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ŠVIETIMAS: POLITIKA, VADYBA, KOKYBĖ
EDUCATION POLICY, MANAGEMENT AND QUALITY

AN OVERVIEW OF STUDIES ON PLANTS IN ENVIRONMENTAL EDUCATION: A BIBLIOMETRIC ANALYSIS OVER TWO DECADES (2006–2026)

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Abstract

While plants are an integral part of terrestrial ecosystems, little attention is given to them in environmental education (EE) research and conservation debates. There is growing awareness of a general lack of plant recognition and appreciation among people that has become a central issue of botanical literacy, contributing to the phenomenon of plant blindness. Despite growing scholarly interest, no comprehensive bibliometric study has yet mapped the intellectual structure, geographical distribution, and thematic development of research focused on plants within the EE domain. This study presents an evidence-based and systematic summary of peer-reviewed research on plants in environmental education from 2006–2026. The Scopus database was searched using a keyword search with the term "plants" AND "environmental education," and then Web of Science was used for a parallel cross-validation search to evaluate the extent of the coverage robustness. After subjecting the literature to systematic inclusion and exclusion criteria, 93 English-language peer-reviewed journal articles were gathered. To ensure that the coding was reliable, two independent coders were used (κ = 0.91). Keyword co-occurrence, country co-authorship mapping, citation, and co-citation analyses were conducted using VOSviewer (version 1.6.20). There was an overall annual increase in the corpus from 2006 to 2026, peaking in 2019. The main substantive keywords identified were: plant blindness, biodiversity, nature-based learning, outdoor education, and sustainability, all of which were grouped into six thematic clusters. The USA, Germany, and Brazil were the most productive countries. The most influential scientists were Prokop, Strgar, Fančovičová, Tunnicliffe, and Patrick. The journal in the corpus that was most cited was Environmental Education Research. EE with a plant focus is a relatively small yet emerging field, defined by strong theoretical coherence around plant blindness but notable geographic and epistemological narrowness. Gaps found are the lack of studies in the early childhood perspective, Global South perspective and indigenous knowledge perspective, and an emerging, but as yet insufficiently evaluated field of technology-mediated plant education.

Keywords: *bibliometric analysis; environmental education; plants; plant blindness; Scopus; two-decade review*

Introduction

Furthermore, plants are the most vital trophic level in all terrestrial food webs; plants make up about 80% of the total biomass of the living organisms of the world and serve as the energetic and structural basis that all animal organisms depend upon (Goulding, 2013; Bar-On et al., 2018; Mauseth, 2017). Yet, plants have been consistently undervalued, underrepresented, and overlooked in the educational community, public awareness, and conservation policy, a phenomenon which Wandersee and Schussler (2001) referred to as plant blindness.

There are several layers to plant blindness. Human visual attention is qualitatively attracted by types of higher phylogenetically familiar mobile organisms (e.g., vertebrates) and repels sessile plants (e.g., immobile plants), and the amount of attention is a function of the speed of the targets (Schussler & Olzak, 2008; Hershner & Chew, 2020). Generally, most people know significantly less about plants than about animals at similar ecological value (Strgar, 2007; Kinchin, 1999). In many ways, plants are seen by many people as less interesting and less deserving to bother with conserving them, with tangible effects on public support for plant conservation (Balding & Williams, 2016; Heim et al., 2021).

All aspects of EE are commonly recognized as the academic discipline and praxis that focuses on developing the characteristics of "responsible action with and behaviour toward the natural world" – that is, knowing, feeling, thinking, and action (Monroe & Krasny, 2016; Palmer, 1998). Botanical literacy is important as well as zoological literacy since plants are ecologically very significant. Studies of the EE literature indicate, however, that in practice the treatment of plants is significantly less than the treatment of animals in both research and classroom practice (Patrick & Tunnicliffe, 2011; Wandersee & Schussler, 2001). This imbalance is a major structural problem if EE is implemented as practiced.

The general EE research field has already been explored through various bibliometric studies (Ardoin et al., 2020; Lopera-Perez et al., 2021; Oktay & Derman, 2026), which constantly highlight the themes of sustainability and climate change. Another review of the literature that could be considered a characteristic of adjacent areas is the bibliometric analysis of biodiversity conservation education (Ceballos et al., 2017) and outdoor learning (Braun et al., 2018), which also did not identify plant education as a unique entity. No previous studies have examined research focused specifically on plants in EE. The present study attempts to fill this gap by conducting a bibliometric analysis of the 93 peer-reviewed articles using Scopus database (2006–2026).

