A Scoping Review of Nature-Based Programmes in Schools for Mental Health and Wellbeing in Young People

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Abstract

Background: Adolescent mental health difficulties are rising in the UK, yet school-based provision is limited. Nature-based Programmes (NbPs) are increasingly promoted as alternative or supplementary interventions for Mental Health and Wellbeing (MHWB), but evidence in secondary schools is under-explored.

Aim: In this scoping review, we map existing NbPs in secondary school contexts; identify reported outcomes for mental health, wellbeing, and learning; and assess evidence quality for NbPs in secondary-school provision.

Methods: We followed PRISMA-ScR guidelines (protocol: https://osf.io/qczas), searching five databases and the grey literature. Eligible studies reported school-based NbPs for students aged 10–18. The review process included screening, data extraction, and appraisal (using MMAT), and was co-produced with policymakers, educators, and young people.

Results: From 17,723 records, 22 studies were included. NbPs encompassed school gardening, outdoor education, conservation, forest pedagogy, recreation in nature, and passive nature engagements. Most NbPs were delivered weekly on school grounds or in local greenspaces. Reported MHWB outcomes included reduced anxiety and stress, improved self-esteem and resilience, enhanced prosocial behaviour and school connectedness, and enhanced nature connectedness. Evidence for academic outcomes was mixed, with modest gains in science engagement and arithmetic but little evidence of broader academic performance benefits. Overall study quality was moderate, with small samples, limited use of control groups, and heterogeneity in outcome metrics.

Conclusion: NbPs show promise for supporting adolescent MHWB in secondary schools, with school and nature connectedness emerging as potential mediators. However, evidence for cognitive and academic gains remains limited. In future, robust, UK-based Randomized Control Trials (RCTs) with standardised outcome measures are needed to assess efficacy of NbPs.

Keywords: Nature-based programmes; educational psychology; mental health; prevention; schools; scoping review

1. Introduction

1.1. Background

Recent estimates indicate that one in five young people in the UK experience mental health difficulties, a figure that has been increasing over the last decade (Newlove-Delgado et al., 2023). For example, the rate of mental health disorders among 7 to 16-year-olds rose from 12% in 2017 to 18% in 2022 (Newlove-Delgado et al, 2023; Lomax et al., 2024). In response to this growing challenge, researchers, educators, and policymakers are working to ease the burden of mental illness on individuals, healthcare systems, and society, while also fostering adolescent wellbeing and promoting 'flourishing.' This shift is reflected in the growing prioritization of mental health and wellbeing as key areas for action and investment across multiple sectors, including education (Henderson andKnight, 2012; Huppert & So, 2013; Keyes, 2010; Witten et al., 2019) and in policy on a national level (Department of Health & Department of Education, 2017; Department for Education, 2021; Prime Minister's Office, 2024).

School-based mental health services can vary widely in form and approach. Interventions were traditionally delivered through Child and Adolescent Mental Health Services (CAMHS); however, more recently schools in the UK have developed Mental Health Support Teams (MHST), which can include educational mental wellbeing practitioners (EMHP), educational psychologists, mental health leads and other providers. These developments are in line with the Government's Department for Education's (DfE) whole school approach to improving students' mental wellbeing (Department for Education, 2021), and may include alternative provisions, such as social prescribing, to support children and young people while they wait for psychiatric services (Children's Commissioner, 2024; Fancourt et al., 2023). Nature-based Programmes (NbPs) are one example of social prescribing that could take place both within the framework of a MHST, and more informally within schools, for instance through teacher-led initiatives.

Across UK schools, education policy, and the academic literature, NbPs take many different forms aimed at preventing the negative outcomes associated with poor mental health. These approaches vary not only by context (shaped by cultural, environmental, and policy differences), but also by age group, with interventions often tailored to meet the developmental needs of early years, primary, and secondary students.

The number and variety of programmes classified as NbPs for Mental Health and Wellbeing (MHWB) is broad and continues to expand. NbPs for MHWB has encompassed nature education (learning about nature in nature settings (Mann et al., 2022); nature-based education (regular school curriculum taught in natural environments (which incidentally result in benefits to MHWB; Natural England, 2022); to care farming (Fell-Chambers, 2022); horticultural therapy (Chiumento et al., 2018); and forest schools (predominately for early years and primary school students (Garden & Downes, 2021), which are more explicitly for MHWB. The delivery of these programs ranges from those targeting the whole school population where mental health difficulties experiences vary in both severity and nature (Van Poortvliet, 2023), to programmes targeting specific (non-clinical) difficulties (e.g. behavioural, anxiety-related distress, etc.)

While there is considerable scoping research on nature-based interventions at the primary school level, particularly for Forest Schools (Garden & Downes, 2023), far less attention has

been paid to secondary school students (ages 11-18). This represents a clear gap in the literature. Adolescence is a critical developmental stage, marked by a sharp rise in mental health difficulties linked to overlapping biological, social, and environmental risk factors (Nwabueze et al., 2025). At the same time, young people are increasingly affected by the psychological impacts of global climate change, with evidence showing a marked increase in climate-related distress among adolescents (Auchincloss et al., 2024; McGushin et al., 2022). By focusing specifically on this age group, this paper addresses an underexplored area of research and contributes to understanding how NbPs might support adolescent MHWB in the face of intersecting challenges.

1.2. Co Production

In conducting the scoping review, we employed co-creation as both a methodological and epistemological approach (Brown, 2022; Vaughn, 2020). Throughout the review, we engaged UK government policy professionals to jointly identify key objectives and methodologies relevant to the project's core research questions, as well as public stakeholders including educators, and students from the NeurOx Young People's Advisory Group (YPAG; Pavarini et al., 2019). Engaging students and educators was essential for grounding the research in lived experience, reflecting a commitment to participatory epistemologies in which diverse perspectives contribute to a more nuanced understanding of MHWB in educational settings.

1.3. Objectives

To address research gaps, we conducted a scoping review to investigate the evidence for school-based NbPs for adolescent MHWB. We aimed to identify the types of NbPs being implemented, the MHWB outcomes measured, the comparability of these studies, and the strength of the evidence supporting the broader implementation of NbPs in secondary schools. We also conducted a quality assessment of our final data corpus. Given the wide variation in methodologies and the absence of a standardised approach for evaluating NbPs in school settings, we assess the robustness of the methods used and identify examples of best practice.

The research questions guiding this review are as follows:

Primary Research Question:

- Do NbPs support MHWB for adolescents of secondary school-age?

Secondary Research Questions:

- What kinds of NbPs for MHWB in adolescents are reported in the literature?
- How robust is the evidence supporting different kinds of NbPs for MHWB in this population?
- For which (1) demographic groups; and (2) mental health risk groups is robust evidence of efficacy available; and for which groups is it absent or lacking?
- Do NbPs explicitly address novel, climate change-related forms of psychological distress in young people, such as eco-anxiety and climate denialism? If so, what are the risks and benefits of NbPs for this subset of psychological distress; and how robust is the evidence?

2. Methods

2.1. Design

A scoping review was conducted following a protocol registered on the Open Science Framework (https://osf.io/qczas), in accordance with the Preferred Reporting Items for Systematic reviews and Meta-Analysis extension for Scoping Reviews (PRISMA-ScR) (Tricco et al., 2018). This review approach allowed us to comprehensively map and synthesise a broad and heterogeneous body of evidence, enabling inclusion of diverse study designs and grey literature. As is usual in scoping reviews, we did not evaluate the effectiveness of specific interventions.

