quality of life and symptoms of stress	Experimental intervention	20 (20)	18–78; Mental health problems or chronic illnesses	The study showed the 'Wildman Programme' has potential to reduce stress symptoms (15.40%) and enhance quality of life (10.07%) among the male participants. Furthermore, physical health (13.92%) and psychological health (16.88%) in relation to quality of life increased during the program
Howarth (2018) United Kingdom [34]	Therapeutic horticulture	MM	To evaluate the impact of a mental health recovery programme that used therapeutic horticulture as an intervention to reduce social inclusion and improve engagement for people with mental health problems	Experimental intervention	47 (NR)	35–68; Mental health problems (not specified)	The recovery star data indicated that participants were working towards self-reliance. Qualitative data from the exit interview and semi-structured focus groups found similar results. The triangulated findings highlight that the mental health recovery programme enabled participant integration into the community through providing a space to grow and build self-confidence while re-engaging with society. The results suggest that using therapeutic horticulture as an intervention within the mental health recovery programme can support people with mental health problems to re-engage socially. Nature-based activities could be used within the 'social prescribing' movement to encourage partnership working between the NHS and voluntary sector organisations which can complement existing mental health services

Table 2 (continued)

First author (year) Country	Type of therapy	Type of study	Study aims	Methodology	N (n male)	Age; Diagnosis	Findings
Hyvönen (2023) Finland [35]	Nature-based treatment	QUAN	To investigate the effects of nature-based treatment on depression symptoms among participants who were diagnosed with clinical depression	Experimental intervention	136 (111)	22–64; depression Or a BDI-I score 10 or above	The study found that participants in the nature-based treatment group experienced a greater decrease in psychological distress and an increase in restorative experiences compared to the standard care-only group, with these effects being statistically significant. Additionally, participants in the nature-based group reported improved self-assessed ability to work or study at the post-measurement stage. Although both groups saw significant reductions in depression scores, no significant differences were found in depression levels between the two groups
Joschko (2023) Germany [36]	Nature-based therapy	MM	To investigate the relationships between nature-based therapy, mental health, and individuals' connectedness to nature	Experimental intervention	16 (3)	18–27; Depression (mild–severe)	The results demonstrated improvements in mental well-being and connectedness to nature through therapy. Additionally, depression scores decreased. Patients reported the importance of the therapist setting the space, the supportive environment, the poems that fostered the nature connection, improvement at the soul level, and overall doing something meaningful. Every patient experienced nature-based therapy as effective
Keenan (2021) Ireland [37]	Three Good Things in Nature (TGTiN) (Nature based or urban (control) walk)	QUAN	To investigate the impact of walking in nature on those with experiences of depression and/or anxiety thereby reaching those interested in walking activities	RCT	50 (20)	19–62; depression and anxiety	An ANCOVA, with age as covariate, showed a significant effect of time by condition on all variables: nature connectedness; positive affect; negative affect; well-being. Post-hoc tests indicated a significant increase in nature connectedness and positive affect in the nature versus an urban walk at post and follow-up. Negative affect decreased in the nature walk at post intervention, while well-being was significantly greater in the nature walk at follow-up

Table 2 (continued)

First author (year) Country	Type of therapy	Type of study	Study aims	Methodology	N (n male)	Age; Diagnosis	Findings
† Kil (2023) United States [38]	Forest Therapy Program	QUAN	To explore whether a structured forest therapy practice influences mindfulness, nature connectedness, mood states, and place meanings, and physiological health responses among children and adolescents with mental health disorders who engaged in two sets of a structured forest therapy program	Experimental intervention	12 (9)	9–14; anxiety, stress, trauma, attention-deficit/hyperactivity disorder, disruptive mood dysregulation disorder, and oppositional defiant disorder	A structured forest bathing program had significant positive changes in mindfulness, nature connection, mood states, place meanings, and physiological health outcomes, which indicates that the forest bathing program effectively improves the psychological and physiological health and well-being of children and adolescents with mental health disorders
Macháčková (2021) Czech Republic [39]	Forest therapy	MM	To discover whether It is possible to reduce aggressive behaviour with forest therapies based on observing the social behaviour of forest animals with the simultaneous therapeutic action of Shinrin-yoku and Outdoor Behavioural Therapy	Experimental intervention	68 (43)	12–16; Affective disorders and Family-related behavioural disorders	The experimental intervention has a statistically significant effect on the decreased final values relating to psychopathology, irritability, restlessness, emotional instability, egocentrism, relativity, and negativism
Maund (2019) United Kingdom [40]	Nature-based health interventions	MM	To engage individuals with wetland nature for the treatment of anxiety and/or depression	Quasi-experimental study	16 (8)	18–84; depression and/or anxiety	Results demonstrate significant improvements in mental health across a range of indicators, including mental wellbeing, anxiety, stress and emotional well-being. Participants and healthcare professionals cited additional outcomes including improved physical health and reduced social isolation. The wetland site provided a sense of escape from participants' everyday environments, facilitating relaxation and reductions in stress. Wetland staff knowledge of the natural world, transportation and group organisation also played a considerable role in the intervention's success
Mitchell (2024) England [41]	Nature-based approaches	MM	To explore the implementation of NBAs within Child and Adolescent Mental Health Services (CAMHS), examining staff attitudes and understanding to identify potential benefits and challenges through a mixed methods study	Explanatory sequential design	154 (20)	< 25–65 +; Child and Adolescent Mental Health Services (CAMHS) staff working at one NHS Trust	Ninety-seven staff responded to the wave 1 survey and 57 responded to the wave 2 survey. Fourteen staff members were interviewed. Data synthesis generated three themes: Tension between the culture of CAMHS and NBAs (Theme 1) and the need for buy-in and governance support (Theme 2)

