

Nature-based interventions for health and wellbeing: what works?

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Key points

- Nature-based interventions are organised outdoor activities that aim to improve people's health through engaging with nature. These interventions are increasingly being offered through green social prescribing, where link workers support people to access activities that 'matter to them'.
- Identifying reliable and accessible research evidence about the effectiveness of nature-based interventions can be difficult for providers, health professionals, link workers and service users.
- We summarise evidence from 12 recent systematic reviews of studies of nature-based interventions.
- We have also created an [online interactive version](#) of this evidence review.
- The headline finding from the reviews is that taking part in nature-based interventions can be beneficial for a range of mental health problems and also boosts social interactions.
- Few studies have evaluated the impact of nature-based interventions on physical health or physical health risk factors, and the evidence is more equivocal.
- The reviews judged that the majority of the studies had a moderate to high risk of bias because of the study design, such as the way participants were selected.
- Most studies concentrated on evaluating short term outcomes only.
- There is little evidence about how the quality of green and blue spaces might contribute to the effectiveness of nature-based interventions.
- The optimum intensity and duration of nature-based activities is still uncertain.
- There is no strong evidence about whether particular nature-based interventions are more beneficial for particular populations.
- Nature-based interventions incorporate multiple interacting elements, but this complexity is rarely described or evaluated.

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What are nature-based interventions?

We know that nature is important for our health and wellbeing (Public Health England 2020; Reyes-Riveros et al. 2021). There has been a growing interest in using organised activities and programmes in nature that aim to improve people's mental and physical health, such as conservation, gardening and green exercise groups (Shanahan et al. 2019; Garside et al. 2020). Some of these 'nature-based interventions' (NBIs) are starting to be 'prescribed' by health professionals, known as link workers, who support people to access activities that 'matter to them' (Garside et al. 2020). This process is called green social prescribing. However, it is uncertain whether the offer of nature-based interventions is an effective way to support people's mental and physical health.

Here we consider nature-based interventions that involve people taking part in an activity outdoors in nature, often alongside a facilitator and/or other participants (Shanahan et al. 2019). Being in nature, carrying out a particular activity and/or being with others might create experiences that directly improve people's health and wellbeing (Bratman et al. 2012; Kuo 2015; Bratman et al. 2019) ([Figure 1](#) and [Box 1](#)). Nature-based interventions might also help people to learn new skills and change their behaviour and choices in ways that improve their health and wellbeing (Shanahan et al. 2019). Natural spaces are often talked about as 'green space' (Taylor and Hochuli 2017) and 'blue space' (Beute et al. 2020).

Despite widespread policy support for green social prescribing it is not clear which types of nature-based intervention are most beneficial, and which populations are most likely to benefit (Shanahan et al. 2019; Wilkie and Davinson 2021). How people engage with and respond to nature-based interventions might vary, depending on their needs, their socio-economic status, and place of residence (Public Health England 2020). Different nature-based intervention programmes might help people with some aspects of their health, but not with others.

Here we summarise the findings of the scientific literature around whether or not nature-based interventions benefit mental health, physical health and social interactions. We also highlight where there are gaps in the evidence and why this matters for different people involved in developing and using nature-based interventions.

We have used information from systematic reviews of peer-reviewed studies of nature-based interventions. We show this information for three aspects of health and wellbeing: mental health, social interactions, and physical health. For physical health we separately looked at activity levels and physiological markers of health.

What are nature-based interventions for health?



You can click on the diagrams for more information

Most nature-based interventions have three elements:

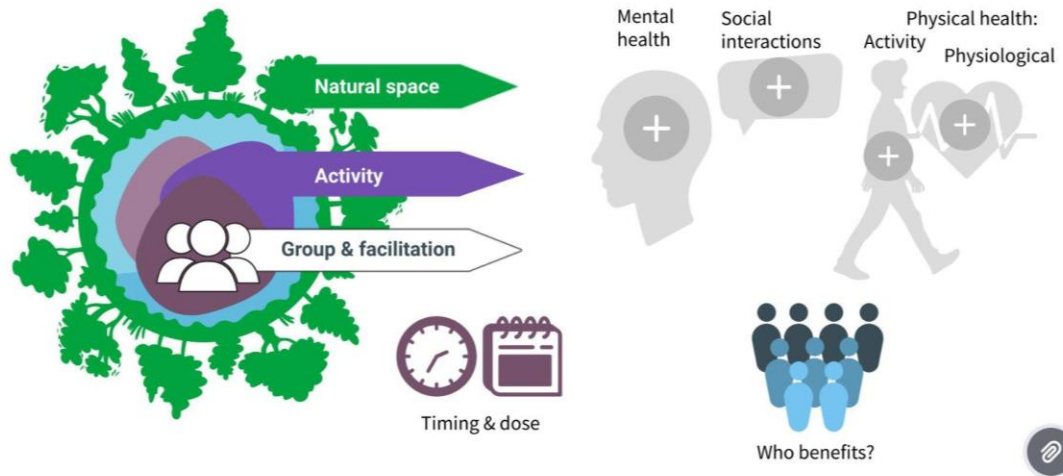


Figure 1. Most nature-based interventions include three aspects: the type of activity, the type of green or blue space, and usually some interaction with a facilitator or other members of the group. [An online interactive version of these diagrams with audio is available here.](#)

