

Accepted for publication in *Health and Place* published by Elsevier.

Greenspace interventions for mental health in clinical and non-clinical populations: What works, for whom, and in what circumstances?

Introduction and background

The beneficial effect of nature on human health and wellbeing is a concept that has been widely accepted since the 1800s (Hickman, 2013). Since then international agreements and organisations such as the World Health Organisation (WHO) have supported the establishment and maintenance of urban greenspaces to promote health and wellbeing, and have reviewed their effectiveness in contributing to healthy, sustainable cities (WHO, 2017). Within public health the positive effects of greenspace are becoming increasingly publicised (van den Berg & van den Berg, 2014). The WHO defines public health as *'the science and art of preventing disease, prolonging life and promoting health through the organized efforts of society, organizations, public and private, communities and individuals'* (Acheson, 1988). Public health therefore encompasses all public and private organisations and all resources that aim to positively impact the health of the whole population. From a public health perspective greenspace can be defined and characterised by its ability to provide healing and 'green care' (Haubenhofer et al., 2010). Greenspace can be used to achieve health outcomes, such as a reduction in stress or an increase in positive mood, in a variety of settings from public parks and woodlands to gardens in hospitals and care homes (Frumkin, 2013). Understanding and recognition of how greenspace can contribute to public health is potentially significant for addressing numerous physical health-related issues, such as obesity, but is equally important to facilitating good mental health and addressing negative mental health.

The term 'mental health' is most commonly used to describe the state of a person's psychological wellbeing, running on a continuum from positive mental health to poorer mental health (Pilgrim, 2017). For this review, we are interested in how greenspace interventions might be effective in improving mental health in those who have a poor mental health diagnosis, or in those who have expressed concern about their own mental health. While 'mental health' is neither positive nor negative by definition (Pilgrim, 2017), the population inclusion criteria for our study means that the term, in this review, is more likely to represent a continuum of states from mild to moderate low mood to severe mental ill health. It is estimated that one in four people in the UK will experience a mental health problem at some point in their life, the most common being anxiety and depression (Kendrick et al., 2015). One of the benefits of using nature to aid mental health recovery is that it can be used alongside a more typical medicalised treatment plan such as talking therapy and interventions could potentially be implemented anywhere. Indeed, greenspace interventions could be a promising addition to both current health and social care provisions as they have the potential

to be low-cost and widely accessible for people within their own communities (van den Berg & van den Berg, 2014).

Previous systematic reviews of greenspace interventions for mental health improvements have provided some evidence of their effectiveness (Bowen, Neil, & Crisp, 2016; Cipriani et al., 2017; Genter et al., 2015; Gorman & Cacciatore, 2017). Gorman and Cacciatore (2017) undertook the first systematic review of care farming, and highlighted that, while understudied, care farming appears to benefit people experiencing psychological distress and could be a feasible non-medicalised approach to improving mental health. Cipriani et al. (2017) found that 11 out of 14 horticultural therapy studies showed significant mood and performance improvements for people with mental health conditions while Genter et al. (2015) found that allotment gardening provided therapeutic benefits and improved health and wellbeing. While the effect size was small, Bowen et al. (2016) also found that wilderness adventure therapy produced statistically significant mental health improvements in young people over ten weeks. However, in these systematic reviews it is unclear why an intervention works and what mechanisms of change lead to the desired outcomes (Norton et al., 2014). For example, a greenspace intervention designed to decrease stress might be deemed effective if it led to quantitative differences in outcome measures such as blood pressure or cortisol levels (Roe et al., 2013). From a qualitative viewpoint, an intervention that has led to participants reporting positive changes, such as lower perceived stress levels, might also be deemed effective (Ellingsen-Dalskau et al., 2015). However, without knowing the necessary components, processes and influences needed for an intervention to work, it is impossible to understand why the programmes work and how best to replicate them. More in-depth reviews such as Lovell et al. (2015) and Husk et al. (2016) have produced more detailed conceptual models of the mechanisms by which engagement with nature impacts physical and mental health. We have built on evidence in these reviews by focusing on context, and on what works 'for whom' and 'in what circumstance'. Different contexts are likely to facilitate different mechanisms and outcomes, and what 'works' in one setting might not 'work' in a different one. To address this, realist methodology will be used to synthesise the evidence more broadly for greenspace interventions for mental health.

A realist review is defined as a '*method for studying complex interventions in response to the perceived limitations of conventional systematic review methodology. It involves identification of contexts, mechanisms and outcomes for individual programmes in order to explain differences, intended or unintended, between them*' (Booth et al., 2012, p. 267). By using realist methodology, the underlying mechanisms and processes through which greenspace can improve mental health will

be identified. This will allow a far greater theoretical understanding of the intervention process, rather than simply deducing whether an intervention is effective or not. Realist review methodology is becoming an increasingly popular way to synthesise public health interventions, given that they are complex by nature (Pawson et al., 2005). Wight et al. (2015) describe public health interventions as complicated and multicomponent, with many feedback loops, rather than simple, easily replicated entities. Greenspace interventions are an example of complex, public health interventions: the setting is in an uncontrolled environment, they are ideally run by multidisciplinary teams, and there are often many intervention components. The interventions may change in regard to context, and all programme components interact leading to outcomes that differ depending on such contextual factors (Wong, Greenhalgh, & Pawson, 2010). For these reasons, a realist review is the most appropriate methodology to synthesise existing greenspace interventions. Pawson et al. (2005) propose five steps which help guide the realist review process. These steps are iterative rather than sequential and each stage can influence another. For example, review questions might be refined after initial programme theory formulation, or the programme theory might be refined at any point when new evidence emerges. Steps 1-5 as reported in Pawson et al. (2005) are shown in Figure 1.

Step 1: Clarify scope

- a. Identify the review question
 - Nature and content of the intervention
 - Circumstances or context for its use
 - Policy intentions or objectives
- b. Refine the purpose of the review
 - Theory integrity – does the intervention work as predicted?
 - Theory adjudication – which theories fit best?
 - Comparison – how does the intervention work in different settings, for different groups?
 - Reality testing – how does the policy intent of the intervention translate into practice?
- c. Articulate key theories to be explored
 - Draw up a ‘long list’ of relevant programme theories by exploratory searching (see Step 2)
 - Group, categorise or synthesise theories
 - Design a theoretically based evaluative framework to be ‘populated’ with evidence

Step 2: Search for evidence

- a. Exploratory background search to ‘get a feel’ for the literature
- b. Progressive focusing to identify key programme theories, refining inclusion criteria in the light of emerging data
- c. Purposive sampling to test a defined subset of these theories, with additional ‘snowball’ sampling to explore new hypotheses as they emerge
- d. Final search for additional studies when review near completion

Step 3: Appraise primary studies and extract data

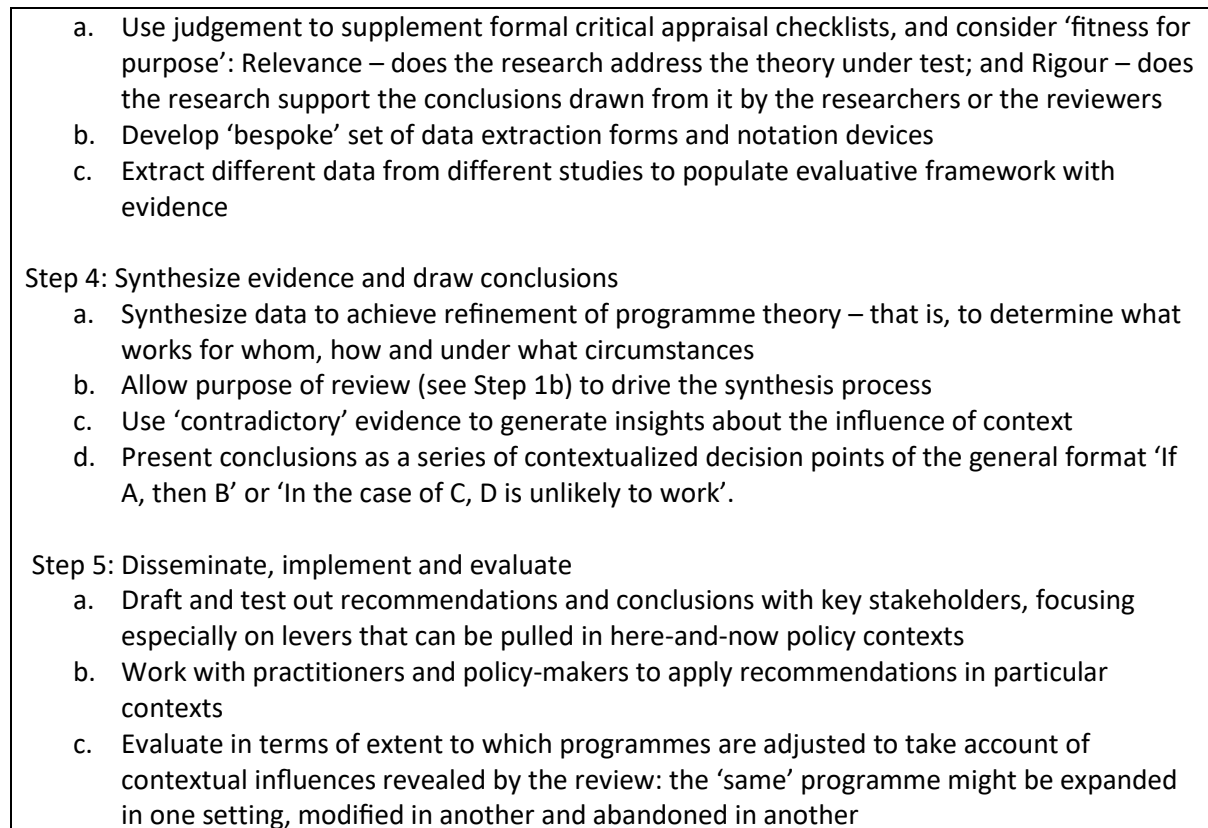


Figure 1: Key steps in a realist review as detailed in Pawson et al. (2005)

Aims and objectives of review

The aim of this realist review is to explore what greenspace interventions work to improve mental health, how they work, why they work, for whom do they work, how does context influence mechanisms of change, and how do mechanisms of change lead to outcomes. The objective of the review, therefore, is to develop initial programme theories and then test and refine these theories using both quantitative and qualitative evidence.

Review questions

1. What interventions, theories or strategies have been used in greenspace interventions that aim to improve mental health (as defined above) in both clinical and nonclinical samples?
2. What outcome measures (O) are associated with current greenspace interventions (e.g. quality of life, increased confidence, increased mood)?
3. What are the potential mechanisms (M) that influence outcomes?
4. What is the role of context (C) in enabling/constraining the above mechanisms?

5. What is the optimal C-M-O configuration that will lead to optimal outcomes in greenspace interventions to improve mental health?

Methods

Formation of Initial Programme Theory

Realist reviews aim to develop theories about how an intervention works. Central to a realist review is identifying the causal mechanisms that lead to an outcome, and in what contexts these mechanisms occur (Wong et al., 2013). This relationship is referred to as the C-M-O configuration (CMOc). By using this methodology realist reviews provide a theory-driven approach to analysing literature and identifying causal relationships. Unlike systematic reviews, meta-analyses or qualitative evidence syntheses, realist reviews analyse quantitative, qualitative, and mixed-method data, as well as grey literature (Abrams et al., 2018). Information about 'what works' is analysed using the findings of each paper, as well as through data extraction and synthesis from other sections of the paper which may inform theoretical understanding of causal pathways. The first step of this review was initial exploration of literature and theory formulation about how greenspace interventions for mental health might be effective. This involved comparing and synthesizing relevant theories and hypothesising how a greenspace intervention is thought to work to achieve desired outcomes. This initial theory mapping provided the proposed framework for the review about what works, for whom and in what circumstances. This framework (initial programme theories, IPTs) was then tested and refined throughout the realist review process as evidence emerged.

The main IPTs were developed initially by the first author (WM) through reading existing literature on greenspace interventions for mental health, conversations with existing greenspace programme staff, and by reading relevant policy documents and reports which discuss conceptual frameworks in relation to practice. These IPTs were checked by the second author (HC) and then by the wider team (TP, KP). This ensured that all authors were involved, and in agreement with, the development of the IPTs. By using this approach, relevant contexts, mechanisms, and outcomes were identified for several different programmes and potential CMOcs developed. The guiding questions for initial theory formulation are 'what outcome measures are associated with current greenspace interventions?', 'what are the potential mechanisms that influence outcomes?', 'what is the role of context in enabling/constraining potential mechanisms?', and 'what is the optimal C-M-O configuration that will lead to optimal outcomes in greenspace interventions for mental health?'

Table 1 shows the eight IPTs proposed under three identified programme theory themes of Nature, Individual Self, and Social Self. To further clarify how contexts, mechanisms, and outcomes fit together in a causal relationship, 'if-then-because' statements are included under each IPT.