Table 2 (continued)

First author (year) Country	Type of therapy	Type of study	Study aims	Methodology	N (n male)	Age; Diagnosis	Findings
† Noushad (2022) Pakistan [42]	Nature-based physical activity	QUAN	To explore the psychophysiological aspects and monitoring nature-based physical activity (walk) effectiveness in achieving Post-Traumatic Growth Inventory	RCT	262 (118)	16–50; Health care providers experienced a traumatic event in the last 12 months	There was a significant effect of nature-based physical activity on traumatic stress and post-traumatic growth in comparison with the sit-in control. A significant post-interventional difference was observed in the mean PTGI score [$F = 5.412$, $p = 0.022$] between the experimental and control groups after 3 months of intervention. All the biochemical estimates, including CRP, BDNF, IL-6, and cortisol levels, were significantly altered in both post-intervention study groups ($p < 0.01$)
Olcoń (2023) Australia [43]	Nature Walking	QUAL	To identify: 1) the benefits and challenges of participating in the NWG and 2) the impact on and meaning of the NWG for participants' mental health	Ethnographic observations	10 (4)	37–66; schizophrenia, depression, and anxiety	Three major themes were identified in the data and participants' words were used to name each theme. Theme 1 – "I can get to a happy place by visiting nature" refers to participants' accounts of the activity's impact on their mental health. Theme 2 – "Knowing that you are not alone" incorporates experiences of social connection and participant interactions. Theme 3 – "It was really rewarding and helpful" describes participants' satisfaction with how the groups were organised and run and the elements they enjoyed the most
Pálsdóttir (2014) Sweden [44]	Nature-based rehabilitation (NBR)	QUAL	To increase the in-depth understanding of supportive outdoor environments, especially the role of nature in the rehabilitation process and the essential qualities by which nature can affect health outcomes	Longitudinal case-study	43 (8)	25–62; adjustment disorder and reaction to severe stress or depression	Three main superordinate themes were identified as the three phases of NBR—Prelude, Recuperating and Empowerment—explaining and illuminating the role of the natural environments in each phase. An explanatory model of NBR in this context is presented including the three phases of NBR, IRP supportive occupations and a pyramid of supporting environments

Table 2 (continued)

First author (year) Country	Type of therapy	Type of study	Study aims	Methodology	N (n male)	Age; Diagnosis	Findings
Pálsdóttir (2021) Sweden [45]	Garden smellscape	QUAL	To investigate how participants in nature-based rehabilitation describe their perceptions and lived experiences of a garden smellscape	Longitudinal Case-Study	59 (9)	25–62; stress-related mental disorders, i.e., exhaustion disorder, or depression	The results revealed in what way nature odor (odor in nature) evoked associations, emotions, and physical reactions and provide examples of how nature scents function as a catalyst for sensory awareness and memories. Findings supported the understanding that experiencing the smell of plants, especially pelargonium, may facilitate stress reduction and support mental recovery in a real-life context
Poulsen (2018) Denmark [46]	Nature-based intervention	QUAL	To explore how veterans with PTSD manage their everyday lives during and after a ten-week nature-based intervention in a therapy garden	Observational study	8 (8)	26–47; Veterans with PTSD	Five themes emerged from the IPA analysis: Bodily symptoms; relationships; building new identities; the future; and lessons learned. All the participating veterans gained a greater insight into and mastering of their condition, achieved better control of their lives, and developed tools to handle life situations more appropriately and to build a new identity. This improved their ability to participate in social activities and employment
Sahlin (2015) Sweden [47]	Nature-Based Rehabilitation	QUAN	To explore whether the mental health and well-being of NBR participants had improved at the end of the NBR and at three follow-ups, and to explore the development of sick leave and health care utilization according to the NBR model (n = 57) and an occupational health service (OHS) model (n = 45)	Quasi-experimental study	102 (4)	26–63; stress-related mental illness (such as ED, depression, anxiety)	Results showed decreased scores on burnout, depression and anxiety, and increased well-being scores and significantly reduced health care utilization in the NBR group
Salonen (2022) Finland [48]	Nature-based rehabilitation	QUAL	To present the central theoretical views, objectives and methods of the Flow with Nature (FWN) treatment, treatment, and, secondly, to qualitatively describe the occurrence of the central theoretical themes in the FWN treatment participants' feedback	RCT	82 (72)	44 (NR); Clinical depression	Content analysis revealed that the participant feedback answers were in agreement with the central theoretical themes of FWN. The participants emphasised the significance of nature, social support and exercises differently. Moreover, the significance of these ingredients differed according to the stages of treatment: in the horizon stage restorative (e.g., fascination) and comprehensive nature experiences (e.g., connectedness with nature), in the growth stage social support (e.g., peer support) and in the path stage environmental self-regulation (e.g., nature as a part of life) were emphasised

Table 2 (continued)