Box 1. Nature-based interventions and possible health benefits

Nature-based interventions include three elements:

Green or blue space. Green space is anywhere with vegetation, for example woodland, nature reserves, parks and gardens. Blue space includes canals, rivers, lakes and the coast. The size, type and quality of the natural green or blue space might impact how people experience the activity and how accessible the space is for different people.

Activity. Activities include arts and crafts in nature, farming activities, gardening, exercise in green or blue space and various types of ecotherapy such as sitting in nature, mindfulness or psychotherapy. These all change how people interact with natural spaces.

Group and facilitation. How the activity is run, how people interact and the size and type of group might all have important impacts on the benefits people obtain from green or blue space.

Possible health benefits include:

Mental health. Mental health benefits might include reports of improvements in depressive mood and anxiety levels.

Social interactions. Benefits for social interactions might include people reporting feeling less lonely, having more contact with others or improvements in behaviours and skills when interacting with others.

Physical activity. Improvements in physical activity might include people reporting being more active or objectively measured increases in activity, for example, using pedometers or step counters.

Other physical health benefits: Other improvements in physical health could include improvements in cardio-vascular health risk factors, such as blood pressure or lipids.

Other important aspects are:

Who benefits? People with different health needs, backgrounds and life experiences might have different needs, and experience different outcomes from the same nature-based intervention.

Timing and delivery. How often, for how long and over what time period the activities take place might affect people's health outcomes.

What do we know?

Impact on health outcomes

Overall, nature-based interventions have positive impacts on various aspects of mental health, including depression, anxiety, and positive and negative affect (Zhang et al. 2017; Corazon et al. 2019; Djernis et al. 2019; Britton et al. 2020; Gritzka et al. 2020; Coventry et al. 2021; Moula et al. 2022), although some reviews did report less positive or no effect for mental health (Tillmann et al. 2018; Lahart et al. 2019; Mygind et al. 2019a; Mygind et al. 2019b; Kotera et al. 2021) ([Figure 2](#) and [Box 2](#)).

Reviews consistently report improvements in social skills, functioning and relationships (Zhang et al. 2017; Djernis et al. 2019; Mygind et al. 2019a; Mygind et al. 2019b; Britton et al. 2020), although these aspects of psycho-social health were less studied than mental health outcomes.

The impact of nature-based interventions on physical health is more equivocal. Some reviews included studies that showed that nature-based interventions were associated with improvement in activity (Mygind et al. 2019b; Coventry et al. 2021), while others found less evidence for this (Lahart et al. 2019; Kotera et al. 2021). Comparing evidence across reviews is difficult because included studies used different methods to evaluate impacts on physical health (Lahart et al. 2019; Mygind et al. 2019b; Coventry et al. 2021; Kotera et al. 2021).

There was generally no impact found on physiological measures of physical health, although there are far fewer good quality studies of this than for mental health (Djernis et al. 2019; Mygind et al. 2019a; Coventry et al. 2021). Physiological measures that are used to indicate levels of stress and mental health, such as blood pressure and cortisol levels, also showed mixed results (Corazon et al. 2019; Djernis et al. 2019; Gritzka et al. 2020).

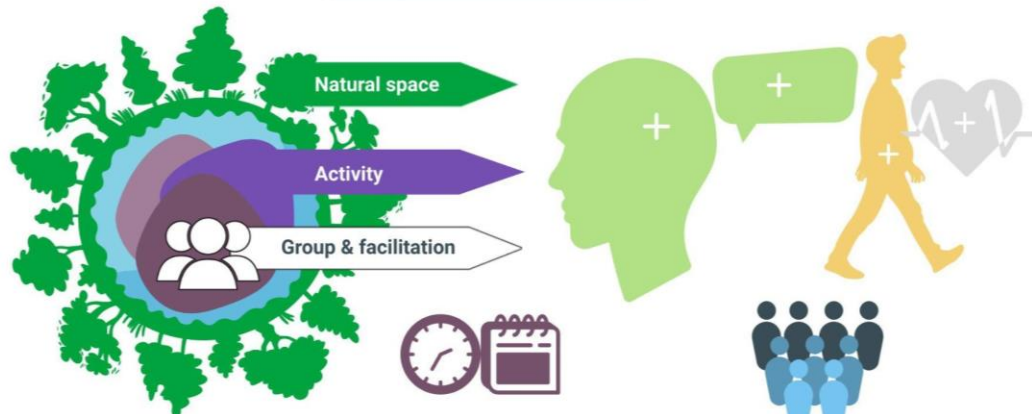
What we know: all nature based interventions.