Theme	Initial Programme Theory (IPT) number	Context (C)	Mechanism (M)	Outcome (O)
Nature	1	Nature-based location Ease of access	Feeling calm Feelings of escape Feeling removed from everyday life	Decrease anxiety Decrease stress
IPT 1: If there is easy access to a nature-based location, then participants may experience decreased anxiety and/or stress. This is because they can feel removed from everyday life, experience feelings of escape in nature, and feel calm. If the nature-based location is not easy to access, it is much less likely that people will go there.				
Nature	2	Nature-based location Ease of access	Indirect attention used	Attention restoration Decrease mental fatigue
IPT 2: If there is easy access to a nature-based location, then participants may experience a decrease in their mental fatigue, as well as feel that their attention has been restored. This is because indirect, or effortless, attention, as described in Kaplan and Kaplan's Attention Restoration Theory (1989), is being used when immersed in nature rather than direct attention. If the nature-based location is not easy to access, it is much less likely that people will go there.				
Nature	3	Nature-based location Ease of access	Time alone to reflect	Increase in readiness to change lifestyle and/or coping strategies Increase in desire to change Increase in awareness of the need for change
IPT 3: If there is easy access to a nature-based location, then participants may experience an increase in readiness to change, an increase in desire to change, and/or an increase in awareness of the need for change. This is because the nature-based location gives participants time along to reflect on their lives and what they want to change. If the nature-based location is not easy to access, it is much less likely that people will go there.				

Individual	4	Availability and resources for trained facilitators Access to resources	Planned structured activities Enjoyment of activities	Increased physical activity Increased physical health Improvement in mood
IPT 4: If there is the availability and the resources to provide trained facilitators, and these trainers have access to a variety of resources (such as equipment), then there will be an increase in physical activity, and a subsequent increase in physical health and improvement in mood. This is because there will be the availability of a number of different planned, structured activities from the trained facilitators, and participants can pick what they would like to do best, and therefore enjoy the activity.				
Individual	5	Availability and resources for trained facilitators	Learning new skills Feelings of self-efficacy	Confidence Confidence in ability to change and cope with challenges in life
IPT 5: If there is the availability and the resources to provide trained facilitators, then this will enable an increase in participant confidence, as well as in their confidence to change and cope with challenges in life. This is because participants are able to learn new skills from the facilitators, which lead to feelings of self-efficacy.				
Individual	6	Time on programme Availability and resources for trained facilitators	Learning new skills Feeling responsible for something	Increased self -esteem Increased vigour for life
IPT 6: If there is the availability and the resources to provide trained facilitators, and if there is adequate time spent on the programme, then participants will show an increase in self-esteem and an increase in vigour for life. This is because participants are able to learn new skills from the facilitators, as well as feelings of responsibility. The longer that the participant is able to feel responsible for something, the bigger the increase in self-esteem and vigour for life.				

Social	7	<p>Previous experience of patient-therapist relationship</p> <p>Existing facilitator attitudes and/or perceived attitudes of facilitator</p>	<p>Feelings of rapport and trust</p> <p>Good relationship with facilitator</p>	Continued engagement with, and after, the programme.
<p>IPT 7: If facilitators have positive attitudes, then participants are more likely to engage with, and after, the programme. This is because, when participants perceive a positive attitude towards them, feelings of rapport and trust are more likely to develop, and a good relationship with the facilitator can be established. Previous experience of a patient-therapist relationship can also influence continued engagement with, and after, the programme. If there is a positive previous experience, then this can lead to engagement. This is because feelings of rapport and trust can be built quicker, and participants can more easily develop a good relationship with the facilitator.</p>				
Social	8	<p>Perception of how others are engaging on the programme</p> <p>Time on programme</p>	<p>Team building/teamwork exercises</p> <p>Feeling safe and unjudged by others with similar backgrounds</p> <p>Feelings of rapport</p> <p>Opportunities to share</p> <p>Opportunities to learn from others</p>	<p>Increased social abilities</p> <p>Improvements in interpersonal relationships</p>
<p>IPT 8: If participants perceive others to be engaging well on the programme, then this can lead to increased social abilities and improvements in interpersonal relationships. This is because, when participants perceive others to be engaging, this increases feelings of rapport between participants. This can lead participants to feel safe and unjudged by others during team building/teamwork exercises where there are opportunities to share and learn from others. Even if others are perceived to be engaging well, time spent on the programme is also important in order to achieve outcomes. This is because social improvements do not occur quickly, and interpersonal relationships take time to build.</p>				

Table 1: Initial programme theories identified to be tested and refined

Testing the Explanatory Framework

To test and refine programme theories a selection of relevant electronic databases were searched between May and July 2019 in order to achieve saturation of results. These were: MEDLINE, PsycINFO, GreenFile, SocINDEX, CINAHL, Health Source, SPORTDiscus, Scopus, Web of Science, Natural Science Collection, and Wiley Online Library. Searches were limited to studies published after 2000 to ensure that included evidence was current. Qualitative, quantitative, and mixed-methods papers were included. Several terms are used interchangeably for ‘greenspace’ and ‘mental health’ so a number of terms were included in the search string (see Table 2).

Databases Searched	Search Terms
MEDLINE	greenspace OR "green space" OR "green care" OR greencare OR "nature
PsycINFO	therap*" OR "wilderness therap*" OR "outdoors behavi*ral healthcare"
GreenFile	OR "outdoors behavi*ral therap*" OR "forest bathing" OR "shinrin yoku"
SocINDEX	OR "shinrin-yoku" OR "horticultur* therap*" OR "therapeutic horticulture"
CINAHL	OR "green exercise" OR ecotherap* OR "conservation therap*" OR "care
Health Source	farm*"
SPORTDiscus	
Scopus	AND
Social Care Online	
Web of Science	"mental health" OR "mental ill health" OR "mental illness" OR "mental
Natural Science	disorder" OR "mental fatigue" OR psychiatric OR "psychiatric illness" OR
Collection	stress OR depression OR anxiety OR recovery OR "low mood" OR
Wiley Online Library	wellbeing

Table 2. Search terms in published literature

Grey literature was searched in June 2019 through search engines (Google, Google Scholar), grey literature databases (OpenGrey, Social Care Online), relevant organisational websites and reports (see Table 3), social media platforms such as Twitter, and through word of mouth.

UK	Europe	International
Venture Trust	Asociacion Experientia (Spain)	Enviros (USA)
Phoenix Futures		Shepherd's Hill Academy (USA)
The Wilderness Foundation		Rites of Passage (USA)
Forest Therapy Scotland		Redcliff Ascent (USA)
Cyrenians		
Venture Scotland		
The Green Team		
Youth Vision		
Venture Mor		

Table 3. Organisations included in search for grey literature

Inclusion/exclusion criteria

Inclusion criteria aligned to both the research questions and IPT development, as suggested by Wong et al. (2013), refined in response to emerging data, and discussed as a team to reach agreement. All programmes had to be greenspace-based however this could include gardens, woodland, plots, parks, and other types of greenspace. All age groups were included. In terms of mental health, both non-clinical and clinical studies were included in the search strategy. Participants could have a mental health diagnosis or be self-diagnosed; as many greenspace interventions are applied in a similar manner to specific and general populations. Programmes were included if improved mental wellbeing was an explicit intended outcome. The exclusion criteria were developed and refined in response to emerging data and again were discussed as a team to ensure consensus. A decision was made to exclude studies focused on dementia because, upon initial analysis, the CMOcs appeared very different to those for mental health. It was unclear whether those with dementia had the capacity to reflect meaningfully on their experiences and if these studies could effectively answer the review questions. Furthermore, many of these studies were implemented inside and could not be described as 'greenspace' programmes.

Results

Search results and study characteristics

In the first stage of searching, after removing duplicates, 2119 titles and abstracts were screened against the inclusion and exclusion criteria: 2095 studies identified through database searching, 19 grey literature sources, and 5 studies through citation searching. In a realist review, the search process is iterative, and during a final search for evidence, another 8 empirical studies and 1 grey

literature evaluation were identified. In total, 113 potentially eligible studies were identified in this process so full texts were obtained. As a result of further close reading of full texts, 49 articles were identified and included. Literature searching and screening results are reported in Figure 2 using PRISMA (Moher et al., 2009). Information provided in each study about the programmes and participants varied, and key characteristics of all included studies were recorded (Table 4 and Table 5).

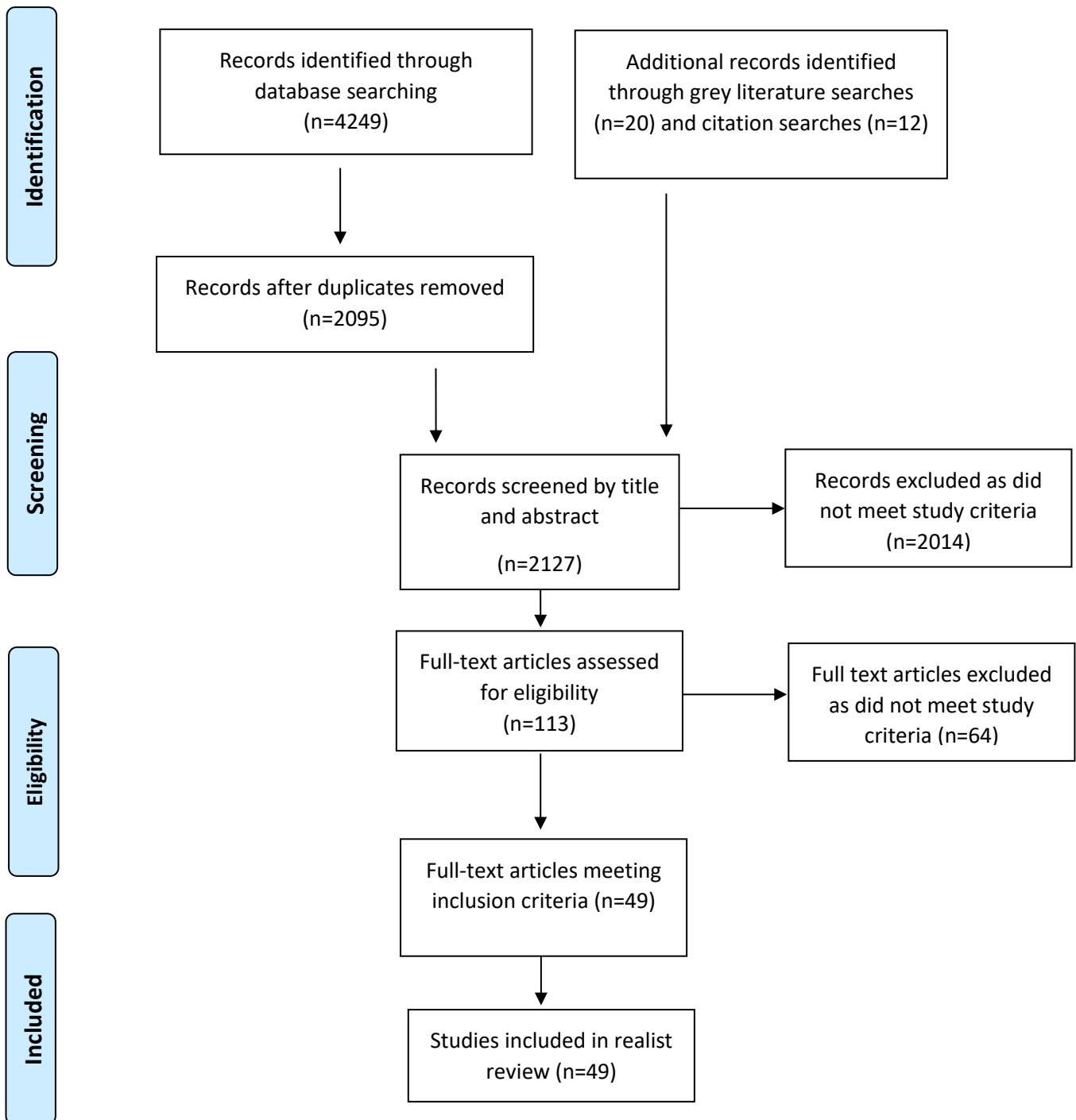


Figure 2. PRISMA diagram

Relevance and rigour

Following the guidance set in the quality standards for realist reviews (Wong et al., 2013), each study was appraised for relevance and rigour. Relevance was assessed in relation to three criteria: population, intervention, or study design; explanation of context, mechanism and outcome as individual aspects as well as in combinations; and explanation of theory. In realist reviews, studies can be included even if only a small part is relevant. This can mean that a certain amount of subjective judgement is necessary to ensure the number of included studies is not unmanageable. Similarly, in realist reviews, studies are assessed for rigour in a different way from systematic reviews: standard quality assessment tools are not used due to the risk of 'nuggets of wisdom' (Pawson, 2004) being missed due to discarding papers deemed methodologically weak. As is advised in the quality standards (Wong et al., 2013), we identified whether the methods in each study were rigorous enough to be able to rely on the small percentage of findings that we needed to draw on and use in our review. However, as discussed in Pawson (2004), even studies typically deemed methodologically weak can be included, with careful analysis and appraisal, since they may explicitly, or implicitly, allow insight into why an intervention did not work. To ensure that the risk of bias was reduced, a second reviewer (HB) checked a selection of included/excluded papers to ensure validity and consistency. Where there was inconsistency, a thorough discussion was held to decide whether to include or exclude the study.