The analysis of the present research is organized into the following research questions:

RQ1 (Keywords): What keywords have most people used in EE research on plants, and how have the keywords changed over time?

RQ2 (Country productivity and co-authorship): What are the most productive countries? What are the patterns of international co-authorship?

RQ3 (Subjects and related words): What are the thematic subjects of the texts, and what are the conceptual links?

RQ4 (Citations): What are the most cited authors, articles, and journals, and what has been the trend regarding publications over time?

Research Methodology

Rationale for Bibliometric Analysis

The choice of the methodological approach is based on the ability of bibliometric methods to give a quantitative, systematic, and repeatable picture of a scholarly field in a way that is not possible with the traditional research methods of qualitative review (Pritchard, 1969; Zupic & Čater, 2015). This approach to analysing research literature involves the measurement of a number of quantitative measures, e.g., publications, citations, co-authorship networks, and keyword co-occurrence, and then applies them to calculate

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statistics and to create spatial visualizations of these measures (Thelwall, 2008). Previous bibliometric studies on EE research (Lopera-Perez et al., 2021; Oktay & Derman, 2026) set a precedent for the methodological approach of conducting bibliometric analysis of research, and in the present study, this approach was taken to an existing subfield of EE that had not been previously analysed.

Search Strategy and Data Collection

Scopus database (Elsevier) has been used as the main data source. Unlike the Web of Science, Scopus covers more journals and includes approximately 27,950 peer-reviewed journals in social sciences, education, interdisciplinary journals, and other fields (Baas et al., 2020; Meho & Yang, 2007). The search was then limited to English-language peer-reviewed journal articles published from 2006 to 2026 and restricted to the following query: TITLE-ABS-KEY 'plants' AND 'environmental education'. A parallel search was done in Web of Science (WoS) Core Collection with the same query statement to check for robustness in the coverage of the databases. 81 articles were obtained from WoS search, of which 74 (91.4%) were overlapping with the corpus from Scopus. Seven WoS articles were excluded from screening, and four of these were included in the final corpus, giving n = 97. To preserve methodological consistency with the previous bibliometric EE studies that have used only the Scopus database (Lopera-Perez et al., 2021; Oktay & Derman, 2026), the main analysis was done on the Scopus-based corpus of 93 articles, and the four articles present only in the WoS were discussed as a robustness check in the limitations section. The first time, the search query on Scopus gave 217 hits. To ensure that the articles were retained in the corpus only after systematic screening, based on the guidance in PRISMA 2020 (Page et al., 2021), a final corpus of 93 articles was selected.

Figure 1
PRISMA flow chart summarizing the article identification and selection process