All nature-based interventions



What we know audio



From 12 systematic reviews published 2017 - 2022 Click below to read the studies

[Britton et al. 2020](#); [Corazon et al. 2019](#); [Coventry et al. 2021](#); [Djernis et al. 2019](#); [Gritzka et al. 2020](#); [Kotera et al. 2021](#); [Lahart et al. 2019](#); [Moula et al. 2022](#); [Mygind et al. 2019a](#); [Mygind et al. 2019b](#); [Tillmann et al. 2018](#); [Zhang et al. 2017](#)



Figure 2. What we know about all nature-based interventions. [An online interactive version of these diagrams with audio is available here](#)

Box 2. What we know about nature-based interventions

Mental health: Overall, studies show that nature-based interventions have positive impacts on mental health.

Social health: Nature-based interventions have positive impacts on social skills, functioning and relationships.

Physical activity: The evidence for any improvements in physical activity is mixed and few studies have evaluated this outcome.

Physiological benefits: In the few studies that have been reviewed, no evidence was found that nature-based interventions had any physiological benefits for physical health.

Timing: One review of multiple types of nature-based interventions found that the optimal length of time for people to take part was 20-90 minutes and that the most effective interventions were offered for 8 to 12 weeks (Coventry et al. 2021).

Different types of nature-based interventions

Studies reviewed included a wide range of types of nature-based interventions, such as horticultural therapy, care farming, environmental conservation, exercise in green/blue space, ecotherapy, and nature based arts/crafts. There was sufficient information about ecotherapy, exercise and horticultural nature-based interventions to summarise these outcomes separately (Table 1 and Figures and Boxes 3 to 6). Ecotherapy interventions include nature-based therapies and immersive experiences where the group is facilitated by a trained therapeutic coordinator, such as outdoor mindfulness training, forest bathing or wilderness experiences with an emphasis on connecting with nature. Exercise interventions included studies of physical activity in green and blue spaces such as walking and jogging, but not organised team sports where the outdoor context is not an essential component (Coventry et al. 2021). Horticulture interventions included social and therapeutic gardening and food growing activities where the main focus was on supporting the wellbeing of participants.

Many of the studies on exercise in green and blue space compared benefits experienced by people exercising outdoors or with a green view with benefits experienced by people exercising indoors to see if there was an additional benefit from exercising in nature. Other studies compared benefits for people taking part in the nature-based intervention with those for people not doing so, or doing something else, and some studies considered changes in physical health benefits before and after the intervention. This makes it difficult to interpret results for physical activity.

Table 1. Summary of evidence of the health benefits of nature-based interventions for adults, teenagers and children from 12 systematic reviews published 2017-2022. Green: Established but incomplete evidence for a positive impact - more than approximately 66% of studies overall find a positive impact on that health domain, but with low to moderate quality evidence. Amber: Unresolved - mixed findings between studies OR Inconclusive - a positive impact found from only one study. Grey: Consistently no impact found for that health domain. Blank: Not studied for that health domain in recent systematic reviews. Review references: 1. ([Britton et al. 2020](#)) 2. ([Corazon et al. 2019](#)) 3. ([Coventry et al. 2021](#)) 4. ([Djernis et al. 2019](#)) 5. ([Gritzka et al. 2020](#)) 6. ([Kotera et al. 2021](#)) 7. ([Lahart et al. 2019](#)) 8. ([Moula et al. 2022](#)) 9. ([Mygind et al. 2019b](#)) 10. ([Mygind et al. 2019a](#)) 11. ([Tillmann et al. 2018](#)) 12. ([Zhang et al. 2017](#)).

