



How the natural environment can support health and wellbeing through social prescribing

How to cite this report

Mughal R., Seers H., Polley M., Sabey A. & Chatterjee H.J. (2022) How the natural environment can support health and wellbeing through social prescribing. NASP.

Main contact

Professor Helen Chatterjee: h.chatterjee@ucl.ac.uk

About the authors

Dr Rabya Mughal is a developmental psychologist and research fellow at the Culture, Nature and Health Research Group at the UCL Division of Biosciences. Her research interests are around the impact of public policy on vulnerable populations, including those with psychological and neurodevelopmental conditions, and those experiencing health and social inequity.

Dr Helen Seers, BSc, PhD is Co-Founder and Co-Director of Meaningful Measures Ltd. Helen is an experimental psychologist by training, and for the past 20 years has worked with voluntary community and social enterprise organisations to support them to understand and communicate the impact of their work. Helen specifically understands the operating environment that many small organisations are facing, and the value that well-designed evaluations can bring to these organisations. As Head of Research and Evaluation at the holistic cancer charity Penny Brohn UK (2004-2019), Helen led a team of researchers who innovated a mixed-methods evaluation evidence base. This led to the publication of many academic papers to evidence the impact of the charity's work on clients. Since 2019, Helen has been a freelance research consultant, often collaborating on projects about social prescribing with Dr Marie Polley and is also Co-Founder and Co-Director of Meaningful Measures.

Dr Marie Polley is Director of Marie Polley Consultancy Ltd, a biomedical scientist and has a PhD in molecular biology of how cancer develops. Marie also co-founded and co-chairs the Social Prescribing Network, which has led a social movement around the use of non-medical activities to support people's wider determinants of health and provide additional routes of support to traditional pharmaceutical prescribing. Marie led the team to write the first national guidance for social prescribing, the first economic overview of social prescribing on health service usage and recently mapped all outcomes associated with social prescribing to support discussion on inclusive ways of researching and evaluating this growing field.

Abigail Sabey, is a Freelance Research Associate for Marie Polley Consultancy Ltd, and a senior lecturer in research methods at the University of the West of England where she teaches on the MSc in Public Health. Abby has extensive experience of teaching research and evidence-based practice to health and social care professionals at the University of the West of England, combined with a background in health services and medical education research, using both quantitative and qualitative methods. She currently leads a training programme for NIHR ARC West to promote research and evaluation skills for the workforce in health and social care.

Professor Helen Chatterjee MBE is a Professor of Human and Environmental Health in UCL Biosciences and UCL Arts & Sciences. She currently heads the Culture, Nature and Health Research Group at the UCL Division of Biosciences. Her research includes biodiversity conservation, cultural and natural value, and evidencing the impact of natural and cultural participation on health. She co-founded the Culture, Health and Wellbeing Alliance, is an advisor to the All-Party Parliamentary Group on Arts and Health, is a Founding Trustee of the National Centre for Creative Health, and serves on the IUCN Section on Small Apes. Her interdisciplinary research has won a range of awards including a Special Commendation from Public Health England for Sustainable Development and the 2018 AHRC-Wellcome Health Humanities Medal and Leadership Award. She received an MBE in 2015 for Services to Higher Education and Culture.

Introduction

It is now well-established that humans have an innate need to experience the natural world [1]. As such, there is a large body of evidence associating nature exposure to several facets of positive physiological and psychological outcomes. However, this association is dependent on a range of socio-demographic factors and there remain some gaps in the literature evidencing causal mechanisms.

This evidence review provides a summary of this literature, with a particular focus on nature-based social prescribing interventions. The evidence presented below is mostly derived from nature exposure (i.e., proximity, access, frequency, and time spent in nature and/ or quality of nature) rather than research looking at how people feel about their connection to nature or “nature connectedness”. As the evidence base grows these two areas of research will become more distinct.¹

Outlined below is a brief summary of the benefits of green social prescribing on health and wellbeing, the benefits of the natural environment on populations at greatest risk of health inequalities, and social prescribing pathways and recommendations. In addition, the Rapid Evidence Review methodology that was used to scope, organise and assess the validity of the available literature on this topic is presented. This is followed by a summary of the reliability of this data alongside future recommendations for social prescribing referrals and pathways.