Authors	Date of Publication	Country	Title	Intervention	Available participant info	Mental health outcomes	Methods	IPT Supported
Adevi & Lieberg	2012	Sweden	Stress rehabilitation through garden therapy: A caregiver perspective on factors considered most essential to the recovery process	Horticultural Therapy	5 participants	Improvements in stress-related ill health	In-depth interviews and focus-group interviews with the rehabilitation team members of Alnarp Rehabilitation Garden in Sweden looking at their understandings of significant factors to the stress recovery process	1, 2, 3, 5, 8
Adevi & Mårtensson	2013	Sweden	Stress rehabilitation through garden therapy: The garden as a place in the recovery from stress	Horticultural Therapy	5 participants 4 female, 1 male	Improvements in stress-related ill health	Interviews with participants of Alnarp Rehabilitation Garden in Sweden who describe their experiences of horticultural therapy and what they perceive as essential for their recovery	1,2,3,4,5,6,8
Barley et al.	2012	UK	Primary care-based participatory rehabilitation: users' views of a horticultural and arts project	Horticultural Therapy	16 participants 7 female, 9 male Ages 38-91	Improved mental wellbeing in those with severe mental health diagnoses	Semi-structured interviews with participants of Sydenham Garden in South London looking at their views and experience of the	1,2,3,5,6,8

							horticultural programme	
Bettman et al.	2011	USA	Adolescents in wilderness therapy: A qualitative study of attachment relationships	Wilderness Therapy	13 participants	Improvements in interpersonal relationships and wellbeing	An evaluation of the narratives of 13 adolescents in a wilderness therapy program in an attempt to understand their attitudes toward parents, therapists, and other adult figures	1,2,6
Bloomfield	2017	UK	What makes nature-based interventions for mental health successful?	Ecotherapy	48 participants	Improved general mental wellbeing	Summary of health and wellbeing benefits derived from A Dose of Nature project in England, UK. Key factors involved in development of interventions were discussed by authors	5,6,7,8
Bryson et al.	2013	Canada	An examination of the feasibility of adventure-based therapy in outpatient care for individuals with psychosis	Adventure Therapy	21 participants 4 female, 11 male Ages 24-48	Engagement in the recovery process, and improvements in emotional wellbeing, energy, self-esteem, and global health in people with Schizophrenia and other psychoses	Mixed-methods pre-post design to examine the feasibility of a 6-week Rise-Up Adventure Therapy intervention in an outpatient care setting. Questionnaires were given pre-post the intervention and interviews were	4,5,7,8

							completed post intervention	
Caulkins et al.	2006	USA	The role of physical exercise in wilderness therapy for troubled adolescent women	Wilderness Therapy	9 female participants (6 on the programme ages 15-16, and 3 instructors)	Emotional, cognitive, and physical changes	A qualitative case study approach was used to investigate the experience of six adolescent women and three female wilderness instructors at an established wilderness therapy program. Data were collected through participant observation, client psychological profiles, and semi-structured interviews. Research explored the emotional, cognitive, and physical impacts attributed to the backpacking component of the therapeutic process and the relationships between these impacts.	4
Combs et al.	2016	USA	Adolescent self-assessment of an outdoor behavioural health programme:	Wilderness Therapy	659 participants 210 female, 449 male	Positive changes in mood, substance use, anxiety, behaviour, and	Participants completed questionnaires 4 times during treatment, and at 6 and 18 months	4,7,8

			longitudinal outcomes and trajectories of change		Average age: 16	attachment concerns	post-discharge. Multilevel modelling was used to explore trajectories and predictors of change during treatment, and a regression and an ANOVA to examine outcomes post-discharge	
Cook	2008	USA	Residential wilderness programmes: the role of social support in influencing self-evaluations	Wilderness Therapy	13 male participants Ages 12-16	Improvements in self-evaluation, mental health, and self esteem	Participants attended interviews on two separate occasions; once upon entrance into the program and then four months later. The interviews consisted of follow-up questions to survey instruments and a semi-structured interview	5,8
Davis-Berman and Berman	2012	USA	Reflections on a trip: Two decades later	Wilderness Therapy	4 participants	The impact a wilderness therapy programme had on the participants' lives and wellbeing	Longitudinal qualitative study that involves the interviews of four adults who participated in one of two 10-day wilderness therapy trips 25 years ago. Using qualitative data collection techniques, we	1,7,8

							conducted in-depth interviews. Respondents were asked to reflect on their lives, the wilderness therapy trip, and the trip's impact on them.	
Dolgin	2014	USA	Into the Wild: A group wilderness intervention to build coping strategies in high school youth through collaboration and shared experience	Wilderness Therapy	21 participants 13 female, 8 male Ages 15-17	Mental health improvements and prevention of internalising disorders	Participants completed two narrative questionnaires to gauge intervention impact and possible preventative functions of the wilderness therapy intervention. Both the pre-narrative and post-narrative exercises included similar open-ended questions	5,8
Elings & Hassink	2008	Netherlands	Green care farms, a safe community between illness or addiction and the wider society	Care Farm	42 participants	Increased mental, physical and social wellbeing in people with psychiatric and/or addiction history	Focus group interviews on 8 different care farms. The interviews explored views and experiences on care farms	5,6,8
Eriksson et al.	2011	Sweden	Experiences of women with stress-related ill health in a therapeutic	Horticultural Therapy	5 female participants Ages 36-52	Improvements in stress-related ill health	Participants completed 3 interviews every 3 weeks including 3	3,4,5,8

			gardening programme				months after. The interviews explored the experiences of participants in a therapeutic garden setting	
Evans	2013	UK	Investigation into the benefits and processes of adventure training among disaffected and at-risk populations	Adventure Therapy	52 participants over 3 studies	Increases in self-esteem and mental wellbeing	Thesis looking at reported benefits and processes of adventure therapy	3,4,5,6,7,8
Ferneer et al.	2017	Norway	Unpacking the black box of wilderness therapy: A realist synthesis.	Wilderness Therapy	N/A	Improvements in mental health in adolescents	A review of the primary qualitative wilderness therapy studies, empirical findings are used to test and refine a key program theory specifically for wilderness therapy	1,2,3,4,5,6,7,8
Ferneer et al.	2018	Norway	Therapy the Natural way: a realist exploration of the wilderness therapy treatment process in adolescent healthcare	Wilderness Therapy	14 participants 8 female, 6 male Ages 16-18	Mental health improvement in those who require mental health treatment (as assessed by a clinical team)	Fieldwork and interviews were combined for an in-depth investigation of the treatment process, where the objective was to acquire a deeper understanding of the opportunities that arise in the	all

							wilderness therapy setting	
Fieldhouse	2003	UK	The impact of an allotment group on mental health clients' health, wellbeing and social networking	Horticultural Therapy	9 participants 3 female, 6 male Ages 24-61	Improvements in health, mental wellbeing, and social networking	Interviews and focus group with participants looked at subjective experience and benefits of an allotment group	all
Gabrielson et al.	2018	Norway	The effectiveness of wilderness therapy as mental health treatment for adolescents in Norway: a mixed methods evaluation	Wilderness Therapy	32 participants 21 female, 11 male Mean age: 16.5	Mental health improvement in participants with severe mental health challenges	Mixed methods study investigating effectiveness of wilderness therapy by incorporating psychometric pre, post-, and 12 month follow-up data; executive functioning data; and qualitative data from two rounds of individual participant interviews	3,7,8
Grahn et al.	2017	Sweden	Longer nature-based rehabilitation may contribute to a faster return to work in patients with reactions to severe stress and/or depression	Horticultural Therapy	106 participants 96 female, 10 male Ages 22-63	Reduction in severe stress and/or depression	Quantitative questionnaires were used to gather data from participants after 8, 12, and 24-week periods of rehabilitation. Return to work data were collected before the intervention and one year after the start of rehabilitation. In	1,2,3

							addition, data were collected regarding self-assessed occupational competence, personal control, and sense of coherence	
Granerud & Eriksson	2014	Norway	Mental health problems, recovery, and the impact of green care services: a qualitative, participant-focused approach	Green Care Services	20 participants	Mental health improvement in mental health service users	Data were obtained from interviews with participants and were analysed qualitatively in order to gain knowledge about service users' experiences of services	1,2,5,6,7,8
Harper et al.	2019	Canada	Client perspectives on wilderness therapy as a component of adolescent residential treatment for problematic substance use and mental health issues	Wilderness Therapy	148 adolescent participants	Mental health improvement and reductions in substance use	A realist approach was used to undertake thematic analysis of written open-ended responses to questions	1,2,3,4,5,6,7,8
Harris	2017	UK	The social dimensions of therapeutic horticulture	Horticultural Therapy	15 participants 8 female, 7 male	Mental health improvement in mental health service users	This study explored the views of service users participating in a horticultural therapy programme using two focus groups with	1,5,7,8

							mental health service users	
Hassink et al.	2010	Netherlands	Care farms in the Netherlands: Attractive empowerment-oriented and strengths-based practices in the community	Care Farm	101 participants (41 service users, 33 care farmers, and 27 employees of care services which collaborate with care farms)	Quality of life and mental health improvements in people with severe mental health challenges	Interviews showed characteristics associated with care farms that seem beneficial for three different participant groups: those with severe mental health problems, those from youth care backgrounds, and frail elderly participants. Data from participant groups were analysed separately	1,2,3,5,6,7,8
Howarth et al.	2018	UK	Growing spaces: an evaluation of the mental health recovery programme using mixed methods	Horticultural Therapy	47 participants Ages 35-68	Mental health recovery	A mixed-methods approach was used and data from four semi-structured focus group interviews, 11 interviews and 20 'recovery star' datasets were collected. The findings were then triangulated to provide an understanding of the impact of the programme	1,5,6,8

Husk et al.	2020	UK	What approaches to social prescribing work, for whom, and in what circumstances? A realist review	Social Prescribing	N/A	Improvements managing health in long term conditions and in health and wellbeing	A realist approach was used to uncover the contexts, mechanisms, and outcomes relating to social prescribing. 109 studies were included in the first phase, and 34 in the second phase	1,7,8
Iancu et al.	2014	Netherlands	Mental health recovery on care farms and day centres: a qualitative comparative study of users' perspectives	Care Farm	26 participants 10 female, 16 male Mean age: 42.5	Mental health recovery	Data were collected through semi-structured interviews with participants on care farms in order to analyse and compare experiences of mental health recovery	1,2,5,6,7,8
Kogstad et al.	2014	Norway	Narratives of natural recovery: Youth experience of social inclusion through green care	Care Farm	9 participants 7 female, 2 male Ages 17-27	Improvements in identified recovery factors: recognition, supportive relationships, motivation, meaning, positive coping, self-esteem, confidence, and hope	Participants from 3 different care farms were interviewed, two or more times over a two-year period. Essential beneficial factors of care farming were explored in order to better understand how the "green" element could add to more traditional recovery factors	1,5,6,7,8
Leck et al.	2015	UK	Growing wellbeings: the	Care Farm	216 participants	Improved general mental wellbeing	A mixed methods design was used which allowed for the	1,4,5,6,8

			positive experience of care farms		62 female, 154 male Ages <16-60+		integration of quantitative measurements of change with qualitative descriptions of this change. Service users completed an initial questionnaire, 63% then provided comparative data in a follow-up questionnaire. Semi-structured interviews with 33 service users then allowed personal experiences to be detailed	
Lehman et al.	2018	USA	Veterans in substance abuse treatment programme self-initiate box gardening as a stress reducing therapeutic modality	Horticultural Therapy	56 male participants	Stress reduction and substance use recovery	Group interviews were conducted with veterans from the last Substance Abuse Rehabilitation Treatment Program classes, as well as individual interviews with staff. Interviews explored time veterans spent in garden, frequency visited, and emotional feelings when in garden	1,2,5,6

Livingston et al.	2011	UK	A tale of the spontaneous emergence of a recovery group and the characteristics that are making it thrive: Exploring the politics and knowledge of recovery	Mountaineering	N/A	Improvements in mental wellbeing, including support with recovery	A narrative report on activity-orientated recovery groups, illustrating their diversity and exploring the issues of knowledge and power	1,2,3,4,5,7,8
McIver et al.	2018	Australia	Healing fears, conquering challenges: Narrative outcomes from a wilderness therapy programme	Wilderness Therapy	19 participants 11 female, 8 male Ages 18-25	General improvements in mental health	Semi-structured interviews were conducted approximately 10 days after the WILD wilderness therapy session to investigate of the narratives of staff and residents. Participants described their experiences and views of what made the programme successful	all
O'Brien	2018	UK	Engaging with and shaping nature: A nature-based intervention for those with mental health and behavioural problems at the Westonbirt	Woodland Activity	62 participants Ages 13-60	Improvements in mental health and behavioural challenges	This study used qualitative mixed methods including in-situ 'being and doing' activities with participants, interviews, and participant observations to	1,4,6,8

			Arboretum in England				explore participant's experiences of a multi-visit nature-based intervention at Westonbirt Arboretum in England	
O'Brien et al.	2010	UK	Doing something positive: volunteers experiences of wellbeing benefits derived from practical conservation activities in nature	Conservation Activity	88 participants 25 female, 63 male Ages 16-76	General improvements in wellbeing	This study used mixed methods to explore the motivations for, barriers to, and benefits of formal practical environmental volunteering for physical, mental, and social wellbeing. Qualitative interviews and quantitative questionnaire data collection was undertaken while spending a day each with ten volunteer groups as they undertook their practical conservation activities	1,2,3,4,6,8
Pálsdóttir et al.	2014	Sweden	The journey of recovery and empowerment embraced by nature — clients' perspectives on	Horticultural Therapy	43 participants 35 female, 8 male Ages 25-62	Improvements in stress-related ill health	43 participants took part in semi-structured interviews to explore the role of natural environments in nature-based	1,2,3,4,5,6,8

			nature-based rehabilitation in relation to the role of the natural environment				rehabilitation for individuals with stress-related mental disorders at the Alnarp Rehabilitation Garden in Sweden	
Rappe et al.	2008	Finland	Group gardening in mental outpatient care	Horticultural Therapy	10 participants 9 female, 1 male Ages 41-64	Mental health rehabilitation	This study was a participatory study amongst mental health outpatients and their support persons gardening on a plot in Annala Manor Park in Helsinki. Ten participants completed the questionnaire about the importance and health-related effects of gardening. The researchers also attended 17 meetings to observe participants	1,5,6,8
Russell & Phillips-Miller	2002	USA	Perspectives on the wilderness therapy process and its relation to outcome	Wilderness Therapy	12 participants 3 female, 9 male Ages 13-17	Improvements in mental health and problem behaviour	This study investigated 4 wilderness therapy programs using a multi-site case study approach and qualitative interviews to examine the wilderness therapy experience	all