	Mental health	Social health	Physical health	
			Physical activity	Physiological health
All NBIs	Established but incomplete Quantity: 12 systematic reviews containing multiple studies. Effects: mainly positive outcomes. Quality: low, occasionally moderate. Agreement: inconsistent. ⁽¹⁻¹²⁾	Established but incomplete Quantity: 6 systematic reviews containing multiple studies. Effects: mainly positive outcomes. Quality: low, occasionally good or moderate. Agreement: consistent. ^(1, 4, 8, 9, 10, 12)	Unresolved Quantity: 3 systematic reviews containing few studies. Effects: mixed between reviews. Quality: low, occasionally moderate. Agreement: inconsistent. ^(3, 7, 9)	No impact found Quantity: 3 systematic reviews containing few studies. Effects: no impact found. Quality: low, occasionally moderate. Agreement: consistent. ^(3, 4, 10)
Ecotherapy	Established but incomplete 5 systematic reviews. Effects: positive outcomes. Quality: low, occasionally moderate. Agreement: consistent. ^(1, 3, 4, 5, 9)	Established but incomplete Quantity: 2 systematic reviews with few studies. Effects: positive outcomes. Quality: low. Agreement: consistent. ^(1, 4)	Inconclusive Quantity: 1 systematic review with 1 study. Effects: positive outcome. Quality: low. ⁽³⁾	No impact found Quantity: 2 systematic reviews with few studies. Effects: no impact found. Quality: low to moderate. Agreement: consistent. ^(1, 3)
Exercise in green/blue space	Unresolved Quantity: 4 systematic reviews. Effects: mixed within and between reviews. Quality: low. Agreement: inconsistent. ^(1, 3, 6, 7)	Established but incomplete Quantity: 1 systematic review of qualitative studies. Effects: mainly positive. outcomes. Quality: low. ⁽¹⁾	No impact found Quantity: 1 systematic review with 2 studies. Effects: no impact found. Quality: moderate. ⁽³⁾	No impact found Quantity: 1 systematic review with few studies. Effects: no impact found. Quality: moderate. ⁽³⁾
Horticulture	Unresolved Quantity: 1 systematic review with multiple studies. Effects: Mixed positive and no impact, with one negative outcome for anxiety. Quality: moderate. ⁽³⁾	No reviews	Established but incomplete Quantity: 1 systematic review with 2 studies. Effects: positive. Quality: moderate. ⁽³⁾	No impact found Quantity: 1 systematic review with 2 studies. Effects: no impact found. Quality: moderate. ⁽³⁾

What we know: ecotherapy interventions.

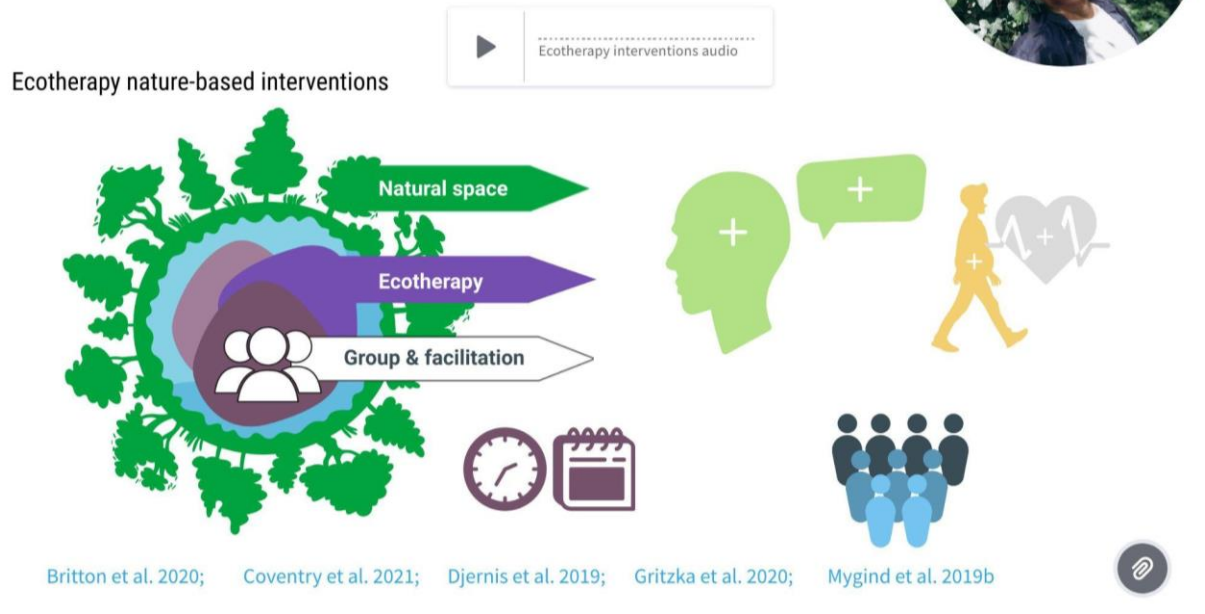


Figure 3. What we know about ecotherapy interventions. [An online interactive version of these diagrams with audio is available here.](#) Ecotherapy interventions include nature-based therapies and immersive experiences where the group is facilitated by a trained therapeutic coordinator, such as outdoor mindfulness training, forest bathing or wilderness experiences with an emphasis on connecting with nature.

Box 3. What we know about ecotherapy interventions.

Mental health: Ecotherapy interventions resulted in large benefits for mental health consistently across different research studies.

Social health: Ecotherapy interventions had positive impacts on social skills, functioning and relationships.

Physical activity: Only one ecotherapy study was reported separately in the reviews that looked at physical activity and this found an improvement.

Physiological health: Only one ecotherapy study was reported separately in the reviews that looked at physiological aspects of health and this found no improvement.