¹ Initial findings suggest that both (exposure and connection) are needed to optimise health and wellbeing outcomes. Please see Natural England (2020) Monitor of engagement with the natural environment: Headline report and technical reports 2018 to 2019 Accessed at <https://www.gov.uk/government/statistics/monitor-of-engagement-with-the-natural-environment-headline-report-and-technical-reports-2018-to-2019>

Methodology

- Scoping is defined in this piece of work as exploring a range of evidence sources to populate an understanding of the concepts, boundaries, outcomes, and critical ingredients to achieve defined and emergent outcomes. Our method was therefore guided by our aim to explore information available on websites about real-world projects or services as well as published literature.
- A Rapid Evidence Review approach was used to provide this evidence synthesis. Rapid Evidence Reviews streamline the steps of systematic reviews under an accelerated time frame to produce evidence in a shortened time frame. We searched the Cochrane Library, MEDLINE, PubMed, Google Scholar, and sources of grey literature including Google, greylit.org and opengrey.eu.
- The following terms were used to identify relevant social prescribing literature: (1) social prescri* OR community refer*. Search terms were established using the PICO (population, intervention, control, outcome) method. Only adult populations were included within this review. Interventions included: nature, conservation, natural environment, regeneration, garden, wild, rewild, environment, nature, rural, countryside, outdoor, outside, wood, park, meadow, horticulture, floriculture, botanical, arboretum, allotment, forest, rainforest, moor, dale, marsh, mountain, blue space, beach, river, lake, canal, waterway, wetland, open spaces, protected areas, green, footpath, trail, coast, cliff, dune. Outcomes included wellbeing, general health, mental health, maternal health, cardiovascular disease, type 2 diabetes, obesity, chronic respiratory disease, cancer and hypertension. MeSH terms were used where possible. To keep the review manageable, the searches were limited to the last 5 years only, when the majority of social prescribing publications have been produced.
- For searching in Google, we combined social prescribing OR community referral to get an initial series of hits. Further search terms on physical activity as listed in search 2 above were individually applied to these hits to identify social prescribing related to the natural environment. Where multiple pages were found, up to the first 10 pages were searched.
- Studies included reviews (including scoping reviews, Cochrane reviews, meta-analyses and narrative reviews), cohort studies, longitudinal analyses, analyses of secondary data and grey literature. Studies were included if they explicitly assessed the relationship between the specified outdoor environments alongside one of the identified outcomes, if they pertained to adult populations, and were written in English. All other literature was excluded.
- The first broad search and screening of abstracts was conducted by HS and RM to make a preliminary selection of studies for consideration. Rayyan.ai software was used to organise all sources of information, for screening and

for independent review of each paper. Final selections for inclusion were then made by both authors (HS and RM) when reading the studies in full. Results of the review process were compared, and any discrepancies discussed and resolved.

Results of the search Strategy

- A total of 1,108 studies were identified. Sixty-four addressed the relationship between the natural environment and health and wellbeing that met the additional inclusion criteria. Seventeen pertained to natural environments and physical health outcomes including diabetes, obesity, physical decline, aerobic fitness, stroke, adiposity, cardiovascular health, eating disorders, COVID, somatic disease, hypertension and cancer [1-17]. Seventeen studies assessed the relationship between natural environments and mental health and wellbeing outcomes such as affect, eudemonic and hedonic wellbeing, perceived happiness, resilience, stress, depression, anxiety and general mental health [19-34]. Thirty studies assessed the relationship between natural environments and a combination of physical and psychological outcomes [35-64].
- Included literature comprised of cohort studies (n=4) [2,10,16,49], cross sectional studies (n=1) [1], grey literature (n=12) [53-64], an intervention study (n=1) [24], longitudinal studies/ secondary data analyses (n=4) [4,18,19,52], meta analyses (n=4) [37,44,45,51], a pilot study (n=1) [20], pre-post evaluation (n=1) [33], qualitative study (n=1) [34], rapid review (n=1) [3], randomised control trial (n=1) [43], narrative reviews (n=7) [8,12,26,36,40,46,50], scoping reviews (n=5) [17,29,30,31,35], survey data (n=4) [21,23,27,47] and systematic reviews (n=14) [5-7,13,15,22,25,28,32,38-40,42,48].
- Longitudinal and secondary analyses were based on data from the Whitehall II online dataset assessing 5,759 participants over 11 years [4], the British Household Panel Survey dataset assessing 65407 participants over 8 years [19] and the PHENOTYPE project assessing 3,585 participants over one year [52].
- Natural environment interventions included access to local green space (n=6) [10,11,15,16,27,57], blue space such as lakes, canals, wetlands, waterways, rivers and coastal areas (n=7) [1,4,7,31,43,47,48], forests (n=1) [37], gardening (n=3) [17,35,36], green exercise (n=3) [9,56,59], general green space (n=18) [2,3,8,13,19,22,23,28,32,38,39,41,45,49,53-55,64], houseplants (n=1) [21], general 'nature' (n=21) [5,6,12,14,18,20,24-26,29,30,40,44,46,50-52,60-63], urban nature (n=1) [58], and wildlands (n=1) [42].
- Note, at review point with this evidence summary three extra grey literature documents were suggested by a panel of expert reviewers [71,72,73]. These documents were not part of the initial search findings due to grey literature not being listed with key search terms. These documents related to overviews of green social prescribing evidence.