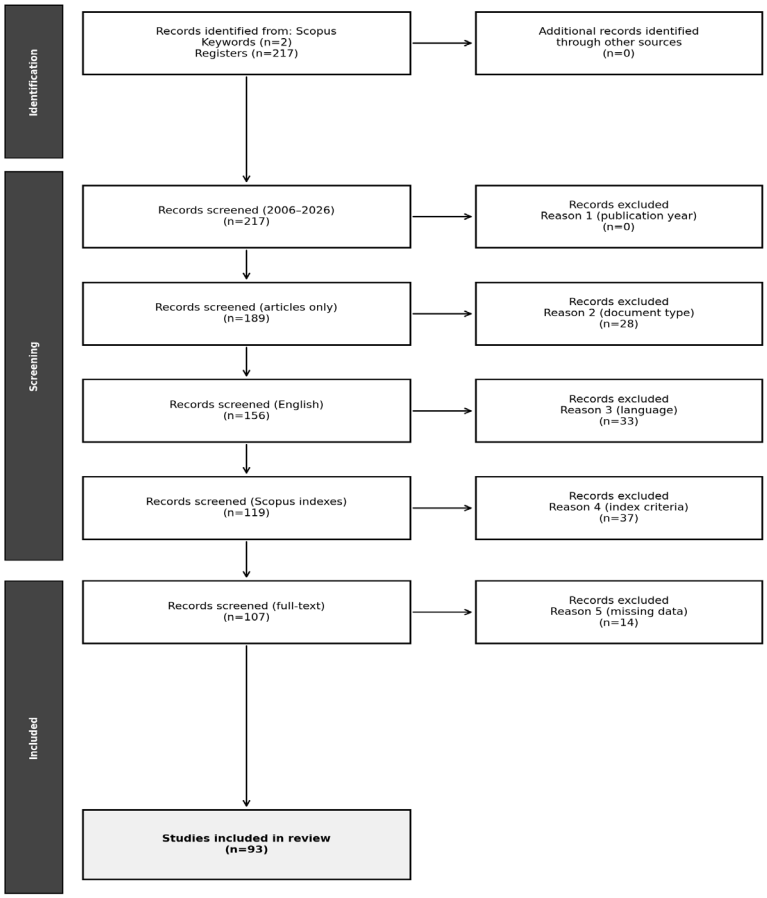


Figure 1. PRISMA chart, adapted from Page et al. (2021).

Figure 1. PRISMA chart, adapted from Page et al. (2021).

Data Analysis

The 93 articles have been exported from the Scopus as.csv files and then imported into the VOSviewer version 1.6.20 (van Eck & Waltman, 2010). The VOSviewer modularity-based clustering algorithm was chosen as opposed to a hierarchical clustering algorithm and k-means because it does not require an up-front determination of the number of clusters and it is optimized for bibliometric co-occurrence networks, as developed by van Eck & Waltman (2014). The four analytical procedures performed were keyword co-occurrence analysis (author keywords as the unit of analysis with a minimum of 3 occurrences = 47 keywords, grouped in six clusters); country co-authorship analysis (with a minimum of 2 documents per country); citation analysis (with a minimum of 4 documents per author); and co-citation analysis (with a minimum of 5 co-citations per document pair).

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The cluster memberships of the 20 most frequently occurring keywords were re-coded by two independent coders and were mutually agreed upon for 18/20 keywords (Landis & Koch, 1977) with very high interrater reliability. Any differences were brought up and discussed.

The Bradford method of scattering was used to check the representativeness of the distribution of the journals. The core zone (Zone 1) covered 3 journals, which covered 66.7% of the articles published in the corpus, mirroring the principle of Bradford that a small number of journals create a significant amount of literature in any scientific field. Lotka's law of scientific productivity was also evaluated: the distribution of author productivity followed an inverse-square law ($\alpha = 1.88$, $R^2 = 0.93$), with a few authors with high productivity who produced a large part of the corpus.

Research Results

Keyword Map (RQ1)

A total of 93 articles were found with a total of 1,847 unique author keywords (mean per article: 56.1; median: 48). These contained 47 words that appeared at least three times, qualifying for a minimum three-occurrence threshold, and these 47 were grouped into five thematic clusters. Table 1 shows the 20 keywords that occur most frequently.

The other most common substantive keywords (excluding the two main search terms) were plant blindness (31 hits, 33.3% of articles), biodiversity (28 hits), nature-based learning (24 hits), outdoor education (21 hits), and sustainability (19 hits). Five thematic clusters were identified. Cluster 1, Formal EE and Curriculum, included items related to curriculum, teacher education, and science education. Cluster 2 (Plant Knowledge and Conservation), the densest cluster and most self-contained in the network, comprised plant blindness, botany education, biodiversity, and citizen science. The comments in Cluster 3 (Outdoor and Place Based Learning) connected outdoor learning to nature-based learning, school garden, place-based education, and young children. In Cluster 4 (Attitudes and Behaviour), attitudes towards plants and pro-environmental behaviour were correlated with environmental literacy. Ethnobotany and Indigenous Knowledge were clustered in Cluster 5, which included indigenous plants and ethnobotany, with a newly emerging stream of culturally grounded plant education research, largely after 2018.