What we know: exercise interventions in green/blue space

Exercise nature-based interventions



Exercise interventions audio

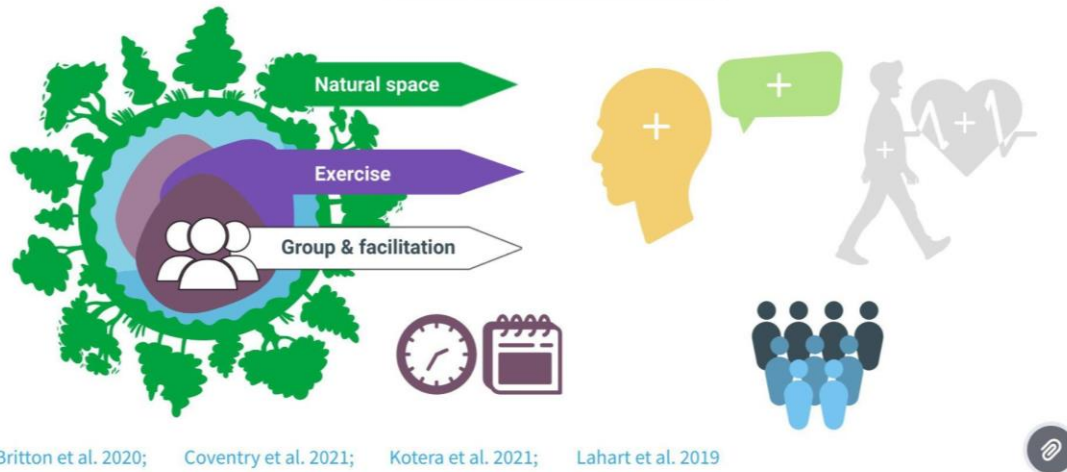


Figure 4. What we know about exercise in green or blue space. [An online interactive version of these diagrams with audio is available here.](#) These included any physical activity in green and blue spaces such as walking and jogging, but not organised team sports where the outdoor context is not an essential component (Coventry et al. 2021).

Box 4. What we know about exercise in green or blue space.

Mental health: Results for the impact of exercise in green and blue space on mental health were very mixed, with some reviews finding improvements and others no evidence for improvements.

Social health: Mainly positive outcomes were found for the impact of exercise in green and blue space on social interactions, although the studies were of poor quality.

Physical activity: Only two studies compared exercise in green and blue space interventions with a control group and found no significant impact on the physical activity levels of participants.

Physiological benefits: Very few reviewed studies looked at physiological measures of physical health. Those that did found no benefits.

What we know: horticulture interventions

Horticulture nature-based interventions

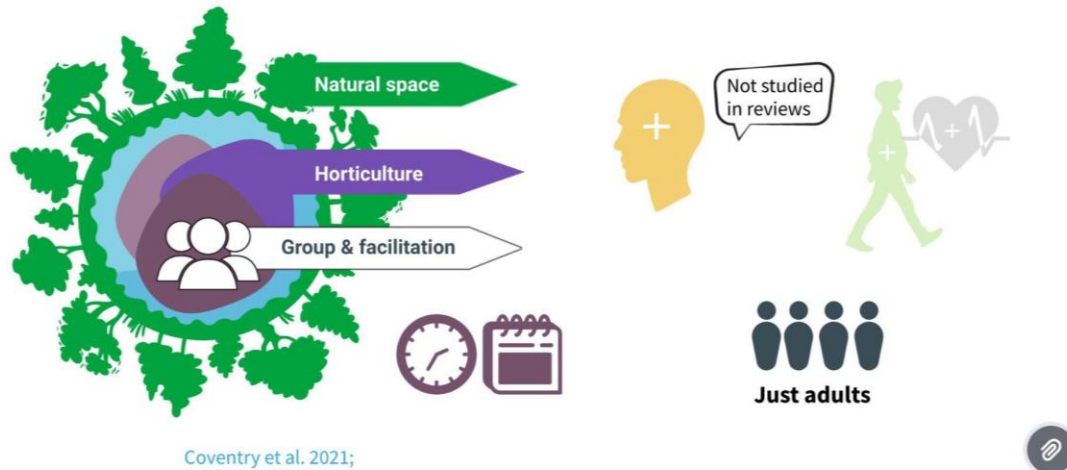


Figure 5. What we know about horticultural interventions. [An online interactive version of these diagrams with audio is available here](#). Horticulture interventions included social and therapeutic gardening and food growing activities where the main focus was on supporting the wellbeing of participants.

Box 5. What we know about horticulture interventions.

Mental health: There were mixed findings about horticulture interventions between studies that used controls. Some studies found that gardening groups had large positive effects on depressive mood and anxiety, but others found no difference, and one study found that people's anxiety became worse.

Social health: None of the systematic reviews included evaluations of the impact of horticulture interventions on social interactions.

Physical activity: Only two studies compared horticulture interventions with controls and found that participants increased their physical activity.

Physiological health: Three studies found that horticulture interventions did not improve cholesterol or blood pressure compared with controls.