First author (year) Country	Type of therapy	Type of study	Study aims	Methodology	N (n male)	Age; Diagnosis	Findings
Schramm (2022) Germany [49]	Nature- and animal assisted mindfulness program (NAM)	QUAN	To evaluate the preventative efficacy of a nature- and animal assisted mindfulness program (NAM) over the course of 1 year in unstable or partially remitted depressed patients with a history of early life trauma	RCT	67 (12)	18–70; unstable or partially remitted depression and a history of childhood maltreatment	Analyses revealed significant differences in relapse rates and number of weeks depressed throughout the course in favor of NAM. Furthermore, global quality of life improved significantly more in the NAM group. There was no significant difference for other secondary outcomes. Satisfaction with the program was high with a low drop-out rate of 6%. The vast majority of the participants felt safe practicing mindfulness in nature and found sheep for assistance helpful and motivating
† Shin (2012) South Korea [50]	Forest therapy camp	QUAN	To evaluate the effect of a forest experience on the levels of depression of alcoholics	RCT	92 (84)	IG: 44.66 (3.90), IG: 45.87 (3.85); Depression of alcoholics	There was a significant improvement in the depression level of alcoholics who had participated in the forest camp program (treatment group)
Sidenius (2017) Denmark [51]	Nature-based therapy (NBT)	QUAL	To illuminate the essence of NBT in Nacadia during a 10 week treatment programme, and to describe the essence of the phenomenon and its constitutive elements	Reflective lifeworld research	42 (NR)	20–60; adjustment disorder and reaction to severe stress	The findings reveal that participants engaged in a searching approach to understand and familiarize themselves with Nature-Based Therapy (NBT) and the Nacadia environment. This process of exploration fostered increased familiarity, which was crucial in cultivating a sense of confidentiality and attachment to Nacadia. Participants emphasized the importance of feeling protected, safe, cared for, and not exposed, which motivated feelings of freedom and reduced perceived demands. As a result, they experienced greater engagement with a wider range of NBT activities
Toews (2018) United States [52]	Nature-based intervention (planting party)	MM	To understand the impact of a short-term nature-based intervention on the social-emotional well-being of women incarcerated on a mental health unit in a state prison	Experimental intervention	16 (0)	NR; Subacute mental health issues (11 female). 5 mentors	Quantitative results: women were significantly happier, calmer, and more peaceful after the intervention than before. Qualitative results: women appreciated the planting party and the way the plants improved the physical environment. Women were also emotionally and relationally impacted by their participation and practiced skills related to planting and working with people

Table 2 (continued)

First author (year) Country	Type of therapy	Type of study	Study aims	Methodology	N (n male)	Age; Diagnosis	Findings
van den Berg (2021) The Netherlands [53]	Walk and talk coaching program	MM	To conduct a quasi-experimental field study into the effectiveness of a walk and talk coaching program for employees with burnout and stress-related complaints	Experimental intervention	40 (9)	IG: 42.05 (1.85), CG: 44.00 (2.55); Burnout and stress- related complaints	Participants in the walk and talk group improved more on burnout, stress symptoms, general mental health, and wellbeing than those in the control group. These improvements were most pronounced at the post-intervention measurement, but some effects were already visible at mid-term. Participants also evaluated the program positively. The majority of participants indicated to have experienced added benefits of the natural setting. The participants in the walk and talk group were asked to estimate the percentage contribution of five factors to the success of the program, with the total adding up to 100% (relation coach-client, professionality/expertise of coach, motivation and commitment of client, carrying out assignments, and walking in a natural environment). 5 participants estimated the five factors to contribute about equally to the success of the program. The factor estimated most important was the motivation and effort of the client (23%), while 18% of the success was attributed to walking in nature
† Vujcic (2017) Serbia [54]	Horticulture therapy	QUAN	To explore the potential of existing environments or specially designed green areas in the city of Belgrade as nature-based solutions for improving mental health	RCT	30 (9)	25–65; psychiatric patients, users of the day hospital of the Institute	The test results indicated that nature based therapy had a positive influence on the mental health and well-being of the participants
Vujcic (2021) Serbia [55]	Nature-based rehabilitation program (NBRP)	MM	To make clearer, with supporting evidence, the clinical benefits of the nature-based rehabilitation program (NBRP) and the restorative values of visiting botanical garden for people with stress-related mental disorders	RCT	27 (19)	25–65; Psychiatric patients and users of the Day Hospital of the Institute of Mental Health	The positive findings on the psychological recovery of the participants seem to be related to NBRP The restorative potential of the garden was recognized through the observed interaction between participants and the natural entities employed through the various themed activities. The observed landscape elements especially solitary plant specimens or tall and single-form trees within the garden can be embraced as design guidelines for the development of an evidence-based practice that can support the recovery process of people with mental health conditions

Table 2 (continued)