The review followed the five-stage framework developed by Arksey and O'Malley (2005), with modifications informed by the JBI Scoping Review Methodology Group for best practice for participatory evidence synthesis (Pollock et al., 2022). Instead of including stakeholder consultations as a sixth step, we embedded stakeholder contributions throughout the review process (including conceptualisation, search strategy, and reporting).

2.2. Eligibility criteria

Study selection criteria and the research questions were developed in line with the Population Concept Context (PCC) framework (Gupta et al., 2023) and based on priority areas identified through discussions with policy professionals. Peer reviewed and grey literature in electronic form published from date of inception to search date was deemed eligible for inclusion / exclusion if they met the following criteria:

Table 1 – Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
(i) Participants were students aged 10-18 years and/or other interested parties (e.g., educators, guardians, etc.) providing evidence about the NbP; (ii) Nature-based programs that incorporated elements of nature or greenspaces with the aim of improving mental health and wellbeing outcomes of students; (iii) implemented in school settings and/or using school resources (e.g; teachers) in any country. (iv) All study types were deemed eligible for inclusion in this review.	(i) Studies not reported in English; (ii) NbPs focused solely on physical health outcomes with no mental health outcomes; (iii) NbP delivered outside school settings and/or with very limited involvement of the school.

2.3. Search strategy

Five databases were searched (Eric, Medline, PsycINFO, Scopus, and Web of Science) for relevant records on September 4, 2024. The search strings were developed based on the

research question, stakeholder priorities, handsearching previous reviews in this area, and consultation with field experts including nature educators, and a librarian. The search string was further refined by conducting a mock search on Web of Science. A full list of the search terms can be found in Supplementary Materials 1.

The search terms were adapted for each database. Subject headings (MeSH terms) and relevant text words within title and abstracts (ti.ab) were used for searches. Boolean operators were used: "OR" to combine search terms within each concept with "AND" to link concepts together.

Policymaker insight was sought to identify potential grey literature including recent policy reports published by the Government's Department for Education, Natural England, Department for Environment, Food and Rural Affairs (DEFRA), and council websites. Additionally, the snowballing method was used to identify records from reference lists of related systematic reviews.

All records retrieved from databases were transferred to Endnote reference manager.

2.4. Study selection

After deduplication, JL, KP and SM independently screened relevant articles for inclusion in two stages: 1. title and abstract screening; 2. full text screening. To ensure adherence to the inclusion criteria, JL and SM piloted screening procedures on 10% of randomly selected articles. Once consensus was reached, all articles were tagged 'include', 'exclude', or 'unsure' at the first screening stage. Articles tagged 'include' and 'unsure' were retained for the full-text screening stage. Any disagreements during either stage of the screening process were resolved through discussion, and, when necessary, by a nature-based education expert embedded within the research team (KP).

2.5. Critical appraisal

The Mixed Methods Appraisal Tool (MMAT) (Hong et al., 2018) was used due to its suitability for evaluating various study designs. Each included study was assessed against five methodology-specific criteria, receiving a rating of "yes," "no," or "partially." Scores were calculated as percentages, with each criterion weighted at 20% if fully met or 10% if partially met; studies meeting all criteria received 100%. Critical appraisal was conducted independently by JL and SM.

Due to the mapping nature of this review and paucity of evidence, no studies were excluded based on MMAT ratings.

2.6. Data extraction

Once consensus regarding final data was reached, JL and SM independently extracted data from included articles onto a matrix table using Microsoft Excel and Covidence. General data extracted included reference, year, and country. Participant characteristic data included sample size, age range, disability or special education needs status, mental health difficulties, and whether they belonged to a group currently underrepresented in such research. NbP data extracted included a description of the program, whether it addressed climate change,

duration, frequency, and outcomes. All quantitative and qualitative outcomes were also tabulated.

2.7. Co-creation procedures

In line with the JBI Scoping Review Methodology Group's recommendations for Co-Creation (Pollock et al., 2022), we co-created all stages of this review with the following stakeholders: policymakers from the UK Government's Department for Education, young people from the NeurOx YPAG, and a nature-educator in the UK (KP). This co-production was made possible through a year-long grant (NERC: NE/W004976/1) which allowed for close collaboration with all stakeholder groups through regular virtual meetings ('co-creation sessions'), emails, and a Deliberative Policy Action (DPA) Workshop, which focused on identifying key factors and outcome measures to address the core research questions.

2.8. Data synthesis and mapping

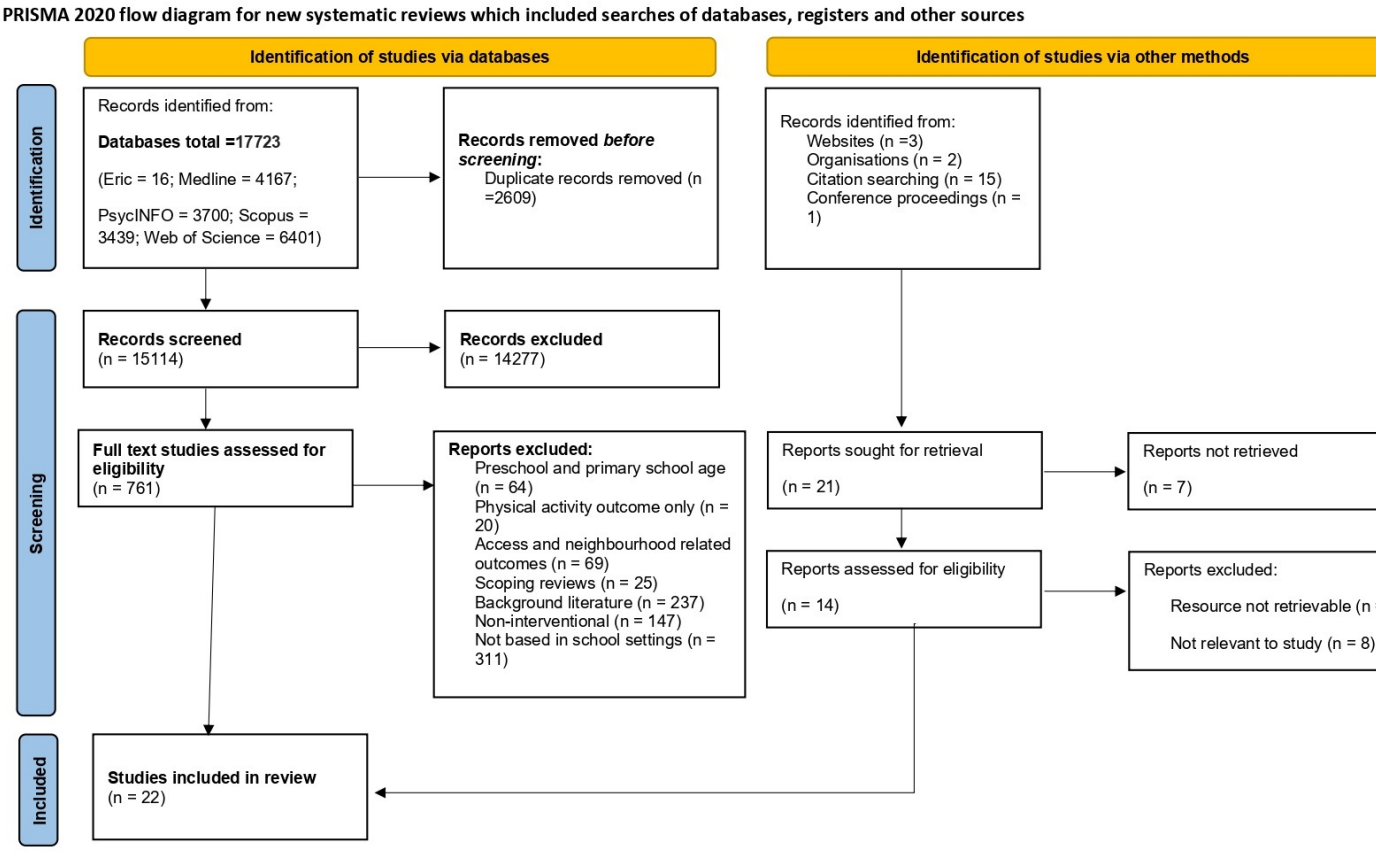
All extracted data was summarised to produce both a descriptive narrative and a tabulated account of the included articles. Co-creation sessions with stakeholders ensured the relevance of findings and helped mitigate bias. To address the research questions, findings are organised by NbP features, participant characteristics, outcomes, mental health condition, and overall study quality. In certain instances, p-values are provided, while in others, p-values are either unavailable or not provided, as they are considered less pertinent to the overall synthesis of data. This approach is considered methodologically appropriate, as the review is not a meta-analysis and does not rely on p-values as a central element of data synthesis.