Schreuder et al.	2014	Netherlands	Exploring salutogenic mechanisms of an outdoor experiential learning programme on youth care farms in the Netherlands: untapped potential?	Care Farm	11 participants 2 female, 9 male Ages 17-22	Improvements in mental health and wellbeing	Participants were asked to look back on their half-year stay on a care farm in the Netherlands. Views were gathered by using semi-structured interviews to elicit their experiences from a salutogenic perspective	1,3,5,6,7
Sidenius et al.	2017	Denmark	"I look at my own forest and fields in a different way": the lived experience of nature-based therapy in a therapy garden when suffering from stress-related illness	Horticultural Therapy	42 participants Ages 20-60	Improvements in stress-related ill health	Fourteen participants took part in semi-structured interviews to explore the phenomenon of participants' lived experience of the nature-based therapy garden in Nacadia (University of Copenhagen)	1,2,3,5,6,7,8
Stevens	2018	UK	A hypnosis framing of therapeutic horticulture for mental health rehabilitation	Horticultural Therapy	12 participants	Mental health rehabilitation in those with severe mental health challenges	In-depth interviews with volunteers attending Cherry Tree Nursery – a sheltered work project for people with severe mental illness in the UK – provided conceptual groupings of reported experiences	1,3,6,7,8

SurrIDGE et al.	2004	UK	Wild at heart: tapping into restorative power of great outdoors	Adventure Therapy	N/A	Improvements in mental wellbeing	Published descriptive article about the benefits of the Reflection project, a UK-based adventure therapy project	1,3,5,7,8
Warber et al.	2015	USA	Addressing nature-deficit disorder: a mixed method pilot study of young adults attending a wilderness camp	Wilderness Therapy	36 participants 24 female, 12 male Ages 18-31	Improvements in mental wellbeing and connection to nature.	Mixed methods were used to investigate whether nature-based camp experiences would increase connection to nature and promote well-being. Participants completed pre-camp and post-camp online questionnaires. Interviews explored camp experiences and social relations	1,2,3,8
Wilson et al.	2010	UK	Green shoots of recovery: the impact of a mental health ecotherapy programme	Ecotherapy	28 participants 10 female, 18 male Mean age: 41.9	Improvements to mental wellbeing, improvements to physical health, provision of daily structure and routine, transferable knowledge and skill acquisition, and increased social networking	Semi-structured interviews with clients and two focus groups with clinicians from referring services to the Branching Out ecotherapy programme were conducted	1,4,5,8

						and social skills development		
Woodford et al.	2017	Canada	A change of scenery: wilderness therapy treatment for inpatients in acute care	Wilderness Therapy	24 participants 11 female, 13 male Ages 19-85	Improvements in mental health	Pre-programme, participants wrote personal goals for the camp experience and filled out the Positive and Negative Affect Scale. Post-programme, participants completed a client satisfaction form, the PANAS, and also provided suggested improvements	all

Table 4: Included empirical studies in the review

Authors/Organisation	Date	Title	Type of document	Reason for inclusion
Cole & Christie	2016	Occupational engagement in a woodland: belonging and wellbeing for mental health and mental health recovery	Presentation at College of Occupational Therapists 40th annual conference and exhibition	Ethnography and interviews of people's views on a garden therapy project who are recovering from mental health issues
World Health Organisation	2017	Urban green spaces and health: a review of evidence	Review of evidence	Relevant information regarding pathways for physical activity and contextual factors such as gender
Redcliff Ascent	2019	The role of field staff	Organisational programme web page	Relevant information regarding role of facilitator - participant relationship
Venture Trust	2019	Facing the forces of nature: a Venture Trust journey	Organisational programme web page	Relevant information regarding culture of organisation and contextual factor of environment being catalyst for change
Phoenix Futures	2019	Recovery through nature	Organisational programme web page	Relevant information regarding group culture, self-efficacy, and confidence
Howes, Edward-Jones, & Waite	2018	Moor health and wellbeing. An evaluation of two National Park projects: Dartmoor Naturally Healthy and Exmoor Moor to Enjoy	Evaluation of two projects	Relevant information regarding enjoyment of activities, sense of belonging, impact of learning, and relaxation in nature

Table 5: Grey literature included in review

Testing and refinement of programme theory

Detail on contexts, mechanisms, and outcomes of each included study were recorded in an Excel spreadsheet. Data extraction and synthesis were undertaken by the first author (WM), with results

regularly discussed with the rest of the study team (HC, TP, KP) to ensure consistency, and reduce bias when refining programme theories. Ongoing conversations with greenspace organisation staff were held throughout the search and appraisal process to further ensure that programme theories accurately described the underlying mechanisms and causal pathways of the interventions. The development of IPTs into seven refined programme theories is described below. It became clear during data synthesis that IPTs did not adequately integrate the ‘for whom’ and ‘in what circumstance’ aspects of the realist method. Therefore, while the programme theory themes stayed similar, there was refinement and greater emphasis placed on these contextual factors given how essential they are for implementation and targeting. Figure 3 shows a brief outline of how the identified programme theories fit in to three overarching themes. The seven programme theories are represented by headings which we believe best describe their core concept.

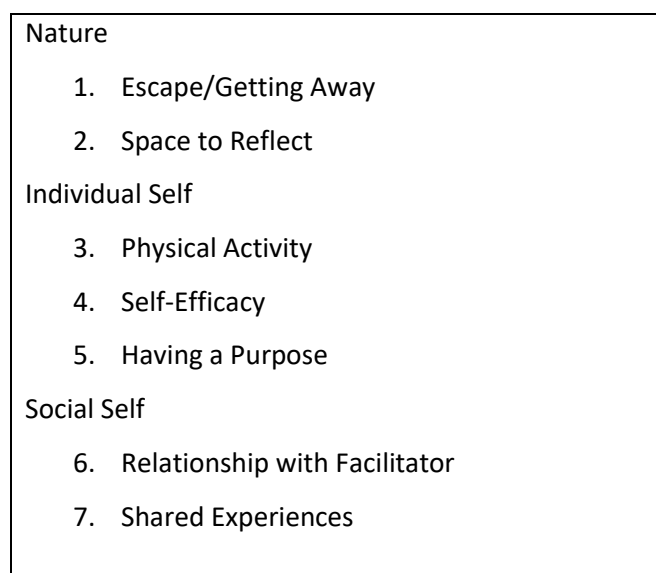


Figure 3: Three programme themes and subsequent representative headings for the seven programme theories identified through data synthesis

1. Escape/Getting Away

Perhaps unsurprisingly, given the integral part nature plays in the programmes, most of the included studies mentioned the importance of immersion in greenspace for mental health benefits. Fernee and colleagues (2018) discuss how the role of the wilderness created a calming effect on participants, in contrast to their usually chaotic lives, and how the calming environment facilitated cognitive processes such as reflection. Participants in Kogstad, Agdal, and Hopfenbeck’s study (2014) described immersion in nature as feeling like a cloud had been lifted, while participants in the study by McIver, Senior, and Francis (2018) reported that immersion in nature helped reduce rumination and stressful, negative thoughts. One participant in O’Brien, Townsend, and Ebdén’s study (2010) reported that he felt sitting on the hillside for ten minutes was as effective as his antidepressant

medication. A number of the studies made reference to well-established theories such as Attention Restoration Theory (Kaplan & Kaplan, 1989) which holds that when a person is immersed in nature this leads to feelings of calm and a reduction in mental fatigue. Previous reviews such as Berto (2014) and Hartig et al. (2014) have also supported the role of attention restoration and a reduction in mental fatigue as mechanisms in health improvement. One of the components of Attention Restoration Theory is that immersion in nature allows a person to feel removed from their everyday life and, therefore, from their everyday stressors. This feeling of escape, or 'getting away', is a key mechanism in the success of greenspace programmes. In the Nacadia Therapy Garden, service users described the garden as 'a magical world of its own' (Sidenius et al., 2017, p. 5), whereas other participants described being out in nature as 'like another world' and 'sort of like part of the world but a pocket. A haven pocket' (Stevens, 2018, p.7 & p.9 respectively).

Refinement of programme theory

IPT 1 and IPT 2, as shown in Table 1, were condensed into the above encapsulating programme theory of *Escape/Getting Away*. The greenspace setting was a key contextual factor as it provided the right supportive environment but also acted as the resource (mechanism resource), otherwise understood as the programme strategy or programme component introduced in a context. Programmes that utilise greenspace, and allow participants to feel as if they are escaping from their day-to-day lives, are shown to be particularly effective for participants with experience of trauma, anxiety, depression, suppressed anger, and other emotions, conflicts in relationships, as well as for people who explicitly state that they need help (Bettmann, Olson-Morrison, & Jaspersen, 2011; Russell & Phillips-Miller, 2002). As well as existing diagnoses, the greenspace setting was particularly effective for participants who had previous experience of more typical treatments such as counselling (context), as they no longer felt as if they were confined within four walls (Ferneer et al., 2018; Granerud & Eriksson, 2014; Sidenius et al., 2017; Woodford, Fenton, & Connors, 2017). It is possible, therefore, that nature-based programmes are most appropriate for participants who have previously attended traditional therapies which they believe were unsuccessful.

The feeling of being away, relaxed, and removed from daily life, was shown to be further facilitated by sensory stimuli (context and mechanism resource) present in the environment (Adevi & Lieberg, 2012; Grahn et al., 2017; Harris, 2017; Rappe, Koivunen, & Korpela, 2008; Sidenius et al., 2017). There was some evidence that ease of access to the programme sites was a contextual factor, with one study highlighting that not owning a car to get to sites could be a barrier (O'Brien, 2018), and Husk et al. (2019) state that support to get to the location of the programme was necessary for

success. Additionally, during a discussion with greenspace programme staff, one manager emphasised that access to minibuses could influence the ease by which the programme was attended so could be a potential contextual factor. Changes in participant reasoning (mechanism reasoning) occur as a result of introduced resources and together these constitute the programme mechanism. In this programme theory, stress levels and mental fatigue were reduced (outcomes) through indirect attention being used (mechanism reasoning), and through the participant feeling removed, relaxed, and 'getting away' from their stressors (mechanism reasoning). The WHO report *Urban Green Space: A Review of the Evidence* (WHO, 2016) discusses the importance of taking account of gender differences in response to exposure to greenspace, however, with a previous longitudinal study by van den Bosch et al. (2015) reporting positive associations between exposure to greenspace and mental health in women, but not men. Furthermore, Combs et al. (2016) reports that female participants showed a faster decrease in stress than male participants, suggesting that a shorter stay on a programme may work for female groups. Such findings suggest that men and women may respond differently to the greenspace environment on programmes so should be considered during programme development. It is also worth noting that cultural differences can influence how well a participant engages with a greenspace programme in the first instance. For example, during conversations with greenspace programme staff, we identified that uptake of greenspace programmes such as forest therapy is much higher in Japanese and Korean culture where time in forests is an integral part of that lifestyle. The normalisation of forest therapy in these cultures will likely have an influence on uptake and engagement of programmes compared to countries where there is stigma attached to such ideas.

2. *Space to Reflect*

The contextual role of greenspace setting is discussed in the above *Escape/Getting Away* programme theory and is also integral to this programme theory. In this programme theory, the greenspace environment acts as a catalyst for change, with McIver et al. (2018), and participants on the *Living Wild* programme (Venture Trust, 2019), describing nature as a mediator in preparing a person for a therapeutic experience. Sidenius et al.'s study (2017) supports this describing nature as providing a 'backdrop' where therapeutic conversations and activities were more accessible. An integral part of this programme theory is that time alone in greenspace can allow participants to reflect on their lives. This is particularly important for those with coping strategies which may be harmful to them, such as using drugs, alcohol, or self-harm (Bettmann et al., 2011). Participants on a wilderness therapy programme (Fernee et al., 2018) spoke about the physical space allowing them to reflect in a prolonged and undisturbed way, both when sitting and walking. This, in turn, can increase their

awareness of the need for change in their lives (Hassink et al., 2010; McIver et al., 2018; Russell & Phillips-Miller, 2002), and how to 'live a better life' (Fieldhouse, 2003, p.90).