First author (year) Country	Type of therapy	Type of study	Study aims	Methodology	N (n male)	Age; Diagnosis	Findings
Walter (2023) United States [56]	Surf Therapy and Hike Therapy	QUAN	To address these limitations and evaluate the efficacy of activity-based interventions for MDD	RCT	96 (46)	28.1 (5.6); Major depressive disorder	Continuous depression outcomes changed significantly over time. Although service members in Hike Therapy reported higher average depression scores than those in Surf Therapy, the trajectory of symptom improvement did not significantly differ between groups. Regarding MDD diagnostic status, there were no significant differences between the groups at post-program, but Surf Therapy participants were more likely to remit from MDD than were those in Hike Therapy at the 3-month follow-up
Währborg (2014) Sweden [57]	Nature-assisted rehabilitation programme	QUAN	To investigate changes in sick-leave status and healthcare consumption in a group of patients with mild to moderate depression and/or reactions to severe stress participating in a nature-assisted rehabilitation programme compared with a control group (treatment as usual) in available healthcare registers	Observational study	781 (89)	IG: 45.9(9.7), CG: 46.3(9.7); on long-term sick leave and referred by social insurance offices in Sweden	A significant reduction in healthcare consumption was noted among participants in the programme compared with the reference population. The main changes were a reduction in outpatient visits to primary healthcare and a reduction in inpatient psychiatric care. No significant difference in sick-leave status was found
Wästberg (2020) Sweden [58]	Garden therapy	QUAL	To investigate whether participants perceived garden therapy as meaningful, and if so, what contributed to the meaningfulness	Observational study	8 (1)	32–61; Common Mental Disorders (CMD)	Perceived meanings in garden therapy were associated to the participants' individual needs and prerequisites: to land, just be, relax, go back to basics, understand, verbalise, enhance energy, and socialise. The group leaders had an important role to create safety and trust, and to adapt the activities and use of the environment. The activities, the garden environment and social group contributed to perceived meaning in garden therapy

Table 2 (continued)

First author (year) Country	Type of therapy	Type of study	Study aims	Methodology	N (n male)	Age; Diagnosis	Findings
Wood (2022) United Kingdom [59]	Green social prescribing/therapeutic community gardening	QUAL	(i) To understand how therapeutic community gardening impacts the mental health of attendees and (ii) To identify the barriers and facilitators to referral and uptake of community-based therapeutic gardening projects from the perspectives of multiple stakeholders	Observational study	13 (7)	NR; staff members ($n=5$), garden volunteers ($n=5$), social prescribing link workers ($n=2$), and a primary care mental health team member ($n=1$)	The three main mechanisms through which GT appears to benefit members' well-being are the opportunities to engage with the natural environment, offering hope for the future, and the development of social relationships and support. Furthermore, the holistic approach, flexibility and inclusivity of GT facilitate referral, uptake and continued engagement by members. Members receive support for all aspects of their health and well-being and have the freedom to use the service in a personal way. Two key barriers to referral, uptake and engagement were a lack of knowledge of the complete offering of the service and the accessibility of the gardens including the physical location and the number of places available
Yang (2023) South Korea [60]	Nature-Based Therapy (NBT)	QUAN	To investigate the effectiveness and feasibility of Nature-Based Therapy (NBT) for the community experiencing psychological distress during the pandemic	Multi-site experimental design	291 (66)	53.48 (24.05); mild depressive or anxiety symptoms	The study demonstrated that Nature-Based Therapy (NBT) significantly alleviated psychological distress during the COVID-19 pandemic. Among the 291 participants, those in the NBT group ($n=192$) showed medium to large effect sizes for various outcomes: depression, anxiety, daily activity, life satisfaction, mindfulness, stress, and loneliness. Multilevel analysis confirmed significant Time × Group interaction effects for all measures, indicating that improvements in psychological well-being were associated with strong therapeutic alliances
Yeon (2023) South Korea [61]	Mobile-Based Forest-Therapy Programs	QUAN	To investigate the effect of mobile-based forest therapy programs on relieving depression (depression, sleep quality, and physical symptoms) to advance non-pharmaceutical treatments for patients with depression	RCT	44 (14)	20–60; Mild depressive disorder	Depression patients who participated in the mobile-based forest therapy program conducted in urban forests showed a significant reduction in MADRS (from 21.48 ± 4.05 to 7.13 ± 7.00). In addition, PSQI (from 19.78 ± 7.69 to 14.48 ± 8.11) and PHQ-15 (from 9.87 ± 5.08 to 7.57 ± 5.03) were also found to significantly improve symptoms

Table 2 (continued)

First author (year) Country	Type of therapy	Type of study	Study aims	Methodology	N (n male)	Age; Diagnosis	Findings
† Yeon (2023) South Korea [62]	Urban Forest Therapy Program	QUAN	To examine the effects of an urban forest therapy program on depression symptoms, sleep quality, and somatization symptoms of depression patients	RCT	50 (8)	37.31 (10.27); Depressive disorder	The results of this study revealed that depression patients in the urban forest therapy program had significantly alleviated depression symptoms and improved sleep quality and somatization symptoms compared to the control group
Yeon (2023) South Korea [63]	Forest healing	QUAN	To reduce depressive and anxiety symptoms in adults with depressive disorders by implementing a structured urban forest healing program	RCT	47 (8)	20–60; mild depressive disorder	The combination of general treatment and forest healing programs for patients with depression is more effective in improving depression and anxiety than routine treatment alone

Studies marked with † did not contribute to the outcome and implementation synthesis and are not discussed in the Results and Discussion due to high risk of bias

Abbreviations: QUAL qualitative study, *QUAN* quantitative study, *MM* mixed-methods study, *RCT* randomised controlled trial, *IG* intervention group, *CG* control group, *NBR* nature-based rehabilitation, *NBRP* nature-based rehabilitation programme, *NBT* nature-based therapy, *NAM* nature- and animal-assisted mindfulness, *CAMHS* Child and Adolescent Mental Health Services, *PTSD* post-traumatic stress disorder, *CMD* common mental disorders, *MDD* major depressive disorder, *ED* exhaustion disorder, *BDI* Beck Depression Inventory, *STAI-S* State–Trait Anxiety Inventory (State), *POMS* Profile of Mood States, *MADRS* Montgomery–Åsberg Depression Rating Scale, *PSQI* Pittsburgh Sleep Quality Index, *PHQ-15* Patient Health Questionnaire–15, *PTGI* Post-Traumatic Growth Inventory, *CRP* C-reactive protein, *BDNF* brain-derived neurotrophic factor, *IL-6* interleukin-6, *NR* not reported