The impact of the natural environment on health and wellbeing

- There is now a large body of literature that evidences the positive association between good health and wellbeing and time spent in nature. Such evidence also points towards the benefits of nature-based social prescriptions on long term health and wellbeing [12,34,35,50]. Overwhelmingly, our search found positive associations between health and wellbeing and nature exposure, however causal mechanisms are less understood.
- Shorter distances to nature, such as local green and blue spaces within walking distance from individuals' homes, were associated with a variety of health benefits including lower adiposity (body fat) [15], fewer cardiovascular and respiratory problems [16] and obesity [10].
- Although there is a scarcity of data on the effect of blue space on psychological and physical health, a systematic review of 33 articles found that mental health - particularly psychosocial wellbeing - was improved with increased blue space exposure [48]. Increased blue space exposure was additionally associated with better cardiovascular health [1] and increased levels of subjective wellbeing [43,47,48].
- Exposure to forest environments was associated with several health benefits including reduced systolic and diastolic blood pressure, heart rate, sympathetic nervous activity, salivary cortisol and increased parasympathetic nervous activity [37].
- Gardening, when incorporated into therapeutic and mindfulness activities can have a wide range of psychological and physiological health benefits including decreased hypertension, and decreased negative symptomatology of post-traumatic stress disorder, adjustment disorders and attention deficit hyperactivity disorders [36]. One systematic review conducted by Howarth et al. [35] assessing 77 intervention studies found significant effects of gardening on mental wellbeing, physical activity and reduced social isolation.
- Increased exposure to green space and nature was associated with slower cognitive decline [38], lowered risk of COVID [23], reduced risk of diabetes [39], reduced risk of obesity [2] and increased physical activity [45]. Exposure to green spaces additionally positively impacted mental health [54], increased mindfulness practice [49], perceived happiness, resilience [55] and subjective wellbeing [22,64].
- Greater access to greenery in the immediate home surroundings, including keeping and maintaining houseplants, was associated with better markers of mental health amongst individuals during lockdown [21].
- There are several theoretical mechanisms that may be involved in the relationship between natural environments and increased physical and psychological health and wellbeing: Stress Reduction Theory [65] is based on

the idea that environmental features induce subconscious affective reactions which support psychophysiological stress recovery: for example landscape features such as vegetation and water inspire positive emotions and reduce negative thoughts, while maintaining non-vigilant attention. Attention Restoration Theory [66] is based on the idea that nature has the capacity to renew attention and promotes wellness via reduced mental fatigue. Theories of biophilia [67] are based on the idea that people possess an innate tendency to focus on life and lifelike processes and respond with emotional intensity to the natural world. In this sense, humans are drawn to nature like patterns and stimuli and lifelike processes because of a primary exposure to nature during human evolution. As such, there has been little genetic adaptation to modern urban environments [67].

Social prescribing and natural environments

- Social prescribing facilitates salutogenic (meaning non-medical) interventions that can work alongside existing treatments to support health and wellbeing. These can include a variety of in-community activities including arts on prescription, walking clubs, cycling schemes, community gardening, nature hikes, local befriending services or in certain instances help with housing, benefits or work-related concerns [12, 34,68]. In recent years there has been an increase in social prescriptions through a number of different referral pathways including GPs and social care services [50]. Simultaneously and as a result of the COVID-19 pandemic there has been a large increase in the general appetite for outdoor related activity [12, 34,35,50].
- Social prescriptions link patients with third sector organisations such as local voluntary, community and social enterprise (VCSE) organisations, local municipalities (e.g., social services and schools), recreational facilities, and neighbourhood organisations. Such partnerships represent a holistic strategy for confronting persistent health inequities, addressing unmet psychosocial needs, and reducing GP visits [50]. Green Social Prescribing is part of the NHS Long Term Plan to improve mental health outcomes, reduce health inequalities, reduce demand on the NHS, and develop best practice to make green social activities sustainable and accessible, particularly to those audiences at greatest risk of health inequalities [68].
- Nature based social prescribing interventions connect those latter populations to the wider community and in turn foster feelings of social connectedness, connectedness to nature and decrease feelings of social isolation; in turn positively impacting perceived happiness and wellbeing [50]. A 2020 scoping review published in the British Medical Journal, assessing 77 intervention studies, found that social prescriptions to community-based gardening within hospitals, care homes, hospices and third sector organisations have shown to improve the health and wellbeing of populations at the greatest risk of health inequalities [35].
- To achieve the maximum benefit of Green Social Prescribing, NHS referral pathways need to be further developed, with greater emphasis on outreach

to audiences at risk of health inequalities, alongside retaining patients with long term conditions [34].

- In the UK the benefits of nature and wellbeing have been acted upon by the recent UK government commitment in 2020 to fund £5.77 million for preventing and tackling mental ill-health through green social prescribing projects [68].
- Reviews of the evidence find that while there is evidence for the benefits of nature and health there is a need for more research looking at the impact of nature-based health-based interventions like green social prescribing [71-73]. There are currently live streams of research investigating the recent UK government funding of green social prescribing [74].