What we don't know

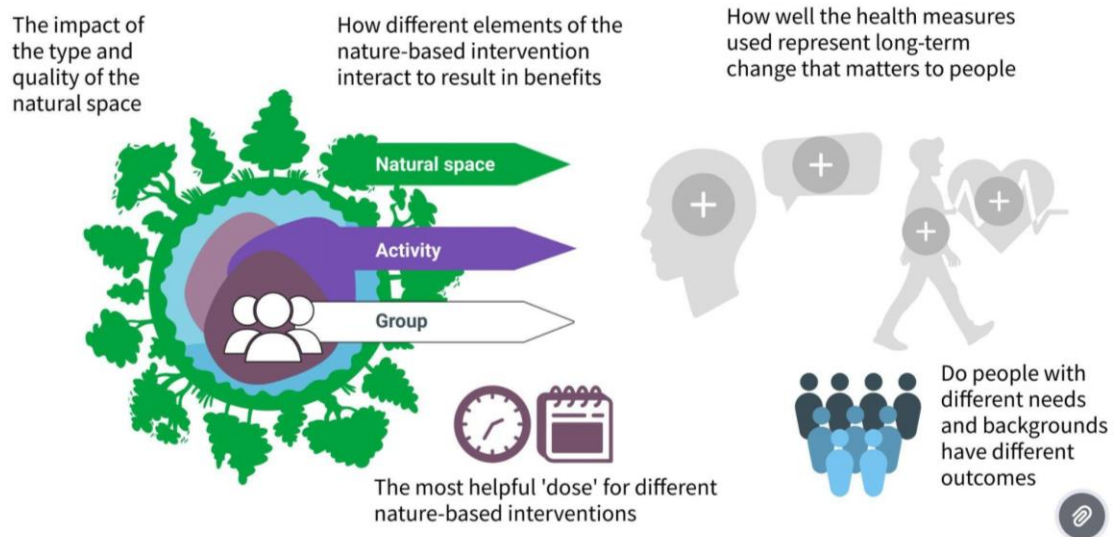


Figure 6. What we don't know about nature-based interventions and health outcomes. [An online interactive version of these diagrams with audio is available here](#)

Box 6. What we don't know

The impact of the type and quality of the natural space on health outcomes. We know that natural space is important, but we don't know much about how the type or quality (such as biodiversity) of the space affects health outcomes. Very few studies compared the same nature-based intervention in different natural spaces or measured aspects of the space such as biodiversity.

Whether different elements of nature-based intervention interact and impact outcomes

Research tends to emphasise and categorise interventions by the broad type of activity, rather than consider other aspects of the programme. Contextual features might be more important than the particular activity or be needed for the activity to result in benefits. For example, two nature-based arts/crafts programmes could vary by place and facilitation methods.

The most helpful 'dose' for different nature-based interventions

Few studies evaluated the optimal frequency, intensity, and duration of nature-based interventions.

Do people with different needs and backgrounds experience different health outcomes

People from different demographics, locations, health needs and ethnicities might respond differently to the same programme or vary in how easily they can access a nature-based intervention. If these features are not addressed there is a risk that offering nature-based interventions could deepen existing health inequalities.

How well the measures of health used represent long-term change that matters to people

It is uncertain whether the metrics typically used in research based evaluations of nature-based interventions map to health outcomes that matter to end-users. Additionally, outcomes are often only measured over the short term and we know little about whether immediate gains in health translate to longer term benefits and health promoting behaviours.

Why do these gaps in knowledge matter?

These evidence gaps have implications for various users and sectors.

Land managers, town planners and public health professionals need to be able to manage and conserve green and blue spaces in a way that is most likely to support local people's health. They also need to be able to assess whether these health aims align or conflict with other functions of green and blue space, such as mitigating climate change, reducing biodiversity loss, and reducing the risk of flooding.

Health professionals and other decision makers need to address health inequalities and provide cost-effective evidence-based care. The current lack of evidence could limit the development of effective interventions and worsen health inequalities (Garside et al. 2020; Robinson et al. 2020). A lack of evidence could even cause harm to participants, if interventions are prescribed in a way that are inappropriate to particular groups of people.

Providers, health professionals and researchers want to develop, evaluate and replicate nature-based interventions that are grounded in evidence. Third sector organisations in particular face considerable barriers to delivering evidence-based interventions in health and social care (Hardwick et al. 2015; Bach-Mortensen et al. 2018). Three areas of potential conflict between academic research and providers are around understanding how different nature-based interventions work, scale and aspects of timing.

Currently, research often considers and evaluates the effectiveness of interventions according to the broad type of activity offered. However, different programmes within the same activity type can have very different characteristics, leading to different experiences and outcomes. It is a challenge to translate findings about nature-based interventions across different regions and at scale. Creating sufficiently large cohorts completing the same programme for statistically significant results is difficult and can place a large burden on service users and providers. It can then be difficult for providers to apply the results of large scale studies to local conditions and particular populations (Harrison et al 2023). Evaluative research also tends to use relatively short-term health outcomes associated with symptom reduction. However, many providers work with service users over the long term and want to use measures and outcomes that are meaningful to the individual.