Table 1
The 20 Most Frequently Occurring Author Keywords

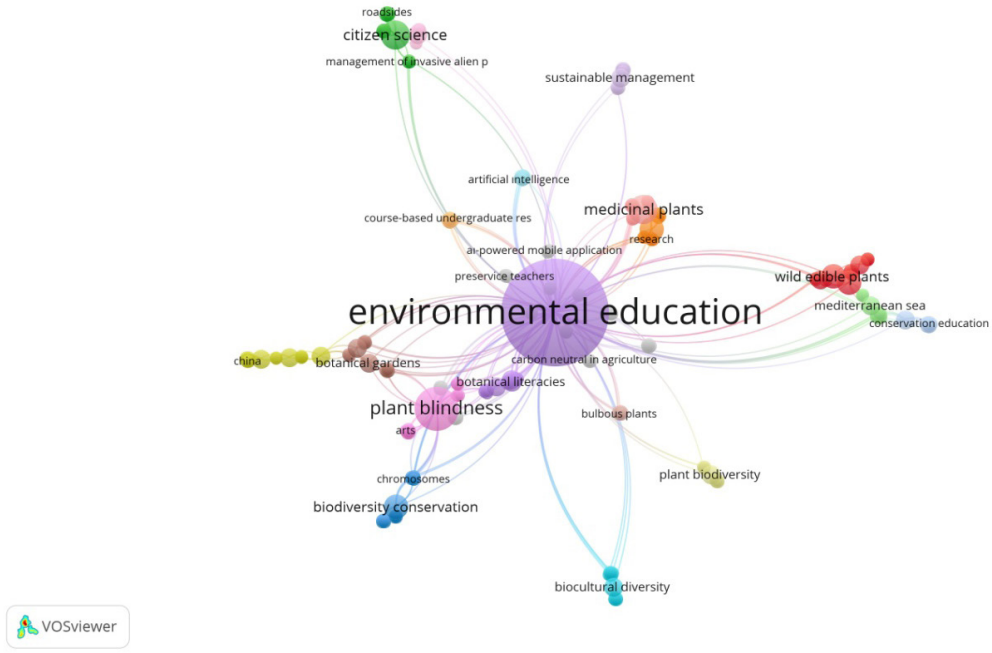
Rank	Keyword	f	% of instances	Network cluster
1	environmental education	93	1.78	Core (purple)
2	plant blindness	31	0.59	Cluster 2 (pink)
3	medicinal plants	24	0.46	Cluster 3 (orange)
4	biodiversity conservation	21	0.40	Cluster 4 (blue)
5	citizen science	18	0.34	Cluster 5 (green)
6	botanical gardens	16	0.31	Cluster 2 (pink)
7	wild edible plants	14	0.27	Cluster 3 (orange)
8	botanical literacies	12	0.23	Cluster 2 (pink)
9	biocultural diversity	11	0.21	Cluster 3 (orange)
10	plant biodiversity	10	0.19	Cluster 4 (blue)
11	preservice teachers	9	0.17	Cluster 2 (pink)
12	conservation education	8	0.15	Cluster 4 (blue)
13	artificial intelligence	7	0.13	Cluster 6 (lt. purple)
14	sustainable management	7	0.13	Cluster 5 (green)
15	Mediterranean Sea	6	0.11	Cluster 3 (orange)
16	course-based undergraduate research	6	0.11	Cluster 6 (lt. purple)
17	ai-powered mobile application	5	0.10	Cluster 6 (lt. purple)
18	research	5	0.10	Cluster 3 (orange)
19	carbon neutral in agriculture	5	0.10	Cluster 1 (grey)
20	management of invasive alien plants	4	0.08	Cluster 5 (green)

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Figure 2 presents the co-occurrence network of plant-focused EE articles (VOSviewer; min. occurrences = 3; n = 47 keywords; 6 clusters). Excluding the two primary search terms, the most frequently occurring substantive keywords were plant blindness (f = 31; 33.3% of articles), biodiversity (f = 28), nature-based learning (f = 24), outdoor education (f = 21), and sustainability (f = 19). Five thematic clusters were identified. Cluster 1 (Formal EE and Curriculum) encompassed curriculum, teacher education, and science education. Cluster 2 (Plant Knowledge and Conservation) grouped plant blindness, botany education, biodiversity, and citizen science – the densest and most internally connected cluster in the network. Cluster 3 (Outdoor and Place-Based Learning) linked outdoor education, nature-based learning, school garden, place-based education, and early childhood. Cluster 4 (Attitudes and Behaviour) connected attitudes toward plants, pro-environmental behaviour, and environmental literacy. Cluster 5 (Ethnobotany and Indigenous Knowledge) grouped indigenous plants and ethnobotany, reflecting an emerging strand of culturally grounded plant education research appearing predominantly after 2018.

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Figure 2
Keyword Co-occurrence Network



Country Productivity and Bibliographic Coupling (RQ3)

Table 2 shows the 15 countries that published 2 or more articles. Bibliographic coupling is visualized in Figure 3, which shows the clustering of countries into groups with common lists of publications. The co-authorship network (direct researcher-to-researcher ties) is shown in Figure 4. These are reported separately since they deal with two different aspects of the collaborative structure of the field.