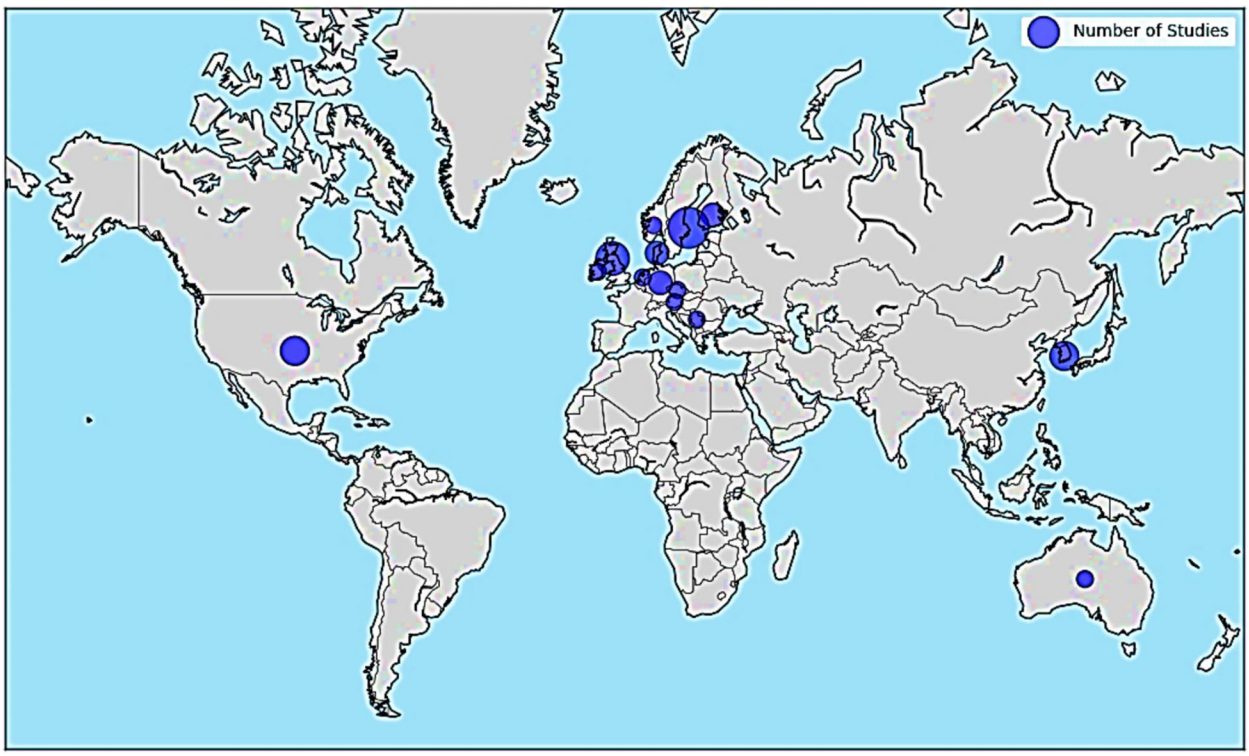

Fig. 2 Geographical distribution of included studies across different countries worldwide

following a therapeutic horticulture program for individuals with clinical depression [69]. Another study focused on a mental health recovery program to reduce social exclusion and improve engagement among people with mental health problems [70]. A study on garden therapy [58] investigated whether participants found it meaningful, and if so, to identify what contributed to that sense of meaningfulness. A study on garden 'smellscape' aimed to explore participants' in rehabilitation programs lived experiences of plant scents and their role in stress reduction, and sensory reconnection [71]. In another study conducted within a specially designed healing garden aimed to gain deeper understanding of health-promoting qualities and healing processes in rehabilitation [26]. The Alnarp rehabilitation garden focused on increasing in-depth knowledge of supportive outdoor environments for health outcomes [72]. One study focused on surf and hike therapy to evaluate the efficacy of activity-based interventions for major depressive disorder (MDD) which is associated with elevated rates of substance abuse, suicidal ideation, and other comorbidities [73]. Finally, a study evaluated green social prescribing to identify i) how therapeutic community gardening impacts the mental health of attendees and (ii) the barriers and facilitators to referral and uptake of community-based therapeutic gardening projects from the perspectives of multiple stakeholders [74].

Outcome measures

Many different approaches were applied to determine the outcome of included studies. Most quantitative studies relied on reliable and valid psychological measures. Depression was a common outcome that was evaluated in the selected studies using the Beck Depression Inventory (BDI) [66, 68, 75], Montgomery–Åsberg Depression Rating Scale (MADRS) [73], Patient Health Questionnaire (PHQ) [73, 76] or the Depression Inventory-Fast Screening (BDI-FS) [68]. In addition, Generalized Anxiety Disorder-7 (GAD-7) [6], State-Trait Anxiety Inventory (STAI) [64], Hamilton Anxiety Rating Scale (HARS) [64] were used to measure anxiety. Stress was assessed by Perceived Stress Scale (PSS) [65], and burnout by Shirom-Melamed Burnout Questionnaire (SMBQ) [66], and The Utrechts Burnout Scale (UBOS) [53]. Sleep quality was measured by PSQI (Pittsburgh Sleep Quality Index) [76]. Several studies ($n=18$) applied qualitative methods to identify the participants' perceptions of outcomes. Perceived emotional and psychological benefits, social connections and support were common themes in most included qualitative studies. Sensory engagement was a

further theme used to evaluate the intervention outcome [67, 71].