3 Results

3.1. Included studies

A search across all databases was conducted on 04/09/2024 whereby 17723 studies with the potential to meet the inclusion criteria were retrieved. After deduplication, 15114 records titles and abstracts were screened. Of these, full texts of 761 studies were reviewed, resulting in the inclusion of 22 studies. Grey literature sources were also searched, and 21 records were sought for retrieval. Of these, 14 records were assessed for eligibility, but all were excluded due to being irrelevant to the study (n = 8) and being unavailable for retrieval (n = 6). The PRISMA flowchart below (Figure 1) outlines the screening stages and number of included and excluded records at each stage.

Figure 1 - PRISMA Flowchart



Source: Page MJ, et al. BMJ 2021;372:n71. doi: 10.1136/bmj.n71.

3.2 Study characteristics

General characteristics of all studies including year of publication, context, school type, and study design are outlined in Supplementary Material 2.

All studies were conducted in the 10-year period between 2014-2024 despite the database search including studies published from inception. 6 studies were conducted in 2018 (Barthel et al., 2018; Bates et al., 2018b; Chiumento et al., 2018; Malberg Dyg & Wistoft, 2018; McAnally et al., 2018; Mygind et al., 2018), 5 in 2021 (Garip et al., 2021; Goodman et al., 2021; Machackova et al., 2021; Sabine Pirchio et al., 2021; Rian & Coll, 2021), 4 in 2024 (Ayotte-Beaudet et al., 2024; Guo et al., 2024; Heidi L. Hollingsworth & Giblin, 2024; Mason et al., 2024), and 1 in each year as follows: 2014 (Chawla et al., 2014), 2016 (Akpinar, 2016), 2017 (Patchen et al., 2017), 2019 (Lam et al., 2019), 2020 (Brown et al., 2020), 2022 (Faber Taylor et al., 2022), and 2023 (Eastwood et al., 2023).

Most of the studies (*n* = 9) were conducted in North America, followed by Europe (*n* = 9) including 3 in the UK (2 UK, 1 Scotland), Asia (*n* = 3), and Oceania (*n* = 1). Specific region and country information is outlined in Supplementary Material 2. With regard to school types, most studies were conducted in government-funded schools (n = 13), whereas twelve studies were conducted across multiple sites including different school types. Of the remaining studies, these were conducted in community schools (*n* = 4), boarding schools (*n* = 3), independent schools (*n* = 2), private schools (*n* = 2), academies (*n* = 1), and hospital schools (*n* = 1).

Design and methodologies of the studies included quantitative design (*n* = 12), qualitative (*n* = 7), and mixed methods (*n* = 3). Out of the 12 quantitative studies reported, 7 included non-randomized control groups. The remaining 5 included no control groups. Control group activities included similar classroom-based instruction (but without a nature component) (Faber Taylor et al., 2024; Rian & Coll, 2021; Mygind et al., 2018); being shown a video of urban settings with cars and road noises (compared to watching a video of natural environments; Mason et al., 2024); and groups who did not attend nature-based activities / workshops, with no alternative provided (Pirchio et al., 2021; McAnally et al., 2018).

3.3. Participant characteristics

Participant characteristics including sample size, age range, UK national curriculum year (if applicable), sex, special educational needs, disability status, and whether participants belonged to under-represented groups or groups at a higher risk of developing mental health difficulties are outlined in Table 2.

320 *Table 2 - Participant Characteristics*

Reference	Number of participants (n)	Age range	UK National curriculum year	Sex (% split)	Special educational needs (SEN)?	Disability status	MH difficulty	Underrepresented group/ MH risk group	Received free school meals?
Akpinar, 2016	223	12-13 years; 13-14 years; 14-15 years; 15-16 years; 16-17 years; 17-18 years	Not applicable (outside UK)	63.2% F; 36.8% M	No	N	Stress; Attention/cognition related	Black, Asian & minority ethnic groups	Not applicable (offered to all students irrespective of socioeconomic status)
Ayotte-Beaudet, et al., 2024	578	Not applicable; only educators	Not applicable (outside UK)	69.7% F; 30.3% M	No	N	Other: Improving nature connectedness and physical health outcomes	Not reported	No
Barthel et al., 2018	25	10-11 years; 11-12 years	Not applicable (outside UK)	Not reported	No	N	Other: Not applicable	Not reported	Not applicable (offered to all students irrespective of socioeconomic status)
Bates, 2018	1518	10-11 years; 11-12 years; 12-13 years; 13-14 years	Not applicable (outside UK)	45% F; 55% M	No	Not recorded	Other: Bullying, negative social interactions	People from lower socioeconomic backgrounds	Yes
Brown, 2020	529	10-11 years; 11-12 years	Not applicable (outside UK)				Other: Not applicable	Black, Asian & minority ethnic groups	Not applicable (offered to all students irrespective of socioeconomic status)
Chawla et al.,	52	14-15	Not	59.61%	No	Not	Stress	Participants	No