Refinement of programme theory

As in the *Escape/Getting Away* programme theory, the greenspace setting provided the supportive environment for the programme (context and mechanism resource). The context of adequate time spent on the programme was a refinement to this programme theory since change and reflection did not happen quickly (Kogstad et al., 2014; Pálsdóttir et al., 2014; Schreuder et al., 2014; Sidenius et al., 2018). Participants in Gabrielson et al. (2018) believed change happened due to the number of unique experiences participants have during programmes, but stated that change could take months to become apparent. Within these contexts, awareness of the need to change (outcome) was achieved by participants spending time alone and reflecting on their lives (mechanism reasoning). Additionally, the desire to change (outcome) could be facilitated by metaphors encountered within the programme (mechanism resource) and participants applying these to their own lives (mechanism reasoning). An example of this was a description of how trying to control a canoe and fight against its natural course proved more difficult than letting nature take its course around obstacles: a metaphor for trying to control life and avoid obstacles (McIver et al., 2018). Adevi and Lieberg (2012) also discussed how participants may seek out specific places in a therapy garden, depending on their emotional state. This is an important contextual factor as it highlights that the most therapeutic place for a participant to reflect is highly individual. It is, therefore, important that participants self-choose places that they have a connection with, or feel comfortable in (mechanism response). According to the staff in this garden programme, reliance on the self-chosen places appears to create greater confidence over time (outcome). Pre-existing diagnoses were also identified as a crucial contextual refinement for this programme theory, particularly important when designing programmes for specific populations. For example, extensive time alone for reflection is not appropriate for participants with existing diagnoses such as severe depression or psychosis (Fernee et al., 2017).

3. Physical Activity

Enjoyment of physical activity appears to be the mechanism that best allows increased physical health and fitness. Two participants in Fernee et al.'s study (2018) described how, even though they felt tired during physically challenging hikes, they still felt happier when taking part and therefore found it easier to push themselves. However, caution must be taken before generalising this finding: Caulkins, White, and Russell (2006) highlighted how young women in their study appeared to benefit

less from wilderness hikes compared to other participants, due to higher levels of aversion to the outdoors. Evans (2013) suggests that greenspace programmes provide participants with unique, exciting experiences which encourage people to participate. Furthermore, with increases in physical activity, improvements in mood are also seen (Bryson et al., 2013; Eriksson, Westerberg, & Jonsson, 2011; Fernee et al., 2018; Fieldhouse, 2003; Leck, Upton, & Evans, 2015; O'Brien, 2018; Wilson et al., 2010). This supports existing systematic reviews and meta-analyses supporting the role of physical activity on mental health (Bize, Johnson, & Plotnikoff, 2007; Penedo & Dahn, 2005; Rosenbaum, Tiedemann, & Ward, 2014). Conversations with service managers identified that availability of resources for equipment is an important contextual factor for successful engagement with physical activities; as programmes must be fully equipped and functional. However, SurrIDGE et al. (2004) discuss how resources from stakeholders can also be in the form of support and advice in areas such as risk assessment and group safety. Six studies stressed the importance of having confident, adequately trained facilitators to enable and lead activities (Bloomfield, 2017; Evans, 2013; Granerud & Eriksson, 2014; Kogstad et al., 2014; O'Brien et al., 2010; SurrIDGE et al., 2004). With a diversity of activities available, participants are more likely find an activity that they enjoy and will engage with.

Refinement of programme theory

The availability of trained facilitators (context), and availability of resources to adequately support and fund programmes and their materials (context), is imperative to provide a variety of activities to service users (mechanism resource). This allows participants to engage with activities they enjoy (mechanism reasoning), and provides person-centred approaches (Barley et al., 2012; Bloomfield, 2017; Cole & Christie, 2016; Harris, 2017; O'Brien, 2018; Schreuder et al., 2014). This enjoyment of physical activity (mechanism reasoning) facilitates engagement (outcome) and, in turn, leads to increased physical activity, improvements in physical health, and improvements in mood (outcomes). However, particularly in winter weather (context), participants who did not like spending time outside found it difficult to enjoy any aspect of the programme due to discomfort (mechanism reasoning) (Harper, Mott, & Obee, 2019), limiting positive outcomes. However, realistic expectations of anticipated challenges did appear to be an influencing context in the lead up to programme uptake in some circumstances. Gabrielson et al., (2018) suggest that clearly informing and preparing participants for any challenges prior to the programme commencing is advisable, in particular, ensuring participants have the right equipment (context), such as waterproof clothing and shoes.

4. Self-Efficacy

Twenty-eight studies reported that service users who learned and mastered new skills had increased self-esteem, pride, and confidence. Indeed, existing evidence supports continued learning as a mechanism for mental health improvement (Feinstein & Hammond, 2004; Hammond, 2004). Learned skills can be practical tasks, for example, learning how to look after plants was very effective for those with stress-related illness (Adevi & Lieberg, 2012; Eriksson et al., 2011), and for those without a clinical diagnosis wanting to improve wellbeing in general (O'Brien, 2010). Learning practical skills on wilderness therapy programmes was shown to be a particularly positive experience for young people (Fernee et al. 2018; Warber et al., 2015), and for those who were in the wilderness alone for the first time (Russell & Phillips-Miller, 2002). However, learned skills can also be skills such as self-regulation of emotion (Adevi & Mårtensson, 2013), and coping strategies (Barley et al., 2012). These psychological skills are particularly important in facilitating self-efficacy post-programme enabling service users to integrate new skills into their lives (Bryson et al., 2013; Howarth et al., 2018; Phoenix Futures, 2019; Sidenius et al., 2017). As with the programme theory for *Physical Activity*, the availability of adequately trained facilitators is necessary to enable participants to learn new skills (Bloomfield, 2017; Evans, 2013; Granerud & Eriksson, 2014; Kogstad et al., 2014; O'Brien et al., 2010; Surridge et al., 2004).

Refinement of programme theory

The availability of trained and confident facilitators (context) is necessary to enable service users to learn both practical and psychological skills (mechanism resource). As well as improved self-efficacy (mechanism reasoning), another identified change in reasoning was an increased feeling of empowerment when learning new skills (Cole & Christie, 2016; Combs, Hoag, Javorski, & Roberts, 2016; Howes et al., 2018; Fernee et al., 2018; Harris, 2017; Lehmann, Detweiler, & Detweiler, 2018; McIver et al., 2018; O'Brien, 2018; Pálsdóttir et al., 2014; Woodford et al., 2017). Through this mechanism, skills development can lead to increases in pride, self-esteem, and confidence (outcome), as well as in self-efficacy for individuals to implement new skills in their life outside the programme (outcome). To ensure that this programme theory is representative of all greenspace programmes it is necessary to highlight that, whilst teaching skills such as coping with challenges were present across programme type, the type of challenges varied. For example, in wilderness therapy, adventure therapy, and care farming programmes, coping strategies focused on overcoming physical challenges (Fernee et al., 2018), while on horticultural therapy programmes, coping strategies might focus on dealing with how to manage plants or vegetables that were failing to grow or dying (Pálsdóttir et al., 2014). As previously mentioned, realistic expectations of

anticipated challenges also seemed to be an important context in the lead up to programme uptake (Gabrielson et al., 2018).

5. *Having a Purpose*

A number of participants on care farms spoke about the responsibility of looking after animals and how their success with this task allowed them to feel satisfied due to having a purpose (Elings and Hassink, 2008; Schreuder et al., 2014). This appears to be particularly applicable to participants on care farms who have psychiatric or addiction histories, where the work and community-like environment enables them to fill their day and have a routine (Elings & Hassink 2008; Hassink et al., 2010). Participants in Cole and Christie's study (2016) spoke about feeling valued and appreciated for their work, which was motivating. The availability of adequately trained facilitators is necessary for both leading and enabling participants to learn new skills, and provide guidance relating to their responsibilities (Bloomfield, 2017; Evans, 2013; Granerud & Eriksson, 2014; Kogstad et al., 2014; O'Brien et al., 2010; Surridge et al., 2004). Time spent on a programme has been shown to be correlated with achieving outcomes since change occurs slowly (Gabrielson et al., 2018; Harris, 2017; Kogstad et al., 2014; Pálsdóttir et al., 2014; Schreuder et al., 2014; Sidenius et al., 2018), so it seems logical to suggest that time spent on the programme might be a contextual factor in this programme theory too; the longer service users were responsible for something, the higher their self-esteem.

Both this programme theory, and the *Self-Efficacy* programme theory above, provide some explanation of why greenspace interventions may fail, in that when there is an absence of confident, trained facilitators, or an absence of programme components which allow participants to learn new skills, interventions will not be effective. While the need for programme variety has already been covered, routine and planning are also necessary. Although there is some evidence that people on greenspace programmes for leisure purposes can benefit from passive immersion in nature (Lovell et al., 2015), this might not be enough to achieve changes in mental wellbeing in those with high levels of stress/mental ill health. In a previous review by Hunter et al. (2015), greenspace interventions were shown to be most effective when there were structured programmes in place, rather than simply changing the physical environment.

Refinement of programme theory

The availability of trained and confident facilitators (context) and adequate time spent on the programme (context) are both necessary to enable individuals to learn practical and psychological skills (mechanism resource), which facilitate feelings of responsibility and purpose (mechanism

reasoning), and in turn lead to increases in self-esteem and vigour for life (outcomes). The mechanisms of feeling responsible and purposeful were seen across all programme types, however, these mechanisms were facilitated by different contexts. For example, in care farm programmes, participants felt responsible for animals and farm activities (Schreuder et al., 2014), and in horticultural therapy programmes, participants felt responsible for plants and other produce (Hassink et al., 2010). Managers of wilderness therapy and adventure therapy programmes, as well as facilitators in Surridge et al.'s study (2004), also discussed how service users felt responsible for carrying resources, even when this was challenging. Feelings of purpose were also gained from the routine that programmes provided (mechanism resource). Hassink et al. (2010) reported that almost all participants who accessed a care farm to improve their mental wellbeing acknowledged the positive effect that routine had. Similarly, service users in Iancu et al.'s study (2014) reported feeling that structure was something they were lacking before the programme. As well as feelings of purpose, participants reported increases in feelings of empowerment (mechanism reasoning). Twelve studies mentioned how this increase in empowerment led to participants feeling more hopeful and excited about life in general (outcome) (Cole & Christie, 2016; Combs et al., 2016; Gabrielson et al., 2018; Harris, 2017; Howarth et al., 2018; Lehman et al., 2018; O'Brien, 2018; Pálsdóttir et al., 2014; Schreuder et al., 2014; Sidenius et al., 2017; Wilson et al., 2010; Woodford et al., 2017).

6. Relationship with Facilitators

Five studies highlighted the influence of previous relationships with healthcare professionals as a contextual factor in how well participants initially engaged with programmes (Cole & Christie, 2016; Fernee et al., 2018; Granerud & Eriksson, 2014; Stevens, 2018; Woodford et al., 2017). Existing attitudes of programme facilitators were crucial in enabling mechanisms to achieve outcomes: facilitators who appeared non-judgemental, open, and genuine, enabled relationships to be built quickly with participants. Participants in one study discussed the importance of being treated without prejudice and as a person, rather than a diagnosis (Hassink et al. 2010). Through this relationship, participants were able to build rapport, trust, and confidence in facilitators, particularly crucial given many programme users had experienced difficult interpersonal relationships and problems developing trust (Evans, 2013; Fieldhouse, 2003; Iancu et al., 2014; McIver et al., 2018). Overall, the stronger the relationship between programme user and facilitator, the more likely participants were to fully engage with programmes and available aftercare support (Cole & Christie, 2016; Combs et al., 2016; Gabrielson et al., 2018; Redcliff Ascent, 2019; Schreuder et al., 2014; Sidenius et al., 2018, Stevens, 2018).

Refinement of programme theory

Previous positive experience with healthcare professionals such as therapists (context), as well as existing positive attitudes and attributes of programme facilitators (context), influenced good initial engagement with programmes (outcome). These contextual factors enabled relationships between facilitator and participant (mechanism resource) to be built quickly, resulting in trust, confidence in the facilitator, and rapport (mechanism reasoning). However, previous negative experiences (context) can negatively impact engagement, particularly for adolescents who may show lower levels of trust towards all adult relationships after a negative experience (Bettmann et al., 2011). There is some evidence that this might be mitigated by ensuring that adequate information about the programme is provided prior to the start, and that each participant is met by a confident and friendly facilitator at the start to help engage participants (O'Brien et al. 2010). Another contextual factor was effective programmes having a culture of 'doing with' not 'doing for' people. Involvement of the facilitators in the same tasks as the service users (mechanism resource) led to decreased perceived power inequality and increased empowerment (mechanism reasonings). For example, some study participants described how facilitators would ask them what they wanted to do, eat, and which way to go allowing participants to feel empowered, decreasing power imbalances, and promoting inclusion (McIver et al., 2018). These mechanisms made continued engagement with the programme more likely (outcome), as well as acceptance of any available support after the programme (outcome).