Outcomes

In the included studies, most of the NBIs reported reduced depression and anxiety (Table 1). One RCT on urban forest healing found that the combination of forest healing and general treatment for patients with depression led to greater improvement in depression and anxiety compared to routine treatment alone [64]. Another RCT revealed that a psychiatrist's evaluation (MADRS) of patients who took part in the mobile-based forest therapy program in an urban forest found depression decreased significantly (from 21.48 ± 4.05 to 7.13 ± 7.00). There was also a significant improvement in symptoms with PSQI (from 19.78 ± 7.69 to 14.48 ± 8.11) and PHQ-15 (from 9.87 ± 5.08 to 7.57 ± 5.03) [76]. One study conducted with US service members engaged in surf and hike therapy found that it improved depression outcomes over time ($p < 0.001$) [73]. Another study examining a nature and animal-assisted mindfulness program demonstrated its feasibility, high acceptability, and greater efficacy compared to standard treatment in preventing relapses among recurrently depressed individuals with a history of childhood maltreatment [68]. The NBIs not only improved mental health, but they were reported to play a vital role in promoting social interaction which could reduce loneliness and isolation [26, 74, 77]. For an example, one study found that NBIs could foster social connection, and one participant noted that, "I socialized more with others than I usually do" [67]. Social support and social interaction have been identified as one of the key components of participants' acceptance of the intervention [6, 57, 58, 66, 70, 74, 78, 79].

Components related to implementation of the intervention

Service providers

A diverse range of service providers and interdisciplinary institutes implemented nature-based interventions (Table 2). Providers included nonprofit and government organizations such as Trust Links, UK [74] and in Australia, Illawarra Shoalhaven Local Health District (ISLHD) [80]. The programs included trained professionals including foresters and certified forest pedagogues [81], occupational therapists [71, 80, 82], horticulturalists [57], physiotherapists [26, 66, 71], psychologists [65, 78, 83] and psychiatrists [64, 75, 82]. In addition, a military institute also participated in an intervention for their employees [73].

Duration of the intervention

The intervention durations varied widely from 1 day to 12 weeks with some flexible ongoing options (Table 2). Short-duration interventions included the Planting Party (a singular one-hour session) [79], forest therapy for adolescents (two months, biweekly) [81], mobile-based forest therapy (six weekly sessions for 2 h) [76], urban forest therapy (six weeks with weekly two-hour sessions) [76]. Medium-duration therapies included therapeutic horticulture for depression (12 weeks with 24 sessions) [69] and Flow with Nature treatment (12 meetings) [78]. Longer term interventions included nature-based group therapy in inpatient units (nine months with one-hour sessions) [67], nature-based therapy for stress-related illness (ten weeks with three three-hour weekly sessions) [84] and surf and hike therapy for service members (six weekly sessions with three-month follow-ups) [73].

Setting and delivery of the interventions

Programs were delivered via similar components. Natural settings including forests [68, 76, 78], botanical gardens [65], coastal areas and natural parks [80], wetlands [6] and water [73, 78] provided an enjoyable environment for the participants. Interventions were reported to foster a strong sense of connection to nature for the participants [67, 71, 79, 85, 86]. Further, the structure of the program was reported as a key factor influencing participants' uptake of nature-based therapy [26, 65, 78]. Systematic direction provided by qualified facilitators, including psychologists, therapists, and environmental specialists, was crucial in ensuring participants felt supported and involved (Table 2). The presence of trained and empathetic facilitators established a secure, inclusive environment, which is described as critical for the successful execution of the intervention [72, 84].

Funding

Among these selected studies most received funding from the government or non-government organizations (Table 2). However, five studies did not identify any funding, and two studies stated that they had not received funding for their research (Table 2).

Implementation determinants and processes

Few studies described implementation enablers or barriers. To identify any challenges faced, the limitations section of studies was reviewed for statements about implementation (supplementary Table 3). Logistical issues, external conditions, lack of clear guidelines, and resource limitation were identified as potential barriers to implementing nature-based therapy programs. Transportation and accessibility were the main logistics challenges in delivering the intervention [6, 74, 80, 87]. Limited resources including lack of medical or welfare support and lack of trained facilitators were significant challenges that made implementation of some interventions difficult

[53, 87]. External conditions especially extreme weather was identified as a major challenge in implementation [69, 74, 75]. In addition, lack of clear guidelines [67, 83] and small sample sizes [69, 88, 89] also hinder research on implementation and outcomes of nature programs.

Discussion

This systematic review aimed to identify key factors in implementing NBIs in mental health services to inform program delivery. Although outcomes across included studies were predominantly positive, explicit reporting of implementation strategies, enablers, and barriers was rare, limiting the ability to derive a definitive implementation model. Instead, we synthesised implementation-relevant insights from included studies, including programme descriptions, participation patterns, reported challenges, and study limitations to propose a preliminary implementation framework (See Fig. 3) that identifies key components and practical considerations for planning, delivering, and sustaining NBIs, including core programme components, delivery requirements, contextual barriers and enablers, and organisational and system conditions.