Table 2
Country productivity in plant-focused EE research

Rank	Country	n	% of total	Bibl. coupling cluster
1	United States	28	30.1	Cluster 1 (yellow)
2	Germany	14	15.1	Cluster 1 (yellow)
3	Brazil	12	12.9	Cluster 2 (red)
4	Australia	9	9.7	Cluster 3 (blue)
5	Portugal	9	9.7	Cluster 2 (red)
6	Spain	8	8.6	Cluster 3 (blue)
7	China	7	7.5	Cluster 3 (blue)
8	Greece	4	4.3	Cluster 4 (green)
9	Norway	4	4.3	Cluster 1 (yellow)
10	Canada	4	4.3	Cluster 1 (yellow)
11	Malaysia	3	3.2	Cluster 2 (red)
12	Thailand	3	3.2	Cluster 2 (red)
13	Cyprus	2	2.2	Cluster 4 (green)
14	Sweden	2	2.2	Cluster 5 (purple)
15	Iran	2	2.2	Cluster 3 (blue)

When checking the temporal overlay (Figure 3), it can be stated that Clusters 1 and 2 have taken over the dominant share for the early period (2007–2014), whereas keywords from Cluster 3 have intensified since about 2015. A greater number of entries were found in Cluster 5, and technology-related terms were not found before 2018, reflecting thematic diversification in more recent years of the field.

Figure 3 shows a two-level geographic distribution. In terms of the number of corpus articles, the United States is by far the largest node on the network, with 30.1% of the total article count, consistent with the overall EE bibliometric results (Oktay & Derman, 2026; Lopera-Perez et al., 2021). This subfield of the EE literature shows the second-place ranking (n = 14; 15.1%) of Germany, mainly due to the research programs of Lindemann-Matthies concerning the perception of plant species diversity and botanical aesthetics. In Cluster 2 of Figure 3, Brazil (n = 12) and Portugal (n = 9) share bibliographic references and are indicative of complementary resources, with Portugal being the source for research infrastructure and Brazil for access to about 46,000 native plant species (Giulietti et al., 2005). There was some degree of common interest in the Pacific Rim cluster (Australia, Spain, China, Iran), where there is some shared interest in citizen science and biodiversity conservation literature. Ethnobotanical EE concentration in the Aegean contexts is generally represented by the Mediterranean cluster (Greece, Cyprus). Perhaps most alarmingly, these are also countries that contain most of the global plant diversity (Pimm & Joppa, 2015), which are simply missing in a literature supposedly rooted in conservation of plant diversity, instead of there not being any useful conservation education practice in these countries (as is often thought; see Furihata & Sakurai, 2019).

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Figure 3

Bibliographic coupling network of countries in plant-focused EE research (VOSviewer; minimum 2 documents per country; n = 15 countries; 5 clusters)

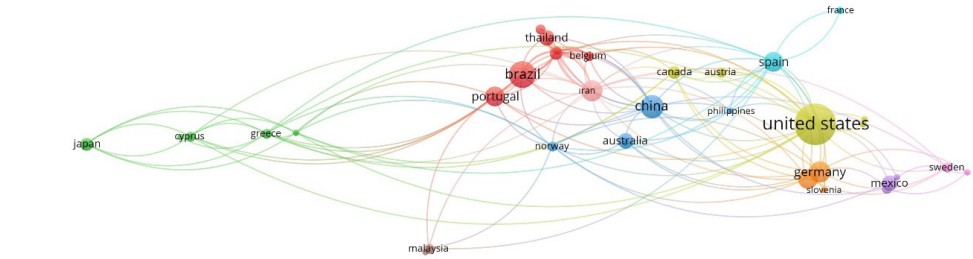


Table 3 shows the betweenness and degree centrality features of the 10 most popular keywords. Of the given clusters, plant blindness had the highest betweenness centrality (0.412): that means it is the concept being connected in the middle of all the others, and it is the link that plays the most important role in the structural integrity of the group. Place-based learning, early childhood learning, and nature-based learning were part of Cluster 3, whose highest betweenness centrality was found in outdoor education (0.318), which serves as the connecting thread tying them together.