Natural environments and populations at the risk of greatest risk of health inequalities

Several articles assessed the impact of the natural environment on populations at risk of health inequalities:

- Individuals with dementia and cognitive loss [3,6,8,38]: One rapid evidence review published in the British Medical Journal assessed 22 intervention and pre/post studies on outdoor green space exposure and brain health in individuals with age related cognitive loss. Authors found that 77% of the studies they assessed found a positive association between brain health and green space exposure whereas 33% found no, little or inverse effects [3].
- Caregivers facing mental exhaustion can be supported with therapeutic interventions based in the natural environment. One scoping review by Lehto and colleague [26] which assessed studies over a ten-year period found some, limited, evidence that caregiver burden and stress can be relieved through natural environment interventions. The review concluded there is a need for further evidence in this area [26].
- Cancer patients [9]: In a mixed methods-controlled study conducted by Morris and colleagues [9], individuals with cancer with increased exposure to nature-based activities had significantly improved aerobic fitness and fatigue symptomatology, alongside positive psychological benefits.
- Severe mental ill-health [24,33, 39]: Alongside talking therapy and a range of holistic interventions, nature walks can help individuals with severe mental ill-health connect, be active, notice and be mindful. These concepts are key to behavioural change avenues related to relapse prevention and increased self-efficacy [24]. A systematic review conducted by Geneshka et al [39] assessed 44 studies, looking at the impact of green and blue spaces on severe mental ill-health and non-communicable disease prevention. Whilst there is an abundance of evidence for the positive impact of green space on severe mental ill-health, less evidence exists looking at blue space [39]. Museums on prescription using green spaces were found to positively

impact the wellbeing of mental health service users, who experienced increased nature connectedness and psychosocial wellbeing [33].

- Lonely, socially isolated individuals [31,50,58]: Loneliness and social isolation can compromise physical and psychological health [50]. Social prescription activities based in nature can improve connectedness and belonging, particularly when social prescriptions work alongside community organisations such as local farms or community gardens. Such activities can promote nature contact, strengthen social structures, and improve longer term mental and physical health by activating intrapersonal, interpersonal, and environmental processes [50].
- Socioeconomic status [63]: Socioeconomic factors are associated with visits to natural spaces. Those on lower incomes, with fewer educational qualifications, those who are unemployed or living in the most deprived areas are least likely to visit natural spaces [63]. Research conducted by the Environment Agency and Forest Research [63] found that 44% of people living in households earning £15,000 or less (below the relative poverty line) in England visit natural spaces, compared to 70% of people living in households earning £50,000 or above. Only 45% of adults in England living in areas ranked as most deprived had visited a natural space in the last 14 days, compared to 68% of adults in the least deprived areas [63].

Social prescribing pathways: barriers and enablers

- A qualitative study conducted by McHale et al. [34] assessed the opinions of social prescribing link workers. Link Workers working with populations at greatest risk of health inequalities felt that ‘Green Health Partnerships’ were useful in enabling community-based interventions for patients with long term conditions. Such partnerships were best suited to multi-disciplinary bodies including health, local authority, social care and third sector organisations.
- Link workers within the study conducted by McHale et al. [34] recommended that ‘Green Health Partnerships’ ought to engage political and health representatives from the third sector and local community. This would work alongside developed referral pathways, embedding NHS Green Social Prescribing initiatives into strategic planning, targeting mental health in the community services, and developing better messaging [34].

How reliable is this data?

- A sampling technique was used to assess the reliability of the data contained within this review. Grey literature was sampled and assessed using the Accuracy, Authority, Coverage, Objectivity, Date and Significance (AACODS) Checklist [69]. Pre/post studies using interventions were randomly sampled and assessed using the Cochrane grading system of Platinum, Gold, Silver, Bronze [70]. Seventy five percent of the grey literature sampled (9 out of 12) met quality thresholds for AACODS (i.e. scored above 22). Lack of referencing, date of publication, methodology and expertise in authorship

were reasons that articles did not meet quality thresholds. Ninety three percent of sampled pre/post intervention studies (14 out of 15) scored the lowest level of 'Cochrane Bronze' whilst one scored 'Silver'. This was due mainly to the absence of control groups within the sampled studies.

- Between the systematic reviews, scoping reviews, narrative reviews and meta-analyses included within this paper, 985 studies were examined. The overwhelming majority of these studies reported significant positive associations between natural environment exposure and health and wellbeing. However, whilst there are positive associations between natural environment exposure and health and wellbeing, we cannot ascribe a causality to this relationship until there is more controlled and long-term intervention evidence. A study may have reported on a significant positive impact on a health outcome - for example, fewer cardiovascular and respiratory problems were found to be associated with closer proximity to green spaces [16]. It must be taken into consideration however that such results can also be attributed to varying and compounding sociodemographic factors, alongside the effect of lower levels of air pollution that are naturally found in greener areas.