Definitions

Blue space: Outdoor environments where water is a large feature, such as streams, canals, rivers, lakes and the sea (Public Health England 2020).

Ecotherapy NBI: These include nature-based therapies and immersive experiences where the group is facilitated by a trained therapeutic coordinator, such as outdoor mindfulness training, forest bathing or wilderness experiences with an emphasis on connecting with nature.

Exercise in green and blue space: Any physical activity in green and blue spaces such as walking and jogging, but not organised team sports where the outdoor context is not an essential component (Coventry et al. 2021).

Green space: Here we consider this to be outdoor areas of natural, planted or maintained vegetation, in rural, suburban and urban areas (Taylor and Hochuli 2017).

Horticultural NBI: Social and therapeutic gardening and food growing activities where the main focus is on supporting the wellbeing of participants.

Mental health: “A state of mental well-being that enables people to cope with the stresses of life, to realise their abilities, to learn well and work well, and to contribute to their communities. Mental health is an integral component of health and well-being and is more than the absence of a mental disorder (WHO 2022).”

Nature-based intervention (NBI): Here we are using ‘nature-based intervention’ to describe organised outdoor activities which aim to improve or maintain the health of participants (Coventry et al. 2021). ‘Nature-based intervention’ is also used where the focus is on improving the quality and accessibility of nature in a space where people live, visit or work (Hunter et al. 2019; Shanahan et al. 2019).

Social determinants of health: The conditions of daily life (non-medical factors) that influence health outcomes such as education, early childhood development, income, housing, the environment, food security, social inclusion and access to affordable quality health care (WHO 2021).

Social health: A state of wellbeing where an individual experiences positive relationships with others and is able to adapt to changing social conditions. Social health outcomes interact with physical and mental health outcomes and are supported by both the environment and the individual skills and behaviours needed to form and maintain interpersonal relationships (Mygind et al. 2019b).

Methods

Literature selection

We searched for recent systematic reviews in Web of Science using the terms: TS=(nature based intervention*) AND (TS=(health) OR TS=(well*being)) AND TS=("systematic review") and with a publication date between 01/01/2017 and 03/10/2022. The databases searched were A&HCI, ESCI, CPCI-SSH, CPCI-S, SCI-EXPANDED and SSCI. This returned 211 publications.

These publications were reviewed by LH to select only reviews of quantitative and/or qualitative studies that:

- investigated organised targeted nature-based activities (as defined by Coventry et al. 2021) including: horticultural therapies, care farming, environmental conservation, green exercise, ecotherapy and nature based arts/crafts, that take place predominantly outdoors in green and/or blue spaces intended to benefit either the mental health and/or physical health and/or broadly defined wellbeing of adults and/or adolescents and/or children.
- included measures associated with psychological/mental health, social health and/or physical health domains.
- included community based adults, adolescents and children, not in hospital settings.

All eligible reviews also needed to include an assessment of study quality. Reviews that only included studies about accessing nature or passive exposure to nature were excluded.

Using these criteria, 202 publications were excluded (199 after an initial screening of the title and abstract, with an additional three rejected after reading further content), leaving nine systematic reviews (Figure 7). We also screened eleven reviews from a broader health and wellbeing literature review funded by iCASP (Ward et al. 2022). Three additional systematic reviews were identified from this secondary batch (Corazon et al. 2019; Lahart et al. 2019; Mygind et al. 2019b), resulting in twelve systematic reviews being used (Figure 7) (Zhang et al. 2017; Tillmann et al. 2018; Corazon et al. 2019; Djernis et al. 2019; Lahart et al. 2019; Mygind et al. 2019a; Mygind et al. 2019b; Britton et al. 2020; Gritzka et al. 2020; Coventry et al. 2021; Kotera et al. 2021; Moula et al. 2022).