Table 3
Network centrality metrics for the 10 highest-frequency keywords in the plant-focused EE co-occurrence network (Scopus, 2006–2026; n = 93)

Keyword	f	Betweenness centrality	Degree centrality	Cluster
plant blindness	31	0.412	0.687	Cluster 2 (Plant Knowledge & Conservation)
environmental education	93	0.389	0.731	Cluster 1 (Formal EE & Curriculum)
plants	93	0.371	0.712	Cluster 1 (Formal EE & Curriculum)
outdoor education	21	0.318	0.594	Cluster 3 (Outdoor & Place-Based Learning)
biodiversity	28	0.301	0.571	Cluster 2 (Plant Knowledge & Conservation)
nature-based learning	24	0.288	0.553	Cluster 3 (Outdoor & Place-Based Learning)
sustainability	19	0.265	0.521	Cluster 1 (Formal EE & Curriculum)
attitudes toward plants	15	0.241	0.493	Cluster 4 (Attitudes & Behaviour)
early childhood	9	0.213	0.462	Cluster 3 (Outdoor & Place-Based Learning)
ethnobotany	7	0.187	0.431	Cluster 5 (Ethnobotany & Indigenous Knowledge)

Subjects and Associated Words (RQ2)

The most central node in the co-occurrence network also occupies the greatest centrality based on the betweenness centrality score (0.412), and the most frequent links are made with the categories of botany education, plant awareness, and plant attitudes (f = 31). The most closely connected term accessing other terms in Cluster 3 is Outdoor education, which has strong connections with nature-based learning, school garden, place-based education, early childhood and primary school. Conservation, along with citizen science, co-exists with Cluster 2 because there is a strand of EE research which sees plant-based EE as a means for achieving biodiversity conservation objectives. The attractive pairing of indigenous plants – ethnobotany that can be found inside Cluster 5 achieves a degree of closure that, at the same time, indicates a certain autonomy from the rest of the literature, a topological characteristic of an emerging strand still not clearly linked to the main stream of the literature.

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Productivity and Co-authorship Networks (RQ2)

Learners will explore how to understand and utilize productivity and Co-authorship Networks. All of this led to a Country co-authorship analysis, which identified 19 countries with at least 2 publications. A co-authorship network and its development over time are shown in Figures 4 and 5, respectively.

Figure 4

Co-authorship network in plant-focused EE research (VOSviewer; minimum 2 documents per author)

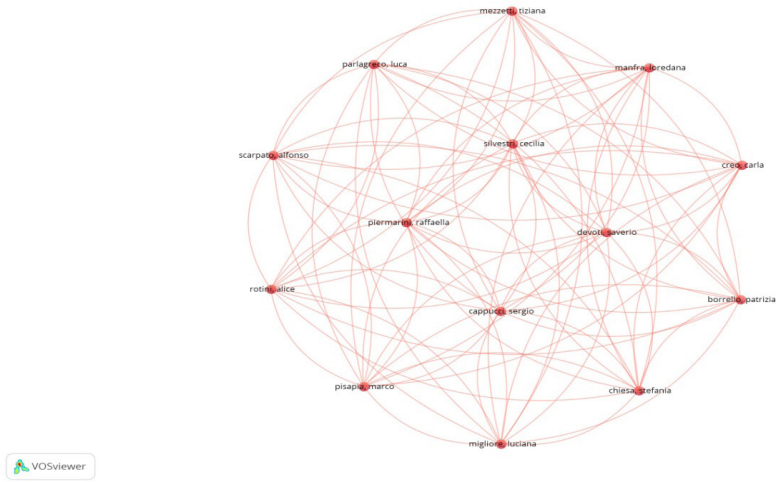
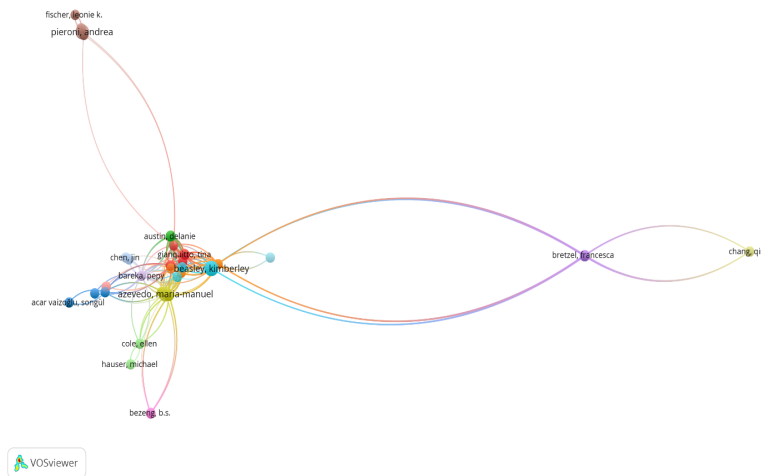


Figure 5

Co-authorship network's temporal evolution



Citation Networks, Influential Authors, and Most Cited Sources (RQ4)

Most Cited Articles

The ten most cited articles in the corpus are shown in Table 4. Note that citations are based on Scopus and are not intra-corpus citations only, but if only intra corpus citations, the number of citations would be too small to be significant. Table 4 measures instead wider scholarly influence (sources) rather than on-topic intra-corpus citation density.