7. Shared Experiences

As highlighted in almost all the included studies, greenspace programmes are typically undertaken in environments that promote social cohesion. It is through these shared experiences that participants experience increased social skills and improvements in interpersonal relationships. Hassink et al. (2010) reported that the community feel of the greenspace programme was the most valued aspect mentioned by the majority of participants, a finding supported by many other studies (Adevi & Mårtensson, 2013; Barley et al., 2012; Bryson et al., 2013; Cole & Christie, 2016; Combs et al., 2016; Cook, 2008; Dolgin, 2014; Fieldhouse, 2003; Gabrielson et al., 2018; Harris, 2017; Howes et al., 2018; Iancu et al., 2014; Leck et al., 2015; O'Brien, 2018; Rappe et al., 2008; Surridge et al., 2004; Stevens, 2018; Wilson et al., 2010; Woodford et al., 2017), as well as by conversations with service managers. Mechanisms identified in this programme theory that led to improved social outcomes were: the group environment feeling safe (Kogstad et al., 2014; Sidenius et al., 2017), lack of stigma and judgement (Combs et al., 2016; McIver et al., 2008; Stevens, 2018), increased rapport (Evans 2013; Fernee et al., 2018; Warber et al., 2015), and trust between people on the programme, with

participants feeling comfortable to express themselves (Adevi & Mårtensson, 2013). Previous systematic reviews support the role of social capital in improving mental health, both in young people (McPherson et al., 2014), and in older adults (Nyqvist et al., 2013). However, the engagement of others on the programme can be a contextual factor to be aware of, with the success of social interactions being a two-way process (Fernee et al., 2018): if a participant does not believe that other participants are engaging, they are less likely to do so. Time spent on the programme is another key contextual factor for social cohesion to occur (Fernee et al., 2018). As previously mentioned, change does not happen instantly and social changes, in particular, can take longer to occur compared to psychological, physical, physiological, or cognitive changes (Fernee et al., 2018).

Refinement of programme theory

Perceived engagement of others on the programme (context), and time spent on it (context), can both facilitate a participant's engagement with team-building activities, and other shared experiences (mechanism resource). Furthermore, the group environment might be described as more like 'real life' than traditional therapy (context) (Fieldhouse, 2003). As a result of these shared experiences in a 'real life' environment, with peers who are perceived to be engaging with the programme, participants begin to feel safe and unjudged, build trust and rapport, and feel more comfortable in trying to interact with others (mechanism reasonings). This in turn leads to improvements in social skills and in interpersonal relationships (outcomes). Three studies (Barley et al., 2012; Cook 2008; Woodford, et al., 2017) also noted that this increase in social skills also led to an increase in self-esteem (outcome). Conversely, if participants do not see others engaging well on the programme (context), then this can hinder increases in social abilities or improvements in relationships (outcome): participants feel less safe/comfortable during team exercises (mechanism reasonings), and do not have the opportunity to share or learn from others (mechanism reasonings). Age (context) can also influence the applicability of this programme theory. For example, adolescents may be more susceptible to peer influence in general, and while perceived social support can have a buffering effect on stress in adolescents, low satisfaction with social support in adolescents can increase anxiety (Dolgin, 2014). Therefore, perceived engagement and social support in programmes may be much more important in adolescent programmes compared to those with older adults. Furthermore, O'Brien et al. (2010) discussed how having people of the same age (context) on the programme facilitated cohesion (outcome), as they were able to speak about similar interests, encouraging rapport (mechanism reasoning).

What does not work

With the increase in awareness of the benefits of being outside for mental health, more greenspace programmes are embedding mental health outcomes into their aims. This increases the risk that some programmes could be claiming all types of benefits, with little evidence to support claims. Without clarity of what approaches may or may not consist of, it is difficult to distinguish practice that is ethical and effective, from programmes that over-claim benefit and put users at risk of potential harm. This potentially makes it difficult to know which programmes to enrol on, or which programmes care providers should recommend. Richards, Hardie, and Anderson (2019) suggest an Outdoor Mental Health Intervention Model outlining the importance of the combination of competence, professional responsibility, and leadership in each intervention. The model maintains that, for best practice, a multidisciplinary team approach is adopted, and professionals work collaboratively in the delivery of an integrated approach. The authors state that programme providers should represent themselves, and their practice, using terms that can be justified and evidenced by professional training and qualifications, rather than using terms such as 'therapy' too loosely. Only then can programmes enhance opportunities for improved mental health and wellbeing and offer a best-fit intervention for individual clients.

There is a myriad of contextual factors which will likely influence the success of greenspace interventions, and it is not feasible to attempt to identify the many individual factors which might make a programme work, or not. However, there are certain factors which seem particularly influential in programme success. For example, as has been identified through this review, programmes based in the wilderness are often undertaken by adolescents or young adults. What seems less clear, is whether wilderness-based programmes are successful for older adults. During a conversation with a greenspace project staff member, the fear of injury or fear of falling was highlighted as the top barrier to engagement. Furthermore, although there are programmes designed specifically for older adults, such as horticultural therapy programmes, specific contextual barriers can limit their effectiveness. For example, the *Greenspace and Health Strategic Framework for Edinburgh and Lothians* (Greenspace Scotland, 2019) discusses how staffing numbers on hospital wards means that patients cannot leave the hospital to access greenspaces with the necessary support. Without staff available to support people who need assistance to and from greenspace programmes, programmes cannot be successful. While this report is specific to one geographical area, it is feasible to see how systemic understaffing will affect any greenspace programme reliant on support staff.

This review also identified that some circumstances, such as time alone in a wilderness environment, might not be appropriate for people with pre-existing diagnoses like psychosis. However, there are other circumstances where certain greenspace programmes might not be appropriate, for example, residential greenspace programmes for those on daily pick-up prescriptions. Livingston et al. (2011) discuss how people on methadone prescriptions can be excluded because early start times mean they cannot pick up their medication beforehand. Another example raised during a meeting with a member of staff was electronic tagging. Greenspace programmes have been successful in supporting people who have been involved in offending (Venture Trust, 2019), but they may be limited to where they can go if a programme does not account for this.

A person's belief about the programme is also a driving contextual factor in initial enrolment. While some people with previous treatment experience may welcome a new approach, particularly if they feel that current treatment has not worked, others may be cynical about its reliability. Husk et al. (2019) reported barriers such as concerns about adequate facilities, and adequate staff experience/training. They also reported concern about the greenspace environment and whether it was an appropriate environment for people with complex needs. Davis-Berman and Berman (2012) state that participants on greenspace programmes need to want to be part of the programme and have some level of self-motivation. If a person does not want to enrol on a greenspace programme because they do not believe that it will be beneficial for them, it is unclear how this can be changed, and even if it should. For example, this review has identified that one of the key mechanisms by which greenspace programmes are effective is through an increase in feelings of empowerment. In contrast, coercion and involuntary treatment has shown to threaten effectiveness of treatment (de Valk et al., 2016). Harper et al. (2019) raise concerns about how this may impact the effectiveness of youth programmes, where parents have enrolled their children, or in hospitals where primary care staff may have enrolled patients on their behalf. Husk et al. (2019) highlight how the power dynamic between care provider and patients can be equally influential, with some patients viewing social prescriptions, such as greenspace programmes, as an order rather than a choice. If empowerment and agency are mechanisms that lead to successful outcomes, then by taking these away it seems unlikely programmes will be effective. However, as identified in Husk et al. (2019), this does not equate to leaving all responsibility for enrolment to the person potentially accessing the programme. Instead, it highlights the importance of dialogue between care provider and participant, as well as the necessity of the provider knowing what is available for recommendation. One of the concerns in this regard, however, is that short term funding makes it difficult for providers to recommend greenspace programmes, due to lack of continuity of services.

Aside from issues which impact uptake of greenspace programmes, it is important to recognise that not everyone will benefit or enjoy programmes when on them. This review has covered the necessity of a variety of activities to initially engage participants (Wilson et al. 2010), but O'Brien et al. (2011) also discuss that activities that are repetitive can cause participants to lose interest and quit. Even participants who enjoy programmes, but see no change in their condition, can become demotivated and quit (Husk et al. 2019). In Husk et al.'s study (2019), participants explicitly said that the main reason for drop-out was lack of change in health status leading to them questioning if the interventions were effective and worthwhile. Similarly, those with higher, or unrealistic, expectations of the intervention were more likely to drop out.

While we have discussed a number of challenges that may hinder the implementation of greenspace interventions, it is necessary to highlight that reporting bias was evident throughout data extraction, in many of the included studies. This finding is supported in a review of wilderness therapy programmes, where Fernee et al. (2017) reported that almost all included studies reported positive results, and some even explicitly reported a reluctance to analyse negative experiences in detail. Without in-depth understanding of negative, or even neutral, experiences, and with no advice or support about how to overcome challenges, then it is unclear how beneficial research can be in informing future practice. In future research, more evidence is therefore needed regarding alternative examples which counter successful case narratives.

Discussion

This review contributes to international empirical research as it is a novel approach to both understanding and evaluating how greenspace interventions can be used to improve mental health. Through an iterative process, data were collected and analysed which allowed continuous development of programme theories as new data emerged. The synthesis of empirical findings allows a greater theoretical understanding of the intervention process itself, rather than reporting whether an intervention is effective or not. The theoretical findings are therefore transferable across a range of interventions and are more useful for the logical, evidence-based development of other effective interventions. To identify the context-mechanism-outcome configuration for each programme theory, the IPTs were first tested against the literature and then refined to explain how, for whom, and in what circumstances, do greenspace interventions for mental health work, or do not work.

Russell and Farnum (2004) have previously suggested a programme theory for wilderness therapy that incorporated three interrelated factors of Wilderness, Physical Self, and Social Self. This programme theory was noted, but did not prematurely influence our review since our review was of greenspace programmes in general, and not of a specific type. In-depth reviews by Lovell et al. (2015) and Husk et al. (2016) have also produced detailed conceptual models of how engagement with nature can impact physical and mental health. These models were helpful for building a deeper understanding of mechanisms and outcomes, as well as touching on some of the contextual factors which may influence programme development. Our review expands on some of the work in these models through further focus on context, additional mechanisms, and the focus on 'for whom' and 'in what circumstance'. Overall, we found that Nature, Individual Self, and Social Self aptly described the three overarching themes under which our programme theories fell. The headings of the seven programme theories identified through a thorough engagement with 49 included studies and discussions with greenspace service providers are shown in Figure 3 under the three identified themes of Nature, Individual Self, and Social Self. The in-depth synthesis of each of the programme theories, as covered in the results, allows an understanding of the causal relationships which make up each programme theory. While it is indeed possible for programme theories to exist independently from each other, it is feasible to deduce that greenspace programmes work best in the circumstances where CMOs are activated under each programme theory simultaneously. As Pawson (2006) states, transformation may be achieved by the fact that CMOs happen together in a process over time. It is worth mentioning that participants may focus their development in one area of the programme which could lead to trade-offs in outcomes. For example, participants who spend time honing a particular independent skill, and therefore increasing in self-efficacy, may actually decrease in social skills due to time spent alone. Further exploration of how mechanisms in one programme theory may affect outcomes in a separate theory is therefore recommended. However, through data synthesis, we found that 27 of the included studies explicitly reported that the interaction of nature, individual changes, and social changes, was related to best outcomes. Therefore, programmes should include adequate opportunities for development in both individual and social skills, in order to mitigate any negative effects of trade-offs.

Based on the seven programme theories, Figure 4 visually depicts a novel conceptual framework developed on the basis of our review findings. The key differences between this conceptual framework and previously mentioned models are: firstly, showing that this framework could be an overarching programme theory for all types of greenspace programmes, and not just one type of programme; and secondly, as well as identifying programme theories about how greenspace

interventions may be successful in improving mental health, within the seven programme theories we have synthesised context, mechanism, outcome configurations which allow a better causal understanding of the pathways to mental health improvement.

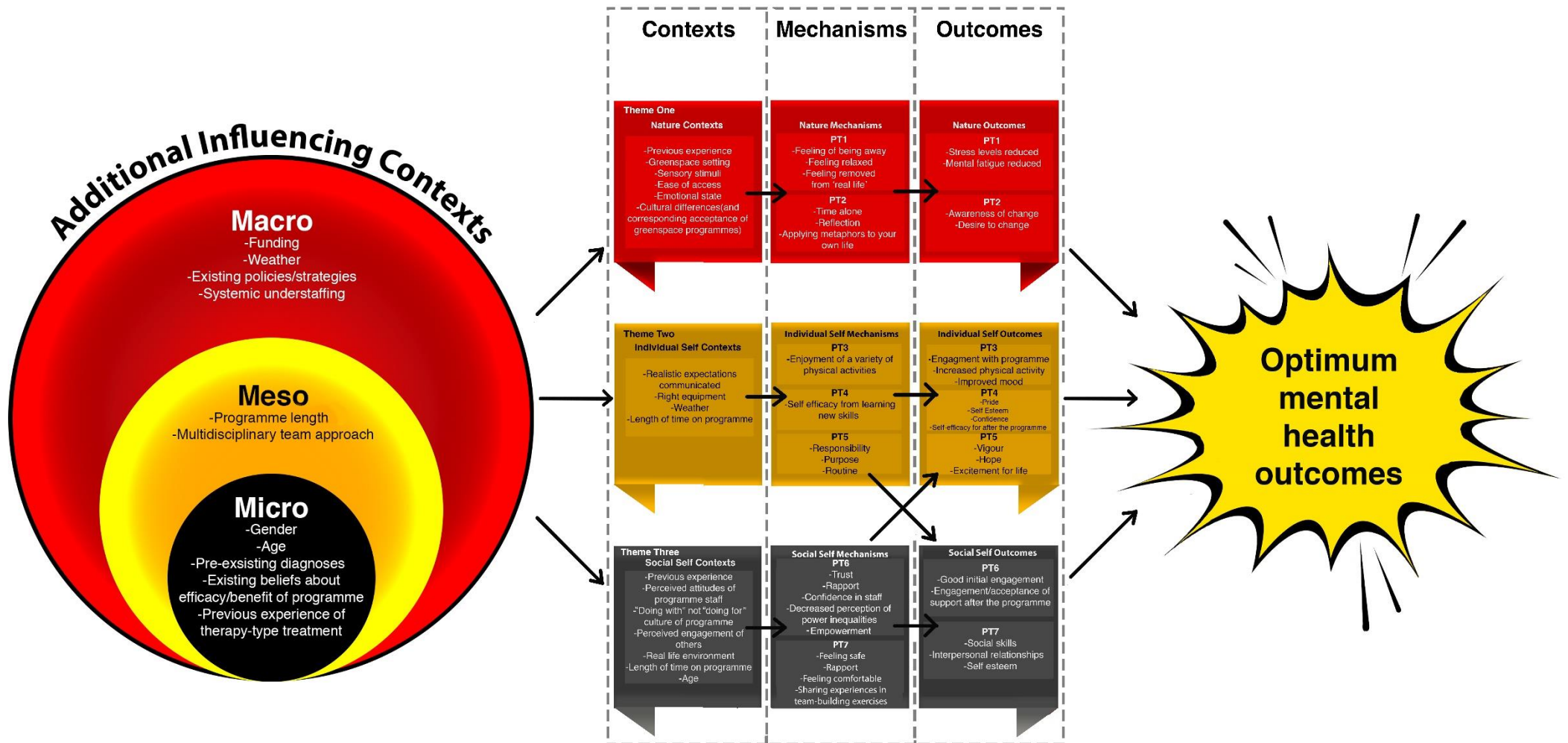


Figure 4: A novel conceptual model developed on the basis of our review findings to show the overarching programme theory for greenspace interventions for mental health