Core programme components

Across diverse intervention types, several core programme components consistently emerged as central to successful implementation. Programmes that incorporated guided contact with nature, rather than unguided exposure, were perceived as more supportive and meaningful by participants [67, 69]. A clear programme structure, including predictable session frequency, duration, and activity flow, appeared to promote psychological safety, engagement, and acceptability [69, 83]. At the same time, built-in flexibility—the capacity to adapt activities, pacing, or content in response to participant needs, environmental conditions, and setting—was essential for feasibility in real-world contexts [74, 78]. Rigid protocols were less feasible than approaches that preserved core components while allowing contextual adaptation. There is no specific recommended duration of interventions. Both brief and extended programs achieved positive outcomes.

However, the fidelity of intervention delivery over time or for different groups was not reported in the included studies yet is typically a major element of intervention delivery when the outcome is change in mental state. Interventions must be delivered as intended with attention to core components and processes [90]. Limitations in training and guidelines for people delivering NBIs suggests work on documenting core components and assuring fidelity will be important steps to increase confidence in the NBI evidence base.

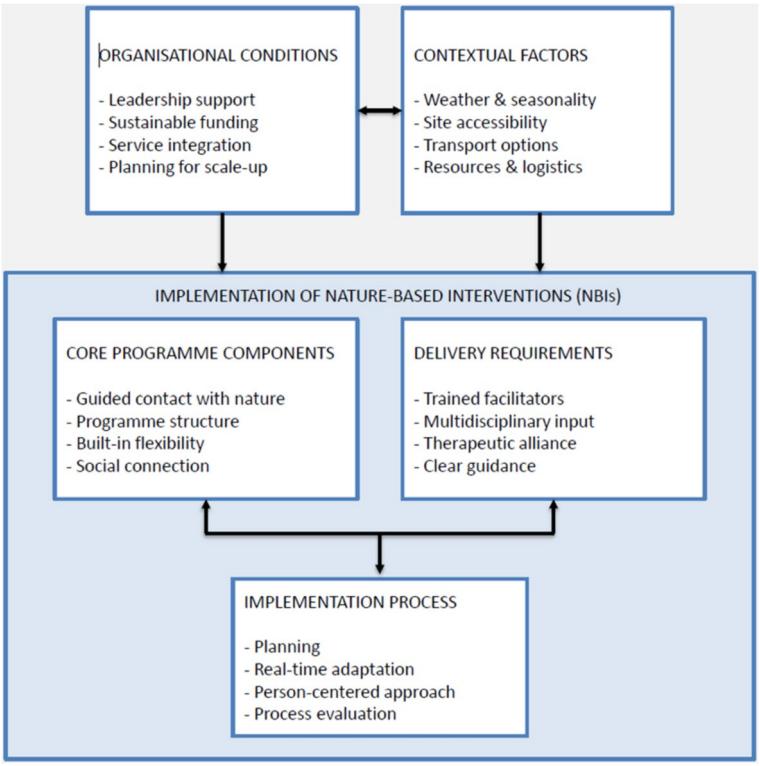

Fig. 3 Essential elements for successful implementation of NBIs in mental-health settings

Delivery requirements

Findings further indicate that delivery requirements play a critical role in shaping implementation success. Most NBIs were delivered by trained facilitators with clinical, therapeutic, or allied health professional qualifications, and facilitator expertise influenced how participants engaged with both the natural environment and therapeutic activities [26]. Several studies reported that facilitating staff lacked confidence or preparation to deliver NBIs, highlighting the importance of training, supervision, and clear participant guidance to support effective delivery [83, 87].

Clinical support for participants appears to be a key element of implementation that is not highlighted enough. Our findings indicate that both multidisciplinary clinicians (psychologists, psychiatrists, physiotherapists and occupational therapists) and other professions (horticulturalists), can foster the establishment of secure environments for participants with mental health conditions and facilitate their engagement in NBIs. This aligns with broader evidence that interdisciplinary teams are crucial for effective healthcare interventions [91] and this element of delivery should not be overlooked because the intervention occurs outside. Similarly, skills in group therapy delivery and group processes are important because social interaction has been identified as one of the essential components of a successful intervention [92]. Peer support and social connections emerged as key therapeutic elements and have been found previously to provide resistance to stress and mitigating genetic and environmental vulnerabilities [58, 67, 74], potentially through its effects on the hypothalamic-pituitary-adrenocortical system reflected in cortisol levels [92]. However, this requires further investigation to establish a connection in relation to NBIs.

Contextual barriers and enablers

A consistent finding across studies was the influence of contextual barriers and enablers on implementation. Environmental and seasonal conditions, site characteristics, and scheduling constraints may disrupt programme delivery and attendance [74, 75]. Accessibility and transport were among the most commonly reported challenges, with distance to sites, entry costs, and limited transport options reducing participation and retention [6, 74, 80]. Resources and logistics, including staffing, time, equipment, and alignment with existing service schedules, further shaped feasibility [75]. Across studies, these contextual factors were predictable rather than exceptional, indicating that they should be explicitly incorporated into implementation planning rather than treated as unanticipated barriers.