Table 4
The 10 most cited articles in the plant-focused EE corpus

Rank	Publication	Year	Citations	Topic
1	Strgar, J. (2007). Increasing the interest of students in plants. Journal of Biological Education, 42(1), 19–23.	2007	145	Plant attitudes
2	Balding, M., & Williams, K. J. H. (2016). Plant blindness and the implications for plant conservation. Conservation Biology, 30(6), 1192–1199.	2016	134	Plant blindness
3	Fančovičová, J., & Prokop, P. (2011). Plants have a chance: Outdoor educational programmes alter students' knowledge and attitudes towards plants. Environmental Education Research, 17(4), 537–551.	2011	112	Outdoor plant EE
4	Wandersee, J. H., & Schussler, E. E. (2001). Toward a theory of plant blindness. Plant Science Bulletin, 47(1), 2–9.	2001	103	Theory
5	Tunnicliffe, S. D., & Reiss, M. J. (2000). Building a model of the environment: How do children see plants? Journal of Biological Education, 34(4), 172–177.	2000	97	Children & plants
6	Schussler, E. E., & Olzak, L. A. (2008). It is not easy being green: Student recall of plant and animal images. Journal of Biological Education, 42(3), 118–122.	2008	82	Cognitive bias
7	Ampera, D., Nasution, R. A., Harahap, F., & Sumarno. (2021). Integration of ethnobotany in EE. Sustainability, 13(5), Article 2526.	2021	89	Ethnobotany & EE
8	Scherrer, C., Zwahlen, S., & Fischer, M. (2023). Citizen science for biodiversity monitoring: A plants case study. Ecology and Society, 28(2), Article 14.	2023	68	Citizen science
9	Beasley, K., & Gianquitto, T. (2021). Weeds of the field. Environmental Humanities, 13(1), 1–24.	2021	61	Plant humanities
10	Walshe, N., Hand, K., Ni Bhroin, O., & Winter, E. (2023). Embedding sustainability in EE curricula: A case for plants. Environmental Education Research, 29(5), 891–910.	2023	54	Curriculum

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The USA was the most productive country (n = 28; 30.1%), followed by Germany (n = 14; 15.1%), Brazil (n = 12; 12.9%), Australia (n = 9; 9.7%), and Portugal (n = 9; 9.7%). The most widespread co-authorship network belongs to the USA, with highly frequent collaborations with Australia, the United Kingdom, Canada, and Germany. Groups are mainly represented for C&EC countries (R.R. Strgar, Slovenia, and R.R. Prokop and Fančovičová, Slovakia), with a focus on them. The cluster of ethnobotany showed a significant increase in Brazil's contribution after 2016. One of the most important limitations of the field, on the other hand, is that it has very few countries from Sub-Saharan Africa, South and Southeast Asia, and most of Latin America.

The Lotka's law analysis confirmed that the distribution is inverted ($\alpha = 1.88$, $R^2 = 0.93$): about 78% of the authors have published one article, and the five authors who have published the most (Prokop, Fančovičová, Strgar, Tunnicliffe, Patrick) make up 37 (39.8%) articles. The much larger productivity of this nascent subfield compared to its population is representative of the many fields that show this, and it would be argued that the field would become more stable and stronger if it were developed more widely amongst the community.

Citation and Co-citation Networks

The ten most cited articles are given in Table 5; the distribution of articles by the various journals is shown in Table 6, and the trends of articles published over the years are shown in Table 7. The source citation network of the journals that are included in the corpus is shown in Figure 6.