2014		years; 15-16 years; 16-17 years; 17-18 years	applicable (outside UK)	F; 40.38% M		reported		included some teen mothers	
Chiumento et al., 2018	36	10-11 years; 11-12 years; 12-13 years; 13-14 years; 14-15 years	Year 6 (10-11 years); Year 7 (11-12 years); Year 8 (12-13 years); Year 9 (13-14 years); Year 10 (14-15 years)	38.8% F; 61.2% M	No	Not reported	Other: Behavioural, emotional and social difficulties (BESD)	People from lower socioeconomic backgrounds	Yes
Eastwood et al., 2023	14	15-16 years	Year 11 (15-16 years)	Not reported	No	Not reported	Stress	At risk of exclusion	Not reported
Faber Taylor et al., 2022	92	10-11 years	Not applicable (outside UK)	Not reported	No	Not reported	Anxiety; Stress; Attention/cognition related	People from lower socioeconomic backgrounds	Yes
Garip et al., 2021	504	10-11 years; 11-12 years; 12-13 years; 13-14 years; 14-15 years; 15-16 years; 16-17 years; 17-18 years	Year 6 (10-11 years); Year 7 (11-12 years); Year 8 (12-13 years); Year 9 (13-14 years); Year 10 (14-15 years); Year 11 (15-16 years); GCSE (16-18 years)	Not reported	Yes	Y; population included some participants with special needs	Anxiety; Stress; Neurodivergence; Other: Population included students in Pupil Referral Units (PRU)	People from lower socioeconomic backgrounds	Yes

Goodman et al., 2021	198	10-11 years; 11-12 years; 12-13 years; 13-14 years; 14-15 years	Not applicable (outside UK)	40.5% F; 59% M	No	N	Anxiety; Depression; Stress; Other: Community violence	People from lower socioeconomic backgrounds	Yes
Guo et al., 2024	48	10-11 years; 11-12 years	Not applicable (outside UK)	Not reported	No	N	Stress	Black, Asian & minority ethnic groups	Not applicable (offered to all students irrespective of socioeconomic status)
Hollingsworth & Giblin, 2024	25	11-12 years	Not applicable (outside UK)	59% F; 39% M	No	N	Other: Peer connectedness	People from lower socioeconomic backgrounds	Yes
Lam et al., 2019	16	13-14 years; 14-15 years; 15-16 years; 16-17 years	Not applicable (outside UK)	56% F; 44% M	No	N	Stress	Not reported	No
Machácková et al., 2021	68	12-13 years; 13-14 years; 14-15 years; 15-16 years	Not applicable (outside UK)	36.7% F; 63.3% M	No	N	Anxiety; Depression; Suicidality; Self harm; Other: Behavioural disorders	Care-experienced people	Not applicable (offered to all students irrespective of socioeconomic status)
Malberg Dyg & Wistoft, 2018	30	11-12 years; 12-13 years; 13-14 years; 14-15 years	Not applicable (outside UK)	Not reported	Yes	Y; some participants had a diagnosis of ADHD and/or autism	Other: Overall wellbeing	Not reported	Not applicable (offered to all students irrespective of socioeconomic status)
Mason et al., 2024	91	10-11 years	Not applicable	46.15% F;	No	N	Attention/ cognition related	Not reported	No

			(outside UK)	53.85% M					
McAnally et al., 2018	15	13-14 years	Not applicable (outside UK)	0% F; 100% M	No	N	Stress; Body image issues; Other: Mental wellbeing	Not reported	Not applicable (offered to all students irrespective of socioeconomic status)
Mygind et al., 2018	47	10-11 years; 11-12 years	Not applicable (outside UK)	36.17% F; 63.83% M	No	N	Stress; Attention/cognition related	Not reported	Not applicable (offered to all students irrespective of socioeconomic status)
Patchen et al., 2016	234	10-11 years; 11-12 years	Not applicable (outside UK)	59.4% F; 40.6% M	No	N	Other: Anxiety around science	Black, Asian & minority ethnic groups	Yes
Pirchio et al., 2021	407	10-11 years; 11-12 years	Not applicable (outside UK)	46% F; 54.1% M	No	N	Anxiety; Stress; Other	Not reported	Not applicable (offered to all students irrespective of socioeconomic status)
Rian & Coll, 2021	60	10-11 years	Not applicable (outside UK)	41.6% F; 58.3% M	No	N	Anxiety	Lower socioeconomic backgrounds	Yes

The terms sex and gender were used interchangeably between studies; for consistency, we use 'sex' throughout this paper. All studies included in this review were conducted with students, except for one (Ayotte-Beaudet et al., 2024) which was conducted with educators. A total of 4810 participants were included across all the studies. A majority of the studies included participants aged 10-14; 10-11 years *n* = 13; 11-12 years *n* = 12; 12-13 years *n* = 7; 13-14 years *n* = 9 where *n* denotes number of studies). A smaller proportion of studies included participants in the 15-18 age range (14-15 years *n* = 8; 15-16 years *n* = 5; 16-17 years *n* = 4; 17-18 years *n* = 3).

Regarding the distribution of sex across all the studies, nine studies recruited mostly male participants (Bates et al., 2018b; Chiumento et al., 2018; Goodman et al., 2021; Machackova et al., 2021; Mason et al., 2024; McAnally et al., 2018; Mygind et al., 2018; S. Pirchio et al., 2021; Rian & Coll, 2021), whereas six studies recruited mostly female participants (Akpinar, 2016; Ayotte-Beaudet et al., 2024; Chawla et al., 2014; Hollingsworth and Giblin, 2024; Lam et al., 2019; Patchen et al., 2017). Six studies did not report this information.

Only two studies included participants with special educational needs including neurodivergence or learning difficulties (Garip et al., 2021; Malberg Dyg & Wistoft, 2018).

Seven studies included participants from low-income and low-socioeconomic backgrounds (Bates et al., 2018b; Chiumento et al., 2018; Faber Taylor et al., 2022; Garip et al., 2021; Goodman et al., 2021; Hollingsworth & Giblin, 2024; Rian & Coll, 2021), four studies included those from Black, Asian and minority ethnicity backgrounds (Akpinar, 2016; Brown et al., 2020; Guo et al., 2024; Patchen et al., 2017), one study included those with experience in the foster care system (Machackova et al., 2021), one study included some participants who were teen mothers (Chawla et al., 2014), and one included those who faced the risk of exclusion from school (Eastwood et al., 2023). Eight studies did not report such information.

We also extracted information on whether participants were eligible for receiving free school meals as a proxy measure of socioeconomic status. Seven studies included participants who received such provisions (Bates et al., 2018a; Chiumento et al., 2018; Faber Taylor et al., 2022; Garip et al., 2021; Goodman et al., 2021; Hollingsworth & Giblin, 2024), whereas nine studies reported all students receive free school meals irrespective of socioeconomic status.

3.4 Critical appraisal

The overall quality of the included studies was moderate; tabulation of each study's scores is in Supplementary Material 3.

3.4.1 Qualitative studies:

Of seven studies, four fully met MMAT criteria whereas the remainder received a ‘partial’ rating on one question for adequacy of data collection methods to address the research question (Brown et al., 2020; Malberg & Wistoft, 2018), and coherence between qualitative data sources, collection, analysis and interpretation (Garip et al., 2021).

3.4.2 Quantitative studies:

Of twelve studies, one fully met MMAT criteria (Guo et al., 2024). The remaining studies received lower ratings due to concerns regarding 1. accounting for confounders (n = 7); 2. incomplete outcome data (n = 5); 3. participants representation of the target population (n = 3); 4. whether the intervention was administered as intended (n = 5).

3.4.3 Mixed methods:

Of three studies, none fully met MMAT criteria due to concerns regarding: 1. adequate rationale for using this study design (n = 1); 2. integration of all study components to answer the research question (n = 2); 3. addressing inconsistencies between qualitative and quantitative results (n = 1); 4. adherence of study component methods to standardised quality criteria for that study type (n = 2).