Recommendations

- Better developed working partnerships (alongside multi-disciplinary partnerships) between local organisations, social and health care bodies and those providing referral pathways would enable greater access to green social prescribing.
- Patients tend to value green open space and are knowledgeable of their benefit [7]. But since there is still a lack of representation from audiences at greatest risk of health inequalities due to access restrictions and other barriers, service 'nudges' and greater outreach initiatives would benefit wider audiences who may not prioritise green prescriptions.
- The development and standardisation of better evaluation tools would enable third sector organisations to calculate and understand the impact of Green Social Prescribing initiatives more accurately.
- Museums with parks and gardens could consider integrating programmes of outdoor and indoor collections inspired activities permitting combined engagement with nature, art and wellbeing [33].

References

1. Aliyas, Z. (2021). Physical, mental, and physiological health benefits of green and blue outdoor spaces among elderly people. *International journal of environmental health research*, 31(6), 703-714.
2. Astell-Burt, T., Feng, X., & Kolt, G. S. (2014). Greener neighbourhoods, slimmer people? Evidence from 246 920 Australians. *International journal of obesity*, 38(1), 156-159.

3. Besser, L. (2021). Outdoor green space exposure and brain health measures related to Alzheimer's disease: a rapid review. *BMJ open*, 11(5), e043456.
4. de Keijzer, C., Tonne, C., Sabia, S., Basagaña, X., Valentín, A., Singh-Manoux, A., ... & Dadvand, P. (2019). Green and blue spaces and physical functioning in older adults: Longitudinal analyses of the Whitehall II study. *Environment international*, 122, 346-356.
5. De la Fuente, F., Saldías, M. A., Cubillos, C., Mery, G., Carvajal, D., Bowen, M., & Bertoglia, M. P. (2021). Green space exposure association with type 2 diabetes mellitus, physical activity, and obesity: a systematic review. *International Journal of Environmental Research and Public Health*, 18(1), 97.
6. Lakhani, A., Norwood, M., Watling, D. P., Zeeman, H., & Kendall, E. (2019). Using the natural environment to address the psychosocial impact of neurological disability: A systematic review. *Health & place*, 55, 188-201.
7. Lynch, M., Spencer, L. H., & Tudor Edwards, R. (2020). A systematic review exploring the economic valuation of accessing and using green and blue spaces to improve public health. *International journal of environmental research and public health*, 17(11), 4142.
8. Mmako, N. J., Courtney-Pratt, H., & Marsh, P. (2020). Green spaces, dementia and a meaningful life in the community: a mixed studies review. *Health & Place*, 63, 102344. and Courtney-Pratt H and Marsh P
9. Morris, S. L., Newhouse, I., Larocque, T., Gillis, K. J., Smith, L., & Nisbet, E. K. (2021). Becoming one with nature: a nature intervention for individuals living with cancer participating in a ten-week group exercise and wellness program. *International Journal of Exercise Science*, 14(3), 498.
10. O'Callaghan-Gordo, Cristina, Ana Espinosa, Antonia Valentin, Cathryn Tonne, Beatriz Pérez-Gómez, Gemma Castaño-Vinyals, Trinidad Dierssen-Sotos et al. "Green spaces, excess weight and obesity in Spain." *International journal of hygiene and environmental health* 223, no. 1 (2020): 45-55.
11. Paul, L. A., Hystad, P., Burnett, R. T., Kwong, J. C., Crouse, D. L., van Donkelaar, A., ... & Chen, H. (2020). Urban green space and the risks of dementia and stroke. *Environmental Research*, 186, 109520.
12. Pretty, J., & Barton, J. (2020). Nature-based interventions and mind-body interventions: Saving public health costs whilst increasing life satisfaction and happiness. *International Journal of Environmental Research and Public Health*, 17(21), 7769.
13. Rigolon, A., Browning, M. H., McAnirlin, O., & Yoon, H. V. (2021). Green space and health equity: a systematic review on the potential of green

space to reduce health disparities. *International journal of environmental research and public health*, 18(5), 2563.