Strengths and limitations of the review

To our knowledge, this review is the first to use realist methodology to examine greenspace interventions for mental health where studies were not excluded based on intervention type. This allowed different types of greenspace programmes to be analysed with a realist lens and similar CMOcs to be identified across programmes. The findings highlight that greenspace programmes appear to be successful as a result of three interacting themes; Nature, Individual Self, and Social Self, regardless of programme type. In future work, interventions such as care farming, wilderness therapy, or horticultural therapy could be analysed in separate reviews which could allow the overarching conceptual framework outlined in this review to be tested and refined further. Another strength is that studies covered nine countries allowing the findings of this review to be internationally relevant.

Limitations must also be recognised when using realist methodology, particularly relating to reviews being based on guiding principles rather than standardised rules (Pawson et al., 2005). Although we have endeavoured to ensure transparency at all points of our review, for example by submitting our protocol to PROSPERO, adhering to robust quality standards (Wong et al., 2013), and through thorough documentation and in-depth discussion of key decisions, the realist review process is inherently interpretive and subjective, especially in regard to relevance and rigour assessment. Secondly, as previously mentioned, further exploration of how mechanisms in one programme theory may affect outcomes in a separate theory is recommended via future research. Thirdly, although not within the scope of the current review, future research should identify whether greenspace programmes are successful in the longer term, and whether the proposed programme theories can also explain long term success. Finally, realist approaches can synthesise data from quantitative and qualitative methods (Manzano, 2016; Pawson & Tilley, 1997), and analysis is guided by data that are best suited to answer research questions. We found that in the examples we examined, the qualitative studies were regarded as higher relevance for informing programme theories compared to quantitative data due to CMOc information in these studies being more accessible. Future research should examine how best to integrate more quantitative data into programme theories, for example with physiological mechanisms and outcomes such as salivary cortisol changes, body mass, and heart rate.

Conclusion

This realist review has examined the contexts and mechanisms in greenspace programmes which can lead to outcomes in mental health to show what works, for whom, and in what circumstances.

These configurations have been developed into an original overriding theory involving seven programme theories under three themes of Nature, Individual Self, and Social Self. The interaction of these three factors represents a new conceptual framework for greenspace interventions for mental health. The findings of this review are not only theoretically novel, but also have practical relevance for those designing such interventions, providing recommendations on how to optimise, tailor, and implement, existing interventions. These will be particularly relevant for academic researchers, health professionals, and mental health multi-disciplinary teams, and for those working in the third sector, developing and delivering such interventions.

Acknowledgments

This work was supported by the Economic and Social Research Council. The authors would also like to thank Hazel Booth for her role as second reviewer during data extraction, as well as all programme staff who contributed to programme theory discussions. We would also like to thank James Masterton for his role in the graphic design of our conceptual framework.

Declarations of interest

None.

Data access statement

This study was a review of existing data, which is openly available at locations cited in the reference section. Further documentation about data access and records are available from the authors.

References

Abrams, R., Wong, G., Mahtani, K. R., Tierney, S., Boylan, A. M., Roberts, N. and Park, S. (2018) Understanding the impact of delegated home visiting services accessed via general practice by community-dwelling patients: a realist review protocol. *BMJ Open*, 8(11), pp. 1-6. doi: 10.1136/bmjopen-2018-024876

Acheson, D. (1988) Public health in England. *The report of the committee of inquiry into the future development of the public health function*. London: The Stationary Office.

Adevi, A. A. and Lieberg, M. (2012) Stress rehabilitation through garden therapy: A caregiver perspective on factors considered most essential to the recovery process. *Urban Forestry & Urban Greening*, 11(1), pp. 51-58. doi:10.1016/j.ufug.2011.09.007

Adevi, A. A. and Mårtensson, F. (2013) Stress rehabilitation through garden therapy: The garden as a place in the recovery from stress. *Urban Forestry & Urban Greening*, 12(2), 230-237. doi:10.1016/j.ufug.2013.01.007

Barley, E. A., Robinson, S., Sikorski, J., Barley, E. A., Robinson, S. and Sikorski, J. (2012) Primary-care based participatory rehabilitation: users' views of a horticultural and arts project. *British Journal of General Practice*, 62(595), pp. 127-134. doi:10.3399/bjgp12X625193

Berto, R. (2014) The role of nature in coping with psycho-physiological stress: a literature review on restorativeness. *Behavioral Sciences*, 4(4), pp. 394-409. Doi:10.3390/bs4040394

Bettmann, J. E., Olson-Morrison, D., and Jaspersen, R. A. (2011) Adolescents in wilderness therapy: A qualitative study of attachment relationships. *Journal of Experiential Education*, 34, pp. 176–194. doi:10.5193/JEE34.2.182

Bize, R., Johnson, J. A., and Plotnikoff, R. C. (2007) Physical activity level and health-related quality of life in the general adult population: a systematic review. *Preventive Medicine*, 45(6), pp. 401-415. Doi: 10.1016/j.ypmed.2007.07.017

Bowen, D. J., Neill, J. T. and Crisp, S. J. (2016) Wilderness adventure therapy effects on the mental health of youth participants. *Evaluation and Program Planning*, 58, pp. 49-59. doi: 10.1016/j.evalproplan.2016.05.005

Bryson, J., Feinstein, J., Spavor, J. and Kidd, S. A. (2013) An examination of the feasibility of Adventure-Based Therapy in outpatient care for individuals with psychosis. *Canadian Journal of Community Mental Health*, 32(2), pp. 1-11. doi:10.7870/cjcmh-2013-015

Caulkins, M. C., White, D. D., and Russell, K. C. (2006) The role of physical exercise in wilderness therapy for troubled adolescent women. *Journal of Experiential Education*, 29, pp. 18–37.

Cipriani, J., Benz, A., Holmgren, A., Kinter, D., McGarry, J. and Rufino, G. (2017) A systematic review of the effects of horticultural therapy on persons with mental health conditions. *Occupational Therapy in Mental Health*, 33(1), pp. 47-69. doi:10.1080/0164212X.2016.1231602

Cole, F. and Christie, M. (2016) Occupational engagement in a woodland: belonging and wellbeing for mental health. *College of Occupational Therapists 40th Annual Conference and Exhibition*. Harrogate, 28-30th June. Available http://insight.cumbria.ac.uk/id/eprint/2593/1/Cole_OccupationalEngagementInAWoodland.pdf [Accessed 21st July 2019].

Combs, K., Hoag, M., Javorski, S. and Roberts, S. (2016) Adolescent self-assessment of an outdoor behavioral health program: longitudinal outcomes and trajectories of change. *Journal of Child & Family Studies*, 25(11), pp. 3322-3330. doi:10.1007/s10826-016-0497-3

Cook, E. C. (2008) Residential wilderness programs: the role of social support in influencing self-evaluations of male adolescents. *Adolescence*, 43(172), pp. 751-774.

Davis-Berman, J., and Berman, D. (2012) Reflections on a trip: Two decades later. *Journal of Experiential Education*, 35, pp. 326–340. doi:10.5193/JEE35.2.326

de Valk, S., Kuiper, C., Van der Helm, G. H. P., Maas, A. J. J. A., and Stams, G. J. J. M. (2019) Repression in residential youth care: a qualitative study examining the experiences of adolescents in open, secure and forensic institutions. *Journal of Adolescent Research*, 34(6), pp. 757-782. Doi: 10.1177/0743558417719188

Dolgin, R. (2014) Into the wild: a group wilderness intervention to build coping strategies in high school youth through collaboration and shared experience. *Journal of Creativity in Mental Health*, 9(1), pp. 83-98. doi:10.1080/15401383.2013.864963

Elings, M. and Hassink, J. (2008) Green care farms, a safe community between illness or addiction and the wider society. *Therapeutic Communities*, 29(3), pp. 310-322.

Ellingsen-Dalskau, L. H., Morken, M., Berget, B. and Pedersen, I. J. W. (2016) Autonomy support and need satisfaction in prevocational programs on care farms: the self-determination theory perspective. *Work*, 53(1), pp. 73-85. doi:10.3233/WOR-152217

Eriksson, T., Westerberg, Y. and Jonsson, H. (2011) Experiences of women with stress-related ill health in a therapeutic gardening program. *Canadian Journal of Occupational Therapy / Revue Canadienne D'Ergothérapie*, 78(5), pp. 273-281. doi:10.2182/cjot.2011.78.5.2

Evans, M. (2013) *An investigation into the benefits and processes of adventure training among disaffected and at-risk populations*. PhD, Cardiff University.

Feinstein, L. and Hammond, C. (2004) The contribution of adult learning to health and social capital, *Oxford Review of Education*, 30(2), pp. 199-221, doi:10.1080/0305498042000215520

Ferneer, C. R., Gabrielsen, L. E., Andersen, A. J. W., and Mesel, T. (2017) Unpacking the black box of wilderness therapy: A realist synthesis. *Qualitative Health Research*, 27, pp. 114– 129. doi:10.1177/1049732316655776

Ferneer, C. R., Mesel, T., Andersen, A. J. and Gabrielsen, L. E. (2018) Therapy the natural way: A realist exploration of the wilderness therapy treatment process in adolescent mental health care in Norway. *Qualitative Health Research*, 29(9), pp. 1358-1377. doi:10.1177/1049732318816301

Fieldhouse, J. (2003) The impact of an allotment group on mental health clients' health, wellbeing and social networking. *British Journal of Occupational Therapy*, 66(7), pp. 286-296. doi:10.1177/030802260306600702

Gabrielsen, L. E., Eskedal, L. T., Mesel, T., Aasen, G. O., Hirte, M., Kerlefsen, R. E., Palucha, V. and Ferneer, C. R. (2018) The effectiveness of wilderness therapy as mental health treatment for adolescents in Norway: a mixed methods evaluation. *International Journal of Adolescence and Youth*, 24(3), pp. 282-296. doi:10.1080/02673843.2018.1528166

Genter, C., Roberts, A., Richardson, J. and Sheaff, M. (2015) The contribution of allotment gardening to health and wellbeing: a systematic review of the literature. *British Journal of Occupational Therapy*, 78(10), pp. 593-605. doi:10.1177/0308022615599408

Gorman, R. and Cacciatore, J. (2017) Cultivating our humanity: A systematic review of care farming & traumatic grief. *Health & place*, 47, pp. 12-21. doi:10.1016/j.healthplace.2017.06.006

Grahn, P., Pálsdóttir, A. M., Ottosson, J. and Jonsdóttir, I. H. (2017) Longer nature-based rehabilitation may contribute to a faster return to work in patients with reactions to severe stress and/or depression. *International Journal of Environmental Research and Public Health*, 14(11), pp. 1310-1327. doi:10.3390/ijerph14111310

Greenspace Scotland. (2019) *Edinburgh and Lothians Greenspace and Health Strategic Framework*. Available: <https://www.greenspacescotland.org.uk/nhs-lothian-green-health> [Accessed: 08 February 2020]

Hammond, C. (2004) Impacts of lifelong learning upon emotional resilience, psychological and mental health: Fieldwork evidence. *Oxford Review of Education*, 30(4), pp. 551-568.

doi.org/10.1080/0305498042000303008

Harper, N. J., Mott, A. J., and Obee, P. (2019) Client perspectives on wilderness therapy as a component of adolescent residential treatment for problematic substance use and mental health issues. *Children and Youth Services Review*, 105, 104450.