3.5. NbP features and delivery

All NbP features, including characteristics, greenspace types, facilitator roles, and delivery duration and frequency, are outlined in Table 3.

375 *Table 3 - NbP Features*

Reference	Nature setting	Sessions facilitated by	NbP description and focus	Addresses climate-change distress?	Duration (mins)	Frequency	Primary outcome	Secondary outcome (if applicable)
Akpinar, 2016	Playground; Urban park	Mentor teachers	Engaging in school greenspaces	No	Not applicable; students reside in school	Not applicable; 2 weeks	Improved restoration (mood, quality of life)	Not applicable
Ayotte-Beaudet, et al., 2024	Playground; Urban park; Woodland	Preschool, elementary and secondary school teachers	Interviewed educators who facilitate outdoor education to improve nature connectedness, mental and physical health outcomes	No	Not applicable	Not applicable	Understanding barriers to the delivery of outdoor education by teachers	Recognise teachers intentions to incorporate the outdoors in their teaching
Barthel et al., 2018	Urban park; Woodland	Teachers, biologist	Stewardship salamander conservation programme	Yes	30 mins	Every school lunch break of the salamander breeding season (April/May)	Improved connection to nature	Pro-environmental stewardship
Bates, 2018	Playground; Urban park	School staff, local school council member	Recess and physical education programmes in renovated schoolyards	No	Duration of school recess break (mins not specified)	3x a week	Improving prosocial behaviours (reducing bullying, teasing)	Increased physical activity
Brown, 2020	Forest; Classroom/ hybrid	Teachers	Stewardship and environmental awareness education programme for	Yes	120 mins	2 sessions	Improving awareness of endangered species	Improved academic comprehension and literacy skills

			endangered slow loris					
Chawla et al., 2014	Playground; Urban park	Gardening teacher, horticultural science teacher, gardening program director	Gardening programme	No	30-90 mins	1x a week	Stress relief	Attention restoration
Chiumento et al., 2018	Playground; Garden	Two horticul-turists; one Child and Adolescent Mental Health Service (CAMHS) psychotherapist	Social and therapeutic horticulture programme	Not applicable	120 mins	1x a month for 6 months	Improved sense of agency and resilience	Sense of participation
Eastwood et al., 2023	Classroom/hybrid	Teachers, support programme teacher, home-school support worker, youth engagement officer	Participatory video programme to encourage nature involvement	No	NR	stage 1: 6x 90 min workshops; stage 2: 2 days; stage 3; 3 days	building agency, improved mental health, increased pro-environmental behaviours	Change of perceptions of greenspace
Faber Taylor et al., 2022	Urban park	Naturalist from nearby nature center, science teacher	Science lessons conducted in natural settings	Not applicable	NR	Biweekly	Improved attention	Reduced anxiety
Garip et al., 2021	Playground; Urban park; Garden; Woodland	Green Spaces, Learning Places (GSLP) practitioners	Outdoor workshops in the woodland including activities such as bug hunting, and building dens.	Not applicable	120 mins	3x	1. Understanding; 2. Wellbeing; 3. Confidence; 4. Nature connection; 5. Involvement	Not applicable
Goodman et al., 2021	Playground; Urban park	Park recreators, recreation leaders	After-school program in parks consisting	No	260 mins	5x days a week; 28 weeks	Improved resilience to cope with	Not applicable

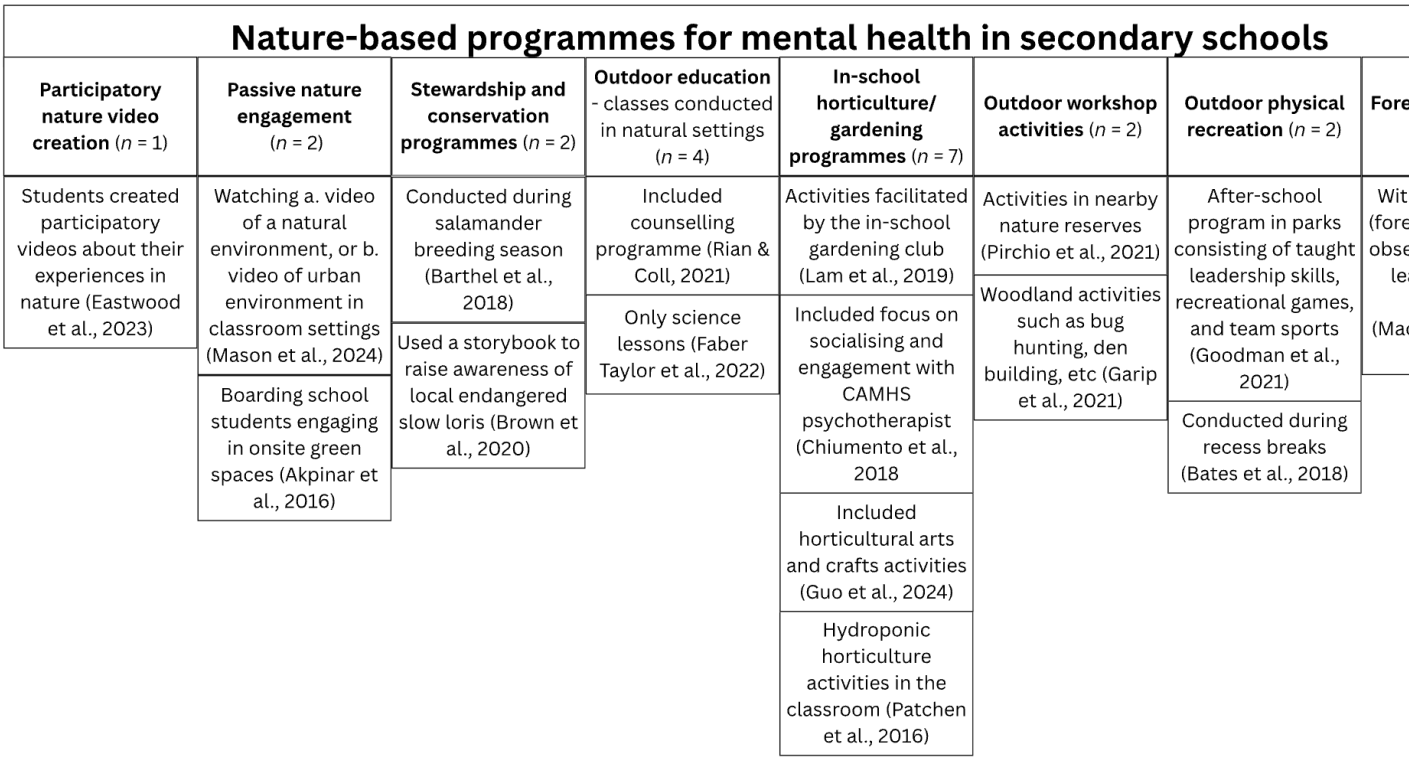
		(educators, coaches)	of taught leadership skills, recreational games, and team sports				community violence	
Guo et al., 2024	Classroom/hybrid	Horticultural course instructor	Horticultural and craft activities	No	20 mins	5x a week; 1 week	Stress relief	Not applicable
Hollingsworth & Giblin, 2024	Playground; Garden	Science and social studies curriculum teacher	In-school gardening programme	No	NR	NR; 11 weeks	Peer connectedness	Enjoyment at school
Lam et al., 2019	Playground; Urban park; Garden	Gardening club educator	In-school gardening club activities	Yes	30 mins	7x sessions	Improved mental wellbeing through gardening	Improved food literacy
Macháčková et al., 2021	Forest; Woodland	Forest pedagogue	Forest pedagogy with Shinrin-yoku and observational learning	No	120 mins	2x a week; for 2 months	Reduction of aggressive behaviours	Improved prosocial behaviours
Malberg Dyg & Wistoft, 2018	Playground; Garden	Garden educators	In-school gardening programmes	Not applicable	Various depending on organising school	Various depending on organising school	Improved wellbeing (emotional, interpersonal, self-esteem, behaviour)	Not applicable
Mason et al., 2024	Classroom/hybrid	Not applicable	Watching a. video of a natural environment, or b. video of urban environment in classroom settings	No	5 min videos	NR	Improved cognitive performance on arithmetic calculation tasks	Improved positive affect
McAnally et al., 2018	Forest	Main classroom teachers,	Outdoor education in	No	NR	Everyday (residential	Improved mental	Creative thinking