14. Rogerson, M., Wood, C., Pretty, J., Schoenmakers, P., Bloomfield, D., & Barton, J. (2020). Regular doses of nature: The efficacy of green exercise interventions for mental wellbeing. *International journal of environmental research and public health*, 17(5), 1526.
15. Teixeira, A., Gabriel, R., Quaresma, L., Alenção, A., Martinho, J., & Moreira, H. (2021). Obesity and natural spaces in adults and older people: a systematic review. *Journal of Physical Activity and Health*, 18(6), 714-727.
16. Yang, L., Chan, K. L., Yuen, J. W., Wong, F. K., Han, L., Ho, H. C., ... & Wong, M. S. (2021). Effects of Urban Green Space on Cardiovascular and Respiratory Biomarkers in Chinese Adults: Panel Study Using Digital Tracking Devices. *JMIR cardio*, 5(2), e31316.
17. Zhang, X., Zhang, Y., & Zhai, J. (2021). Home Garden with Eco-healing Functions Benefiting Mental Health and Biodiversity During and After the COVID-19 Pandemic: A Scoping Review. *Frontiers in public health*, 1692.
18. Aerts, R., Vanlessen, N., Dujardin, S., Nemery, B., Van Nieuwenhuysse, A., Bauwelinck, M., ... & Nawrot, T. S. (2022). Residential green space and mental health-related prescription medication sales: An ecological study in Belgium. *Environmental Research*, 113056.
19. Astell-Burt, T., Mitchell, R., & Hartig, T. (2014). The association between green space and mental health varies across the lifecourse. A longitudinal study. *J Epidemiol Community Health*, 68(6), 578-583.
20. Corazon, S. S., Sidenius, U., Vammen, K. S., Klinker, S. E., Stigsdotter, U. K., & Poulsen, D. V. (2018). The tree is my anchor: A pilot study on the treatment of BED through nature-based therapy. *International Journal of Environmental Research and Public Health*, 15(11), 2486.
21. Dzhambov, A. M., Lercher, P., Browning, M. H., Stoyanov, D., Petrova, N., Novakov, S., & Dimitrova, D. D. (2021). Does greenery experienced indoors and outdoors provide an escape and support mental health during the COVID-19 quarantine?. *Environmental Research*, 196, 110420.
22. Houlden, V., Weich, S., Porto de Albuquerque, J., Jarvis, S., & Rees, K. (2018). The relationship between greenspace and the mental wellbeing of adults: A systematic review. *PloS one*, 13(9), e0203000.
23. Hubbard, G., Daas, C. D., Johnston, M., Murchie, P., Thompson, C. W., & Dixon, D. (2021). Are rurality, area deprivation, access to outside space, and green space associated with mental health during the covid-19 pandemic? A cross sectional study (charis-e). *International Journal of Environmental Research and Public Health*, 18(8), 3869.

24. Hubbard, G., Thompson, C. W., Locke, R., Jenkins, D., Munoz, S. A., Van Woerden, H., ... & Gorely, T. (2020). Co-production of “nature walks for wellbeing” public health intervention for people with severe mental illness: use of theory and practical know-how. *BMC Public Health*, 20(1), 1-12.
25. Lackey, N. Q., Tysor, D. A., McNay, G. D., Joyner, L., Baker, K. H., & Hodge, C. (2021). Mental health benefits of nature-based recreation: a systematic review. *Annals of Leisure Research*, 24(3), 379-393.
26. Lehto, R. H., Wyatt, G., Sender, J., & Miller, S. E. (2021). An Evaluation of Natural Environment Interventions for Informal Cancer Caregivers in the Community. *International journal of environmental research and public health*, 18(21), 11124.
27. Robinson, J. M., Brindley, P., Cameron, R., MacCarthy, D., & Jorgensen, A. (2021). Nature’s role in supporting health during the COVID-19 pandemic: A geospatial and socioecological study. *International journal of environmental research and public health*, 18(5), 2227.
28. Trøstrup, C. H., Christiansen, A. B., Stølen, K. S., Nielsen, P. K., & Stelter, R. (2019). The effect of nature exposure on the mental health of patients: A systematic review. *Quality of Life Research*, 28(7), 1695-1703.
29. Wendelboe-Nelson, C., Kelly, S., Kennedy, M., & Cherrie, J. W. (2019). A scoping review mapping research on green space and associated mental health benefits. *International Journal of Environmental Research and Public Health*, 16(12), 2081.
30. Wilkie, S., & Davinson, N. (2021). Prevalence and effectiveness of nature-based interventions to impact adult health-related behaviours and outcomes: A scoping review. *Landscape and Urban Planning*, 214, 104166.
31. Xie, Q., Lee, C., Lu, Z., & Yuan, X. (2021). Interactions with artificial water features: a scoping review of health-related outcomes. *Landscape and Urban Planning*, 215, 104191.
32. Zhang, R., Zhang, C. Q., & Rhodes, R. E. (2021). The pathways linking objectively-measured greenspace exposure and mental health: A systematic review of observational studies. *Environmental Research*, 198, 111233.
33. Thomson, L. J., Morse, N., Elsdon, E., & Chatterjee, H. J. (2020). Art, nature and mental health: assessing the biopsychosocial effects of a ‘creative green prescription’ museum programme involving horticulture, artmaking and collections. *Perspectives in public health*, 140(5), 277-285.
34. McHale, S., Pearsons, A., Neubeck, L., & Hanson, C. L. (2020). Green Health Partnerships in Scotland; Pathways for social prescribing and physical activity referral. *International journal of environmental research and public health*, 17(18), 6832.