Organisational conditions for sustainability

Beyond programme delivery, organisational conditions were critical for sustainability. Several studies highlighted the importance of leadership and organisational support in enabling implementation within mental health services [87]. Stable and sustainable funding emerged as a prerequisite for continuity, whereas short-term or project-based funding limited long-term viability [57, 66]. In this review, we found that most of these studies received funding from the government and non-government organizations. It is evident that consistent and planned funding is crucial for the execution of implementation research [93]. The introduction of NBIs into the healthcare system requires commitment from all in that system, not just those delivering the program. Healthcare leadership needs to understand the costs and resourcing required to deliver NBIs and further research on cost–benefit is required. Programmes that achieved better integration with existing service pathways appeared more likely to be sustained over time [74]. However, systematic planning for longer-term continuity and scalability was rarely described, highlighting an important gap in the implementation evidence base.

Implementation process

While studies included in this review rarely described implementation processes in detail, guidance on implementation processes can be drawn from a small but growing body of implementation-focused literature on NBIs. First, programmes should be supported by clear and structured planning, including simple and detailed implementation plans aligned with defined objectives, explicit roles and responsibilities, schedules, and arrangements for use, maintenance, and long-term assurance, with leadership involvement to support feasibility and continuity [94, 95]. Second, real-time adaptation should be anticipated and enabled, allowing activities, pacing, and use of space to be adjusted in response to participant needs, environmental conditions, and service constraints, rather than treating adaptation as a deviation from protocol [95, 96]. Third, implementation should adopt a person-centred approach, tailoring activities to individuals' symptoms, physical capacity, preferences, and support needs, and providing choice and flexibility to promote engagement and accessibility [94]. Finally, implementation should explicitly incorporate process evaluation, ensuring sufficient time and space for reflection and using standardised, cyclical methods to monitor delivery, adaptations, and contextual influences, inform continuous improvement, and support sustainability over time [94–96]. Together, these recommendations emphasise that successful NBI implementation requires ongoing attention to process alongside intervention content.

Strengths and limitations

The components of NBIs that are crucial to their effective implementation by mental health services have been synthesized in this review. The review's primary strength is its extensive use of four databases, which has resulted in a more comprehensive understanding of the key components of NBIs and worldwide coverage. This review included quantitative, qualitative, and mixed-method studies, which led to a diverse range of studies being included. However, it is important to recognize several limitations. Different duration (ranging from a few days to a few months) and structure of the programs (single-session vs multi-week) make it difficult to identify key factors in NBI implementation. Diverse self-report measures and qualitative themes were used to assess the outcomes, complicating the comparison of intervention effects and program delivery. In the included studies, some implemented RCTs with controls, however, others focused on single group design, qualitative methodologies or observation studies without a control. Therefore, it is difficult to determine whether the improvement in mental health was due to NBIs themselves, the physical activities involved [97], or other external factors, particularly given that many NBIs combine exposure to natural environments with physical activity and may also operate through physiological mechanisms that were not assessed in this review. Most included studies focused on specific population groups which may limit the generalizability of findings. Finally, the geographical concentration of studies in Europe, Australia, and the USA—particularly in Nordic countries—may further constrain transferability.

Directions for future research

Based on our findings, there is scope for future studies to include objective physiological measures of change, including, for example, cortisol levels, to help clarify mechanisms of action and disentangle the effects of nature exposure from physical activity. We also suggest that future research should prioritise clearer reporting of core programme components and implementation processes, including fidelity and adaptation over time. In addition, this review proposes a preliminary set of essential components and implementation considerations derived from a limited and heterogeneous literature; future empirical studies are therefore needed to explicitly test and validate the components and recommendations outlined in this review. Further research is also needed to examine NBI implementation as a process over time, including how implementation determinants, adaptations, and contextual factors interact and influence feasibility, fidelity, and sustainability across different stages of delivery. Finally, consistent with Silva et al. [98], further research is needed in underrepresented regions, as existing evidence is concentrated in Nordic countries, where cultural alignment with nature-based approaches may influence acceptability, engagement, and feasibility. However, the role of culture as an enabling contextual factor has not been empirically tested. Studies across diverse cultural settings, including collaborations with researchers in Asia, South America, and Africa, are therefore needed to examine how cultural factors enable or constrain the implementation of NBIs.

Conclusion

NBIs have potential for mental health services as an adjunct to treatment programs. The successful implementation of nature therapy programs depends on organizational and contextual factors. However, these are not well described in the research literature limiting uptake of nature-based approaches within mental health services. An implementation and evaluation guide are required to support multi-disciplinary practitioners in systematic delivery of programs. Without this, evidence-based implementation advice for mental health services is limited.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s43058-026-00902-5.

Supplementary Material 1.

Acknowledgements
Not applicable.

Authors' contributions
ZAR wrote the review protocol, conducted the searches, title and abstract screening, full text review and extraction and wrote the first draft of the manuscript. OG revised the protocol, conducted title and abstract screening, full text review and extraction and contributed to the first draft of the manuscript. NS resolved conflicts during the review process and contributed to the first draft of the manuscript. JLD, JSM, CRF and KO reviewed and revised the protocol and manuscript drafts. JA conceptualised the review question, assisted with study screening and data extraction, contributed to writing the protocol and the first draft of the manuscript. All authors read and approved the final manuscript.

Funding
This study was funded by The Australian Commonwealth Department of Health and Aging (Grant number—4-DGEJZ1O/4-CW7UT14). The funder had no role in conceptualization, design, data collection, analysis, decision to publish, or preparation of the manuscript.

Data availability
All data generated or analysed during this study are included in this published article [and its supplementary information files].

Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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Received: 17 July 2025 Accepted: 9 March 2026
Published online: 17 March 2026

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