		educators	natural settings			programme); 15 weeks	wellbeing (life satisfaction, self-esteem)	
Mygind et al., 2018	Forest; Classroom/ hybrid	Not applicable	Outdoor education in natural settings	No	60 mins	1x; one-off	Stress relief	Improved cognitive abilities
Patchen et al., 2016	Classroom/hybrid; Other: Hydroponic setups in classrooms	Afterschool program staff, science specialists	Hydroponic activities in classrooms to reduce anxiety around science	No	120 mins	1x a week; for 13 weeks	Improved attitudes towards science (anxiety, desire, self-concept)	Not applicable
Pirchio et al., 2021	Forest; Woodland	Main classroom teachers	Outdoor workshop activities in nearby nature reserves	No	240 mins	1x a month;4-5 sessions	1. Psycho-social wellbeing; 2. Connectedness to nature; 3. Life satisfaction; 4. Pro-environmental attitudes and behaviours; 5. Reduced anxiety	Not applicable
Rian & Coll, 2021	Playground; Urban park	School counselors	Outdoor education and counselling programme	Not applicable	NR	1x a week; 6 sessions	Reduced anxiety	Nature connectedness

3.5.1 NbP types and characteristics

There was significant heterogeneity in the types and features of NbPs across all included studies: in-school horticulture or gardening programmes (n = 7); outdoor education where classes are conducted in natural settings (n = 4); stewardship and conservation programmes (n = 2); outdoor workshop activities (n = 2); those implementing physical recreation activities (n = 2); forest pedagogy (n = 1); participatory videography of nature (n = 1); and passive engagement in nature (n = 1). There was further heterogeneity in the activities and features within the categories; these have been outlined below in Figure 2.

Figure 2 - Categorisation of NbPs and individual programme features where ‘n’ indicates number of studies in each category. This figure excludes Jean-Philippe Ayotte-Beaudett's (2024) study as it interviewed educators who facilitate NbPs.



3.5.2 NbP delivery:

Most studies looked at NbPs delivered across more than one type of greenspace or setting (*n* = 21). Most NbPs were conducted in local urban parks (*n* = 10), or on school premises such as classrooms (*n* = 6), playgrounds (*n* = 11), and gardens (*n* = 5). Other settings include forests (*n* = 4) and woodlands (*n* = 5).

There was significant heterogeneity in the duration of NbPs delivered (see Table 3). Frequency of the NbP sessions tended to be 1x a week across several months.

3.5.3 NbP facilitator characteristics:

Across the studies, a majority of the NbPs were facilitated by a combination of staff from within the school and external facilitators. In thirteen studies, teachers or educators of different roles facilitated sessions; further information regarding these roles is outlined in Table 3.

Other types of school staff involved in facilitating NbPs ranged included school counsellors (Rian and Coll, 2021), afterschool programme staff (Patchen et al., 2016), park recreational leaders (Goodman et al., 2021), home-school support workers (Eastwood et al., 2023), and local school council members (Bates et al., 2018).

The external facilitators involved in delivering NbPs included a general science specialist (Patchen et al., 2016), biologist (Barthel et al., 2018), forest pedagogy instructor (Machácková et al., 2021), horticultural arts course instructor (Guo et al., 2024), horticulturists (Chiumento et al., 2018) practitioners from the Green Spaces, Learning Places (GSLP) program (Garip et al., 2021), naturalist from local nature center (Faber Taylor et al., 2022), youth engagement officer (Eastwood et al., 2023), and a Child and Adolescent Mental Health Service (CAMHS) psychotherapist (Chiumento et al., 2018).

3.6. NbP Outcomes

This section focuses on the reported outcomes of NbPs, categorized into two main areas: mental health and wellbeing, and cognitive and academic outcomes. All quantitative outcomes are in Supplementary materials 4, and qualitative outcomes in Supplementary materials 5.

3.6.1. Mental Wellbeing

Across the 22 studies, mental health and wellbeing was often inconsistently defined, functioning as a broad, catch-all term. Some studies focused on reducing symptom severity of anxiety (n = 5), whereas a majority focused on improving participants' general emotional state and wellbeing (n = 12), with the latter category including studies focused on reducing the impact of risk factors known to worsen mental health difficulties, including stress (Chawla et al., 2014; Mygind et al., 2018; Guo et al., 2024); low self-esteem (McAnally et al., 2018); bullying (Bates, 2018), community violence (Goodman et al., 2021); and aggressive behaviours (Machácková et al., 2021).

Reflecting this variation, the measurement tools used across the quantitative studies varied significantly. For example, anxiety was a frequent outcome measured, with researchers using a range of validated tools; e.g. Beck Anxiety Inventory for Youth (BAI-Y) (Rian & Coll, 2021), Self Administrated Psychiatric Scales for Children and Adolescents - Anxiety (SAFA-A) (Pirchio et al., 2021), State-Trait Anxiety Inventory (Faber Taylor et al., 2022). General wellbeing and mental health were also captured using a heterogenous set of tools, including the World Health Organization-Five Well-Being Index (WHO-5), Short Moods and Feelings Questionnaire (SMFQ), Satisfaction with Life Scale, and the Rosenberg Self-Esteem Scale (Pirchio et al., 2021; McAnally et al., 2018).

Across the wide variety of tools used to measure wellbeing and mental health, the NbPs surveyed were largely reported as successful in improving mental health and wellbeing outcomes, particularly in reducing anxiety. For instance, Rian and Coll (2021) found that participation in an outdoor education and counselling programme, held once a week for six weeks, led to decreased anxiety levels, as measured by the BAI-Y. Similarly, Pirchio et al. (2021) reported reductions in anxiety following monthly outdoor workshop activities in nearby nature reserves over a four- to five-month period, assessed using the SAFA-A scale.

Reductions in anxiety were reported both as primary targets of NbPs (above examples), and as incidental findings when the programmes were aimed at achieving other outcomes. Goodman et al. (2021) evaluated an after-school programme conducted in parks five times a week for 28 weeks, which focused on leadership skills, recreational games, and team sports. The programme was associated with indirect reductions in anxiety, as measured by the Screen for Child Anxiety Related Disorders (SCARED) tool. Likewise, Faber Taylor et al. (2022), in a study involving 92 participants engaged in nature-based science lessons, also observed indirect reductions in anxiety compared to traditional classroom instruction.