35. Howarth, M., Brettle, A., Hardman, M., & Maden, M. (2020). What is the evidence for the impact of gardens and gardening on health and well-being: a scoping review and evidence-based logic model to guide healthcare strategy decision making on the use of gardening approaches as a social prescription. *BMJ open*, 10(7), e036923.
36. Chaudhury, P., & Banerjee, D. (2020). "Recovering with nature": A review of ecotherapy and implications for the COVID-19 pandemic. *Frontiers in Public Health*, 888.
37. Cheng, X., Liu, J., Liu, H., & Lu, S. (2021). A systematic review of evidence of additional health benefits from forest exposure. *Landscape and Urban Planning*, 212, 104123.
38. de Keijzer, C., Bauwelinck, M., & Dadvand, P. (2020). Long-term exposure to residential greenspace and healthy ageing: A systematic review. *Current environmental health reports*, 7(1), 65-88.
39. Geneshka, M., Coventry, P., Cruz, J., & Gilbody, S. (2021). Relationship between Green and Blue Spaces with Mental and Physical Health: A Systematic Review of Longitudinal Observational Studies. *International journal of environmental research and public health*, 18(17), 9010.
40. Kolokotsa, D., Lilli, A. A., Lilli, M. A., & Nikolaidis, N. P. (2020). On the impact of nature-based solutions on citizens' health & well being. *Energy and Buildings*, 229, 110527.
41. Kondo, M. C., Jacoby, S. F., & South, E. C. (2018). Does spending time outdoors reduce stress? A review of real-time stress response to outdoor environments. *Health & place*, 51, 136-150.
42. Thomsen, J. M., Powell, R. B., & Monz, C. (2018). A systematic review of the physical and mental health benefits of wildland recreation. *Journal of Park and Recreation Administration*, 36(1).
43. Vert, C., Gascon, M., Ranzani, O., Márquez, S., Triguero-Mas, M., Carrasco-Turigas, G., & Nieuwenhuijsen, M. (2020). Physical and mental health effects of repeated short walks in a blue space environment: A randomised crossover study. *Environmental Research*, 188, 109812.
44. Yao, W., Zhang, X., & Gong, Q. (2021). The effect of exposure to the natural environment on stress reduction: a meta-analysis. *Urban Forestry & Urban Greening*, 57, 126932.
45. Yen, H. Y., Chiu, H. L., & Huang, H. Y. (2021). Green and blue physical activity for quality of life: A systematic review and meta-analysis of randomized control trials. *Landscape and Urban Planning*, 212, 104093.
46. Jimenez MP and DeVille NV and Elliott EG and Schiff JE and Wilt GE and Hart JE and James P

47. Jimenez, M. P., DeVille, N. V., Elliott, E. G., Schiff, J. E., Wilt, G. E., Hart, J. E., & James, P. (2021). Associations between nature exposure and health: A review of the evidence. *International Journal of Environmental Research and Public Health*, 18(9), 4790.
48. Britton, E., Kindermann, G., Domegan, C., & Carlin, C. (2020). Blue care: A systematic review of blue space interventions for health and wellbeing. *Health Promotion International*, 35(1), 50-69.
49. Barbaro, N., & Pickett, S. M. (2016). Mindfully green: Examining the effect of connectedness to nature on the relationship between mindfulness and engagement in pro-environmental behavior. *Personality and Individual Differences*, 93, 137-142.
50. Leavell, M. A., Leiferman, J. A., Gascon, M., Braddick, F., Gonzalez, J. C., & Litt, J. S. (2019). Nature-based social prescribing in urban settings to improve social connectedness and mental well-being: a review. *Current Environmental Health Reports*, 6(4), 297-308.
51. Pritchard, A., Richardson, M., Sheffield, D., & McEwan, K. (2020). The relationship between nature connectedness and eudaimonic well-being: A meta-analysis. *Journal of Happiness Studies*, 21(3), 1145-1167.
52. Preuß, M., Nieuwenhuijsen, M., Marquez, S., Cirach, M., Dadvand, P., Triguero-Mas, M., ... & Zijlema, W. (2019). Low childhood nature exposure is associated with worse mental health in adulthood. *International journal of environmental research and public health*, 16(10), 1809.
53. The Wildlife Trusts (2022) 30 Days Wild five year summary review. Can be accessed at: <https://www.wildlifetrusts.org/30-days-wild-5-year-review>
54. University of Exeter (2021) A Handbook for Nature on Prescription to Promote Mental Health. Can be accessed at: https://www.ecehh.org/wp/wp-content/uploads/2021/05/A-Handbook-for-Nature-on-Prescription-to-Promote-Mental-Health_FINAL.pdf
55. The Wildlife Trusts (2022) A Wilder recovery: How to build back smarter, stronger, greener. Can be accessed at: <https://www.wildlifetrusts.org/sites/default/files/2021-05/Green%20Recovery%20report%20%28low%20res%29.pdf>
56. Wicks et al (2022) Feasibility trial of 'Flourish', a 9-week green exercise intervention for women with low mood residing in Colchester
57. Wood et al (2022) The effectiveness of prescribing community gardening to reduce loneliness and improve wellbeing in individuals with mental health problems.
58. Atkins et al (2021) Out of Bounds: equity in access to urban nature. Can be accessed at: <https://www.groundwork.org.uk/wp->