Harris, H. (2017) The social dimensions of therapeutic horticulture. *Health & Social Care in the Community*, 25(4), pp. 1328-1336. doi:10.1111/hsc.12433

Hartig, T., Mitchell, R., De Vries, S., and Frumkin, H. (2014) Nature and health. *Annual Review of Public Health*, 35, pp. 207-228. Doi: 0.1146/annurev-publhealth-032013-182443

Hassink, J., Elings, M., Zweekhorst, M., van den Nieuwenhuizen, N. and Smit, A. (2010) Care farms in the Netherlands: attractive empowerment-oriented and strengths-based practices in the community. *Health & Place*, 16(3), pp. 423-430. doi:10.1016/j.healthplace.2009.10.016

Haubenhofner, D. K., Elings, M., Hassink, J. and Hine, R. E. (2010) The development of green care in western European countries. *Explore*, 6(2), pp. 106-111. doi:10.1016/j.explore.2009.12.002

Hickman, C. (2013) To brighten the aspect of our streets and increase the health and enjoyment of our city': the National Health Society and urban green space in late-nineteenth century London. *Landscape and Urban Planning*, 118, pp. 112-119. doi:10.1016/j.landurbplan.2012.09.007

Howarth, M., Rogers, M., Withnell, N. and McQuarrie, C. (2018) Growing spaces: an evaluation of the mental health recovery programme using mixed methods. *Journal of Research in Nursing*, 23(6), pp. 476-489. doi:10.1177/1744987118766207

Howes, SE, Edward-Jones, A, and Waite, S. (2018) Moor health and wellbeing. An evaluation of two National Park projects: Dartmoor Naturally Healthy and Exmoor Moor to Enjoy. Available: <https://pearl.plymouth.ac.uk/handle/10026.1/11791>

Hunter, R. F., Christian, H., Veitch, J., Astell-Burt, T., Hipp, J. A. and Schipperijn, J. (2015) The impact of interventions to promote physical activity in urban green space: a systematic review and recommendations for future research. *Social Science & Medicine*, 124, pp. 246-256. doi:10.1016/j.socscimed.2014.11.051

Husk, K., Blockley, K., Lovell, R., Bethel, A., Lang, I., Byng, R., and Garside, R. (2020) What approaches to social prescribing work, for whom, and in what circumstances? A realist review. *Health & Social Care in the Community*, 28(2), pp. 309-324. Doi:10.1111/hsc.12839

Iancu, S. C., Zweekhorst, M. B. M., Veltman, D. J., van Balkom, A. J. L. M. and Bunders, J. F. G. (2014) Mental health recovery on care farms and day centres: a qualitative comparative study of users' perspectives. *Disability and Rehabilitation*, 36(7), pp. 573-583. doi:10.3109/09638288.2013.804595

Kaplan, R. and Kaplan, S. (1989) *The experience of nature: A psychological perspective*. Cambridge: Cambridge University Press Archive.

Kendrick, T., Stuart, B., Newell, C., Geraghty, A. W. and Moore, M. (2015) Did NICE guidelines and the Quality Outcomes Framework change GP antidepressant prescribing in England? Observational study with time trend analyses 2003–2013. *Journal of Affective Disorders*, 186, pp. 171-177. doi: 10.1016/j.jad.2015.06.052

Kogstad, R. E., Agdal, R. and Hopfenbeck, M. S. (2014) Narratives of Natural Recovery: Youth Experience of Social Inclusion through Green Care. *International Journal of Environmental Research and Public Health*, 11(6), pp. 6052-6068. doi:10.3390/ijerph110606052

Leck, C., Upton, D. and Evans, N. (2015) Growing well-beings: The positive experience of care farms. *British Journal of Health Psychology*, 20(4), pp. 745-762. doi:10.1111/bjhp.12138

Lehmann, L. P., Detweiler, J. G. and Detweiler, M. B. (2018) Veterans in substance abuse treatment program self-initiate box gardening as a stress reducing therapeutic modality. *Complementary Therapies in Medicine*, 36, pp. 50-53. doi:10.1016/j.ctim.2017.10.013

Livingston, W., Baker, M., Jobber, S., and Atkins, B. (2011) A tale of the spontaneous emergence of a recovery group and the characteristics that are making it thrive: Exploring the politics and knowledge of recovery. *Journal of Groups in Addiction & Recovery*, 6(1-2), pp. 176-196.

McIver, S., Senior, E. and Francis, Z. (2018) Healing fears, conquering challenges: narrative outcomes from a wilderness therapy program. *Journal of Creativity in Mental Health*, 13(4), pp. 392-404. doi:10.1080/15401383.2018.1447415

McPherson, K. E., Kerr, S., McGee, E., Morgan, A., Cheater, F. M., McLean, J., and Egan, J. (2014) The association between social capital and mental health and behavioural problems in children and adolescents: an integrative systematic review. *BMC Psychology*, 2(1), 7. Doi: 10.1186/2050-7283-2-7

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G. and PRISMA Group. (2009) Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med* 6(7): e1000097. doi:10.1371/journal.pmed1000097

Murphy, S. L., Dubin, J. A., and Gill, T. M. (2003) The development of fear of falling among community-living older women: predisposing factors and subsequent fall events. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, 58(10), pp. M943-M947. doi: 10.1093/gerona/58.10.M943

Norton, C. L., Tucker, A., Russell, K. C., Bettmann, J. E., Gass, M. A., Gillis, H. L. and Behrens, E. (2014) Adventure therapy with youth. *Journal of Experiential Education*, 37, pp. 46–59. doi: 10.1177/1053825913518895

Nyqvist, F., Forsman, A. K., Giuntoli, G., & Cattan, M. (2013) Social capital as a resource for mental well-being in older people: A systematic review. *Aging & Mental Health*, 17(4), pp. 394-410. Doi: 10.1080/13607863.2012.742490

O'Brien, L. (2018) Engaging with and shaping nature: a nature-based intervention for those with mental health and behavioural problems at the Westonbirt Arboretum in England. *International*

Journal of Environmental Research and Public Health, 15(10), pp. 2214-2223.
doi:10.3390/ijerph15102214

O'Brien, L., Townsend, M. and Ebdon, M. (2010) 'Doing something positive': volunteers' experiences of the wellbeing benefits derived from practical conservation activities in nature. *Voluntas*, 21(4), pp. 525-545. doi:10.1007/s11266-010-9149-1

Pálsdóttir, A. M., Persson, D., Persson, B. and Grahn, P. (2014) The journey of recovery and empowerment embraced by nature - clients' perspectives on nature-based rehabilitation in relation to the role of the natural environment. *International Journal of Environmental Research and Public Health*, 11(7), pp. 7094-7115. doi:10.3390/ijerph110707094

Pawson, R. (2006) Digging for nuggets: how 'bad' research can yield 'good' evidence. *International Journal of Social Research Methodology*, 9(2), pp. 127-142. Doi:10.1080/13645570600595314

Pawson, R. (2006) *Evidence-based policy: A realist perspective*. London: Sage.

Pawson, R., Greenhalgh, T., Harvey, G. and Walshe, K. (2005) Realist review - a new method of systematic review designed for complex policy interventions. *Journal of Health Services, Research & Policy*, 10, pp. 21-34. doi:10.1258/1355819054308530

Penedo, F. J., & Dahn, J. R. (2005) Exercise and well-being: a review of mental and physical health benefits associated with physical activity. *Current Opinion in Psychiatry*, 18(2), pp. 189-193.

Phoenix Futures (2019) *Recovery Through Nature*. Available:
<https://www.phoenix-futures.org.uk/recovery-through-nature> [Accessed: 29 July 2019].

Pilgrim, D. (2017) *Key concepts in mental health*. London: Sage.

Rappe, E., Koivunen, T. and Korpela, E. (2008) Group gardening in mental outpatient care. *Therapeutic Communities*, 29(3), pp. 273-284.

RedCliff Ascent (2019) *Role of Field Staff*. Available: <https://www.redcliffascent.com/therapy-experience/field-staff/> [Accessed: 10 August 2019].

Richards, K., Hardie, A., and Anderson, N. (2019) *Outdoor Mental Health Interventions*. Available:
<https://www.outdoor-learning.org/Good-Practice/Good-Practice/Outdoor-Mental-Health> [Accessed: 07 February 2020]

Roe, J., Thompson, C., Aspinall, P., Brewer, M., Duff, E., Miller, D., Mitchell, R. and Clow, A. (2013) Green space and stress: Evidence from cortisol measures in deprived urban communities. *International Journal of Environmental Research and Public Health*, 10(9), pp. 4086-4103. doi: 10.3390/ijerph10094086

Rosenbaum, S., Tiedemann, A., and Ward, P. B. (2014) Meta-analysis physical activity interventions for people with mental illness: a systematic review and meta-analysis. *Journal of Clinical Psychiatry*, 75(0), pp. 1-11.

RSPB (2018) *Nature to be prescribed to help health and wellbeing*. Available:
<https://www.rspb.org.uk/about-the-rspb/about-us/media-centre/press-releases/nature-prescribed-to-help-health/> [Accessed: 24 April 2019].

Russell, K. C. and Phillips-Miller, D. (2002) Perspectives on the wilderness therapy process and its relation to outcome. *Child and Youth Care Forum*, 31(6), pp. 415-437. doi:10.1023/A:1021110417119

Schreuder, E., Rijnders, M., Vaandrager, L., Hassink, J., Enders-Slegers, M.-J. and Kennedy, L. (2014) Exploring salutogenic mechanisms of an outdoor experiential learning programme on youth care farms in the Netherlands: untapped potential? *International Journal of Adolescence and Youth*, 19(2), pp. 139-152. doi:10.1080/02673843.2014.896267

Sidenius, U., Stigsdotter, U. K., Varning Poulsen, D. and Bondas, T. (2017) 'I look at my own forest and fields in a different way': the lived experience of nature-based therapy in a therapy garden when suffering from stress-related illness. *International Journal of Qualitative Studies on Health and Well-being*, 12(1). Available: doi:10.1080/17482631.2017.1324700 [Accessed 21st June 2019].

Stevens, P. (2018) A hypnosis framing of therapeutic horticulture for mental health rehabilitation. *Humanistic Psychologist*, 46(3), pp. 258-273. doi:10.1037/hum0000093

SurrIDGE, J., McKie, J., Housden, J. and Whitt, D. (2004) Wild at heart: tapping into the restorative power of the great outdoors. *Mental Health Practice*, 7(7), pp. 20-26. doi:10.7748/mhp2004.04.7.7.20.c1800

van den Berg, A. E. and van den Berg, M. M. (2014) Health benefits of plants and green space: establishing the evidence base. In S.A. Park and C. Shoemaker, eds. XI International People Plant Symposium on Diversity: Towards a New Vision of Nature. Baarlo: Acta Horticulturae pp. 19–30.

den Bosch, V., Annerstedt, M., Östergren, P. O., Grahn, P., Skärbäck, E., and Währborg, P. (2015) Moving to serene nature may prevent poor mental health—Results from a Swedish longitudinal cohort study. *International Journal of Environmental Research and Public Health*, 12(7), pp. 7974-7989. Doi: 10.3390/ijerph120707974

Venture Trust (2019) *Facing the forces of nature: a Venture Trust journey*. Available: <http://www.venturetrust.org.uk/news/2019/2/facing-forces-nature-venture-trust-journey/> [Accessed 02 August 2019].

Warber, S. L., DeHudy, A. A., Bialko, M. F., Marselle, M. R. and Irvine, K. N. (2015) Addressing "nature-deficit disorder": a mixed methods pilot study of young adults attending a wilderness camp. *Evidence-Based Complementary and Alternative Medicine*, 2015. Available: doi:10.1155/2015/651827 [Accessed 20th June 2019].

Wilson, N. W., Fleming, S., Jones, R., Lafferty, K., Cathrine, K., Seaman, P. and Knifton, L. (2010) Green shoots of recovery: the impact of a mental health ecotherapy programme. *Mental Health Review Journal*, 15(2), pp.4-14. doi:10.5042/mhrj.2010.0366

Wight, D., Wimbush, E., Jepson, R. and Doi, L. (2016) Six steps in quality intervention development (6SQuID). *Journal of Epidemiology and Community Health*, 70(5), pp. 520-525. doi: 10.1136/jech-2015-205952

WHO (2017) *Urban green space interventions and health. A review of impacts and effectiveness*. Available: <http://www.euro.who.int/en/health-topics/environment-and-health/urban-health/publications/2017/urban-green-space-interventions-and-health-a-review-of-impacts-and-effectiveness.-full-report-2017> [Accessed – 21 July 2019].

Wong, G., Greenhalgh, T. and Pawson, R. (2010) Internet based medical education: A realist review of what works, for whom and in what circumstances. *BMC Medical Education*, 10(12), pp. 1-10. doi: 10.1186/1472-6920-10-12

Wong, G., Greenhalgh, T., Westhorp, G., Buckingham, J. and Pawson, R. (2013) RAMESES publication standards: realist syntheses. *BMC medicine*, 11(1), p. 21. doi: 10.1186/1741-7015-11-21

Wong, G., Greenhalgh, T., Westhorp, G. and Pawson, R. (2014) *Quality standards for realist syntheses and meta-narrative reviews*. London: RAMESES, 24.

Wong, G., Westhorp, G., Manzano, A., Greenhalgh, J., Jagosh, J. and Greenhalgh, T. (2016) RAMESES II reporting standards for realist evaluations. *BMC Medicine*, 14(1), p. 96. doi: 10.1186/s12916-016-0643-1

Woodford, K. M., Fenton, L. and Connors, J. (2017) A Change of Scenery Wilderness Therapy Treatment for Inpatients in Acute Care. *Therapeutic Recreation Journal*, 51(4), pp. 258-273. doi:10.18666/trj-2017-v51-i4-7374