Beyond reducing anxiety, qualitative studies included within this review showed improvements in participants' quality of life, life satisfaction, and resilience (e.g., Lam et al., 2019, using food literacy and garden-based activities; Garip et al., 2021, through outdoor nature programmes in green spaces). Malberg and Wistoft (2018) also implemented a school gardening programme and reported reductions in inter-personal conflict, increased emotional wellbeing, and improvements in self-esteem and pro-environmental behaviours.

Collectively, these studies highlight the potential of structured NbPs to reduce anxiety and to positively impact children's mental health and wellbeing.

3.6.2. Cognitive and Academic Outcomes

Cognitive and academic performance related outcomes included improving attitudes and reducing anxiety around learning science, which was measured through the Modified Attitudes Toward Science Inventory (MATSI) (Patchen et al., 2016); improved cognitive abilities measured by the d2 cognitive performance test (Mygind et al., 2018); improving performance on arithmetic calculation tasks (Mason et al., 2024); and improving math and science curriculum engagement and performance which was measured on the Math and Science Engagement Scales (Faber Taylor et al., 2022).

Where studies included outcome measures for cognition, academic performance and MHWB (n = 3), the results for cognition and academic performance were marginal compared to the more positive findings in mental health outcomes. For example, a study by Mygind et al. (2018) found that while students in an outdoor natural environment experienced significantly greater stress relief, as indicated by higher tonic vagal tone ($p = 0.031$), there was no statistically significant improvement in cognitive performance (measured by d2 test scores) between the natural and traditional classroom settings ($p = 0.691$).

Interestingly, some positive effects of NbPs on cognitive performance were observed in both real-life natural settings and virtual experiences. For instance, Mason et al. (2024) found that watching a video of a natural environment significantly improved children's arithmetic

performance and perceived restorativeness, when compared to viewing an urban video, with both effects statistically significant ($p < 0.001$). However, there were no significant differences in positive or negative affect scores between the groups ($p = 0.874$ and $p = 0.673$, respectively).

3.7 Additional Factors

The studies also identified several additional variables related to students' mental health and wellbeing, notably school community outcomes and nature connectedness.

3.7.1 School Community Outcomes

Six studies reported broad improvements in students' relationship to their school context by focusing on peer connectedness (Hollingsworth et al., 2024; Lam et al., 2019), increased sense of participation and belonging (Chiumento et al., 2018), improved prosocial behaviours and reduced conflict (Bates et al., 2018; Machácková et al., 2021; Malberg & Wistoft, 2018).

With regard to peer connectedness, qualitative data from Hollingsworth et al. (2024) found that the garden space provided opportunities for students to collaborate on tasks and learn about each other whereas quantitative data from the School Connectedness questionnaire showed a statistically significant increase ($p = 0.042$) on the "*I feel close to my classmates*" question compared to baseline. Similarly, Lam et al. (2019) reported that the school garden offered a space for students to build relationships and a sense of community.

3.7.2. Nature Relatedness

Eleven studies investigated young people's relatedness or connectedness to nature (Chawla et al., 2014; Barthel et al., 2018; Brown, 2020; Eastwood et al., 2023; Garip et al., 2021; Guo et al., 2024; Rian & Coll, 2021; Pirchio et al., 2021, Mason et al., 2024; Malberg & Wistoft, 2018; Akpinar, 2016).

Within these studies, there is significant heterogeneity in the conceptualisation of nature relatedness and its anticipated impact on students' mental health and wellbeing outcomes, ranging from the perceived restorative effect of nature on mood (Akpinar, 2016; Chawla et al., 2014; Guo et al., 2024; Mason et al., 2024), to the impact of such relatedness on developing pro-environmental behaviours and improved attitudes towards nature including seeing oneself as a 'part' of nature (Barthel et al., 2018; Brown, 2020; Pirchio et al., 2021; Eastwood et al., 2023; Garip et al., 2021).

Nature relatedness was quantitatively measured in four studies: through the Perceived Restorativeness Scale (PRS) (Akpinar, 2016) and its adaptation for children (PRS-ch) (Mason et al., 2024), Connectedness to nature scale (CNS) (Pirchio et al., 2021), and the Connection to Nature Index (CNI) (Rian & Coll, 2021). Statistically significant increases were reported in two studies (Mason et al., 2024) ($p = <0.001$) and Akpinar (2016) ($p = \leq .001$ on all PRS items

except PRS Coherence where $p \leq .05$). Marginal increases were reported in Rian & Coll (2021) ($p = 0.075$) and Pirchio et al. (2021) ($p = 0.188$).

Qualitative studies reported that NbPs were associated with an improved sense of care and responsibility towards nature (Barthel et al., 2018; Brown et al., 2020; Malberg & Wistoft, 2018); Garip et al., 2021), and the adoption of pro-environmental behaviours such as reduced littering (Eastwood et al., 2023).

4. Discussion

This scoping review synthesized existing research to identify the types of NbPs currently implemented in secondary schools to support mental health and wellbeing, and to summarize their effects. Although only 22 studies were included in this review, the findings provide a signal that the use of NbPs in secondary schools has positive effects on mental health and wellbeing, especially anxiety, with moderate or minor impacts on academic and cognitive outcomes.

Our review also found that nature connectedness and the school community (e.g., peer and school connectedness) may serve as protective factors in students' mental health and wellbeing, and may mediate or moderate the impact of NbPs on positive mental health and wellbeing (e.g. Richardson et al. (2020) on nature connectedness, and Millings et al. (2012) on school connectedness). However, further research is required to establish the precise nature and direction of the relationships among NbPs, school and nature connectedness, and MHWB, particularly within the secondary school setting. Furthermore, identifying these potentially protective factors is not a unique contribution in itself, as previous reviews have identified multiple factors moderating or mediating the effects of NbPs on mental health. Kaleta et al. (2025) found 11 such factors, including social interaction, physical activity, age, nature connectedness, and intervention duration. Similarly, Shrestha et al. (2025) identified eight overlapping factors, such as immersive engagement, social and physical dimensions, intervention quality, and co-design. This review found comparable influences, particularly regarding nature-relatedness and school or peer connection, but also identified a significant limitation within the research i.e. the heterogeneity in how different factors were classified across studies.

Critically, in relation to our secondary research question concerning novel, climate change-related forms of psychological distress, we did not identify any studies that explicitly addressed these phenomena. This represents a notable gap in the literature, suggesting that while the broader psychological impacts of environmental degradation are increasingly recognized, there is currently no research that systematically examines NbPs as a viable approach within secondary schools to reduce, mediate, or prevent such forms of distress.

4.1. Types of NbPs

This review strengthens the existing NbP framework by providing greater detail on the implementation factors (such as facilitator type), and programme factors (such as nature-type) observed across the 22 cases. Previous researchers, such as Lomax et al. (2022), have developed frameworks for categorizing nature-based interventions more broadly; this study extends that work by presenting the first framework specifically designed to categorize NbPs within the secondary school setting. Presented in Section 3.5, Figure 2 offers a valuable resource for teachers, providing a practical, evidence-informed framework for implementing NbPs in schools, and supports researchers in more effectively evaluating future interventions within a landscape marked by the significant heterogeneity of nature- and implementation-types (Kaleta et al., 2025; Shrestha et al., 2025).