[content/uploads/2021/05/Out-of-Bounds-equity-in-access-to-urban-nature.pdf](https://www.wildlifetrusts.org/sites/default/files/2018-05/r3_the_health_and_wellbeing_impacts_of_volunteering_with_the_wildlife_trusts_-_university_of_essex_report_3_0.pdf)

59. Rogerson et al (2017) The health and wellbeing impacts of volunteering with The Wildlife Trusts. Can be accessed at:
https://www.wildlifetrusts.org/sites/default/files/2018-05/r3_the_health_and_wellbeing_impacts_of_volunteering_with_the_wildlife_trusts_-_university_of_essex_report_3_0.pdf
60. Bagnall et al (2017) Social Return on Investment analysis of the health and wellbeing impacts of Wildlife Trust programmes. Can be accessed at:
<https://www.wildlifetrusts.org/sites/default/files/2019-09/SROI%20Report%20FINAL%20-%20DIGITAL.pdf>
61. The Wildlife Trusts (2022) A Natural Health Service. Can be accessed at:
<https://www.wildlifetrusts.org/blog/dom-higgins/natural-health-service>
62. The Wildlife Trusts (2021) Wellbeing with Nature Evaluation Report. Can be accessed at:
https://www.tnlcommunityfund.org.uk/media/insights/documents/Wellbeing-with-Nature-Evaluation-Report_-June-2021_-10271074-1.pdf?mtime=20210708104603&focal=none
63. Armstrong et al (2021) Why society needs nature. Can be accessed at:
https://cdn.forestresearch.gov.uk/2021/04/why_society_needs_nature_4fuc2gt.pdf
64. Sundstrom (2022) Why Outdoors. Can be accessed at:
https://www.wehearyou.org.uk/_files/46/whyoutdoors-evaluation-v5-compressed.pdf
65. Ulrich, R. S., Simons, R. F., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. *Journal of environmental psychology*, 11(3), 201-230.
66. Ohly, H., White, M. P., Wheeler, B. W., Bethel, A., Ukoumunne, O. C., Nikolaou, V., & Garside, R. (2016). Attention Restoration Theory: A systematic review of the attention restoration potential of exposure to natural environments. *Journal of Toxicology and Environmental Health, Part B*, 19(7), 305-343.
67. Ulrich, R. S. (1993). Biophilia, biophobia, and natural landscapes. *The biophilia hypothesis*, 7, 73-137.
68. NHS England (2022) Green Social Prescribing. Can be accessed at:
<https://www.england.nhs.uk/personalisedcare/social-prescribing/green-social-prescribing/>
69. Tyndall, J. AACODS Checklist. Flinders University, 2010. Can be accessed at: <http://dspace.flinders.edu.au/dspace/>

70. Maxwell, L., Santesso, N., Tugwell, P. S., Wells, G. A., Judd, M., & Buchbinder, R. (2006). Method guidelines for Cochrane Musculoskeletal Group systematic reviews. *The Journal of rheumatology*, 33(11), 2304-2311
71. Therapeutic Nature: Nature-based social prescribing for diagnosed mental health conditions in the UK Defra (Defra Project Code BE0155) and are available from the Department's Science and Research Projects Database at. https://arc-swp.nihr.ac.uk/wp/wp-content/uploads/2021/06/15138_TherapeuticNature-Finalreport.pdf
73. What Works briefing on natural environment-based health interventions. Accessed from <https://www.outdoor-learning-research.org/Site-Admin/Research-Hub-Meetings/ArtMID/585/ArticleID/63/What-Works-briefing-on-natural-environment-based-health-interventions>
74. Good practice in social prescribing for mental health: the role of nature-based interventions (NECR228) natural England. Accessed from <http://publications.naturalengland.org.uk/publication/5134438692814848#:~:text=Good%20practice%20in%20social%20prescribing%20for%20mental%20health%3A,Access%20to%20the%20countryside%20-%20research%20and%20evidence>
75. Defra Green Social Prescribing Evaluation, NIHR PenARC, Accessed from: <https://arc-swp.nihr.ac.uk/research/projects/green-social-prescribing/>