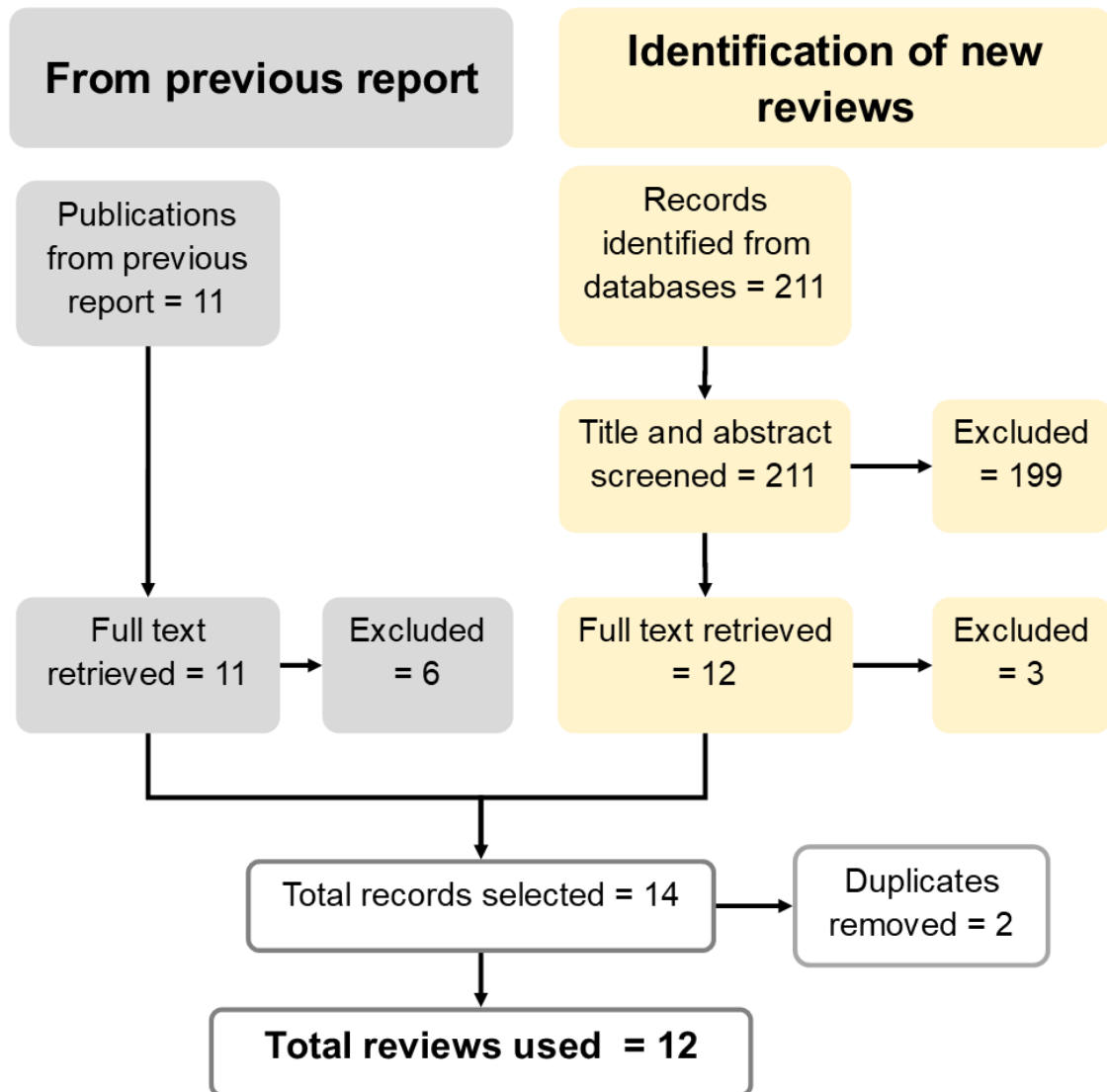


Figure 7. Literature selection process.

Summarising the systematic reviews

Health was conceptualised as including either a mental health domain, a social health domain, or a physical health domain (Mygind et al. 2019b). Differences in outcomes meant that we presented physical activity measures separately from physiological measures primarily indicating physical health. For each of the systematic reviews we looked for evidence about efficacy corresponding to each of these domains. For reviews that did not report individual study results separately, we extracted the author's analysis and/or summary of the evidence about efficacy for that domain. Where different components of the domain were reported separately, we extracted summary evidence such as the number of studies with positive, mixed and no impact results. Where individual study results were reported separately, we extracted information about the measure used, the type of study (randomised controlled trial, controlled or uncontrolled), and for quantitative studies the significance level and effect size. For each review we then used this information to make a judgement about whether mainly positive outcomes had been found (approximately >66% studies), if findings had a balanced mix of positive, no impact and negative

outcomes, or if mainly no impact was found on that health domain. We then combined information across reviews and assessed whether reviews were mainly in agreement or were inconsistent in their conclusions for that health domain. We also recorded the review author's assessment of the overall quality of studies they reviewed and used this to describe the quality of studies contributing evidence for each health domain. Where only a few studies from one review were contributing to the evidence we used information about the type of study to describe the quality, rather than the overall assessment of that review. We then used information about the balance of direction of evidence, quality, and where applicable consistency between reviews, to make a judgement about whether the evidence for a positive impact on that health domain was established but incomplete, unresolved, inconclusive (IPBES 2018), or no impact found.

Some of the reviews reported results separately by the broad type of nature-based intervention. We were able to extract sufficient information from the Ecotherapy, Green Exercise and Horticulture categories of nature-based interventions to summarise these outcomes separately.

Acknowledgements

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