4.2. Robustness of Evidence

We found that the overall quality of the studies included in this review were rated as moderate to poor based on the MMAT. This was largely due to a lack of reporting or minimisation of confounding factors, and the sample sizes in individual studies being too small and not representative of the target population, thereby impacting the generalisability of these studies' findings. Furthermore, inconsistent reporting of key demographic variables such as sex, age, and socio-economic background placed further limitations on the interpretability and generalisability of findings, and made it difficult to answer the question, *for which (1) demographic groups; and (2) mental health risk groups is robust evidence of efficacy available; and for which groups is it absent or lacking?*

Only seven of the quantitative studies included control arms (and no group was randomized). Many studies did not have appropriate control groups or randomisation of participants to different conditions. This introduces a higher risk of bias in the data and an inability to properly ascertain what factors in the NbPs are driving change. Our findings echo concerns raised in previous scoping reviews about NbPs for mental health and wellbeing across a range of ages and conditions (e.g. Lomax; 2024; Taylor et al. (2022); Coventry et al., 2021; Mygind et al., 2019; Nguyen et al., 2023; van den Bogerd et al. 2020; Wood et al. 2024).

We recommend that future research in this area includes Randomised Control Trials (RCTs). We recognise the practical and ethical challenges of conducting NbP RCTs, including the difficulty of blinding and the highly contextual nature of the interventions. Nevertheless, existing studies demonstrate that rigorous RCTs are possible. For instance, Coventry et al. (2021) report sixteen RCTs exploring the mental health impacts of green social prescribing and related interventions. This demonstrates that rigorous evaluation is possible despite methodological challenges around using RCTs for measuring NbPs.

4.3. Heterogeneity in Language and Tools

This review identified a range in both conceptual and operational definitions of MHWB, with few studies using the same tools when evaluating the impact of their school NbPs.

Similar to the lack of consistency in defining MHWB across studies, ‘nature connectedness’ and ‘school community’ outcomes were often defined differently and lacked a unified measurement language or tool. For example, ‘nature connectedness’ was conceptualized and measured differently across included studies, with definitions ranging from nature connection, nature connectedness, and nature relatedness, and approaches ranging from assessments of pro-environmental behaviours to self-identification as part of nature. Nature relatedness was measured through the Perceived Restorativeness Scale (PRS) (Akpinar, 2016) and its adaptation for children (PRS-ch) (Mason et al., 2024), as well as the Connectedness to nature scale (CNS) (Pirchio et al., 2021), and the Connection to Nature Index (CNI) (Rian & Coll, 2021).

These behavioural and emotional constructs capture distinct dimensions of the human–nature relationship (such as emotion, identity, empathy, and experiences). As a result, these measures may represent conceptually non-equivalent aspects of nature connectedness and cannot be directly compared. However, it is important to note that Richardson et al. (2019) found strong correlations between the NCI and other scales (such as the NR-6 (Nature Relatedness scale), INS (Inclusion of Nature in Self scale), and EWNB (Engagement with Beauty scale), providing evidence of convergent validity while still reflecting distinct underlying dimensions. This suggests that, although the constructs differ conceptually, there may nevertheless be meaningful convergence across these measures in capturing aspects of human–nature connectedness.

4.4. Additional Limitations

A significant limitation for UK policymakers is the fact that most of the studies reviewed were conducted in the United States. This geographic imbalance reduces the relevance and applicability of the findings to the UK context, where educational systems, cultural norms, and environmental factors may differ considerably. However, it is also important to recognise that certain aspects of NbPs are generalisable across countries and systems. For example, Jordan and Chawla (2019) highlight socio-demographic consistencies in how nature experiences foster connectedness and wellbeing. Finally, it is important to recognise that much relevant work in this field occurs outside the academic landscape, meaning that this review may not capture all existing NbPs being used for MHWB. Although efforts were made to mitigate this limitation through the inclusion of a practitioner (author KP) and representatives from the Department for Education (DfE), further co-production approaches, such as collaboration events between researchers, practitioners, and the students themselves, may help bridge this gap by facilitating the inclusion of practice-based evidence and experiential knowledge that often remain undocumented in academic literature.

Ultimately, while the included studies demonstrated some strengths, including the use of diverse methodologies (quantitative, qualitative, and mixed methods), further high-quality research is needed (particularly studies conducted within the UK) to strengthen the evidence base and offer clear, contextually relevant guidance for UK schools. This will further enable policymakers, educators and wider stakeholders such as parents to understand how secondary school-based NbPs may support students' MHWB.

4.5. Implications for Education Practice

Research evaluating the impact of NbPs on MHWB in UK secondary schools remains relatively underdeveloped. Although the overall evidence is weaker than sometimes portrayed in the media, the findings presented in this paper suggest that wider adoption of NbPs could positively influence students' MHWB, especially anxiety, as well as improve educational attainment and behaviour across diverse student populations.

However, as noted, there are significant differences in how programmes are implemented across schools, and limited information about which approaches are most effective. These variations have important implications for educational practice.

Schools will need practical guidance on how to design and implement NbPs suited to their individual circumstances. This paper highlights that positive MHWB outcomes appear to be mediated by improvements in students' connection to school and to nature. Supporting schools to optimise these mechanisms, for example by training EMHP staff on the different nature-based programmes available, and/or equipping educators with relevant skills through teacher training, will be crucial to successful implementation.

5. Conclusion

The potential benefits of NbPs align closely with broader governmental priorities, including reducing preventing poor mental health among young people, narrowing educational disparities, and promoting student engagement, wellbeing, citizenship, and long-term thriving (Transforming Children and Young People's Mental Health Provision Green Paper, 2017; Department for Education, 2025; Prime Minister's Office, 2024; Department for Education, 2025b). Consequently, NbPs are increasingly being promoted and implemented as a valuable and timely means of advancing national policy goals amid growing concern over youth mental health and the need for inclusive, whole-school approaches to wellbeing and achievement.

While there are early indications of positive impact, the overall evidence base remains limited, particularly in the UK context. UK research funders, together with policymakers, have an opportunity to significantly increase the number of high-quality, scalable research projects

located across a range of UK settings. With more of this kind of evidence to hand, better policy decisions on the widespread adoption of NbPs can be made.

However, because the risk of harms from NbPs is relatively low, and the need to protect and to improve young people's MHWB is urgent, policymakers could also decide to widely implement a standardised set of 'evidence-informed' NbPs across UK schools alongside a major funding commitment to conduct research on these NbPs as they unfold in situ. Indeed, the UK already has already committed the resources to pursue such a research agenda, through the National Education Nature Park (Hazell & Clarke, 2024). This set of over 7,500 educational settings offers an opportunity to create a national systematic dataset on NbPs in schools, that can inform future investments and policymaking.

To better inform school leaders and policymakers, future studies should prioritise standardised and clearly defined measures of MHWB, nature connectedness, and academic achievement. Aligning this work with guidance from bodies such as the DfE would enable meaningful comparisons across studies and support the development of more effective interventions. In turn, this would help schools make informed choices about which programmes to adopt.

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