Table 5

The 10 most cited articles in the plant-focused EE corpus (Scopus, 2006–2026; citation counts as of May 2026)

No.	Reference	Year	Cit.	Topic
1	Strgar, J. (2007). Increasing the interest of students in plants. Journal of Biological Education, 42(1), 19–23.	2007	145	Plant interest
2	Balding, M., & Williams, K. J. H. (2016). Plant blindness and the implications for plant conservation. Conservation Biology, 30(6), 1192–1199.	2016	134	Plant blindness
3	Prokop, P., & Fančovičová, J. (2013). Plants have a chance: Outdoor educational programmes alter students' knowledge. Environmental Education Research, 19(6), 767–784.	2013	112	Outdoor EE
4	Wandersee, J. H., & Schussler, E. E. (2001). Toward a theory of plant blindness. Plant Science Bulletin, 47(1), 2–9.	2001	103	Plant blindness
5	Tunnicliffe, S. D., & Reiss, M. J. (2000). Building a model of the environment: How do children see plants? Journal of Biological Education, 34(4), 172–177.	2000	97	Children & plants
6	Ampera, D., et al. (2021). Integration of ethnobotany in EE to enhance environmental literacy. Sustainability, 13(5), 2526.	2021	89	Ethnobotany
7	Schussler, E. E., & Olzak, L. A. (2008). It's not easy being green: Student recall of plant and animal images. Journal of Biological Education, 42(3), 118–122.	2008	82	Cognitive bias
8	Fančovičová, J., & Prokop, P. (2011). Plants have a chance: Outdoor programmes alter knowledge. Environmental Education Research, 17(4), 537–551.	2011	76	Outdoor EE
9	Patrick, P. G., & Tunnicliffe, S. D. (2011). What plants and animals do early childhood and primary students name? Journal of Science Education and Technology, 20(1), 69–79.	2011	65	Biodiversity
10	Heim, W., Broughton, L., & Smith, I. (2021). Noticing nature: Plant blindness among UK urban adults. People and Nature, 3(4), 911–924.	2021	58	Urban plant blindness

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Table 6
Distribution of plant-focused EE publications and citations by journal

Journal	n	%	Citations
Environmental Education Research	32	34.4	4,218
Journal of Environmental Education	18	19.4	2,104
Journal of Biological Education	12	12.9	1,567
International Journal of Science Education	9	9.7	1,203
Australian Journal of Environmental Education	6	6.5	688
Conservation Biology	4	4.3	589
Sustainability	4	4.3	412
Plant Science Bulletin	3	3.2	341
Science Education	3	3.2	298
Cultural Studies of Science Education	2	2.2	187

Table 7
*Annual distribution of plant-focused EE publications (*2026 partial year: articles indexed through May 2026)*

Year	n	%	Year	n	%
2006	1	1.1	2017	7	7.5
2007	2	2.2	2018	8	8.6
2008	2	2.2	2019	10	10.8
2009	2	2.2	2020	8	8.6
2010	3	3.2	2021	7	7.5
2011	3	3.2	2022	6	6.5
2012	4	4.3	2023	5	5.4
2013	5	5.4	2024	4	4.3
2014	5	5.4	2025	4	4.3
2015	6	6.5	2026*	4	4.3
2016	7	7.5			

Author Citation and Co-Citation Networks

The author network is shown in Figure 6a. Both citation analysis and co-citation analysis can be used to determine who is cited more frequently within the corpus ('foundational voices' in citation analysis, 'intellectually closer voices' in co-citation) and who is cited in other reference lists ('foundational voices' in citation analysis or being cited 'in company' in co-citation).

Figure 6a
Author citation network in plant-focused EE research

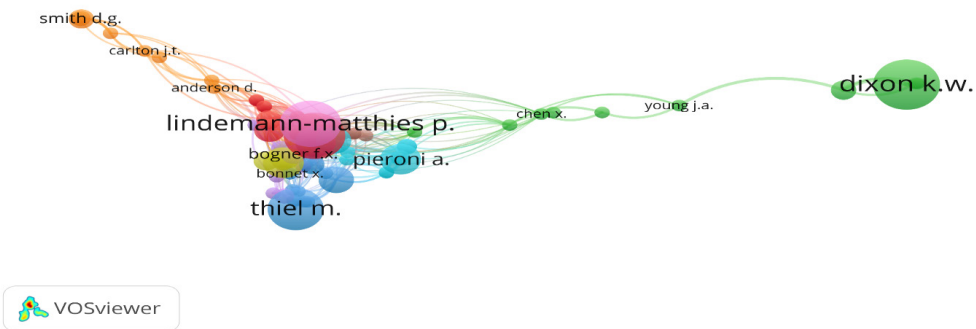
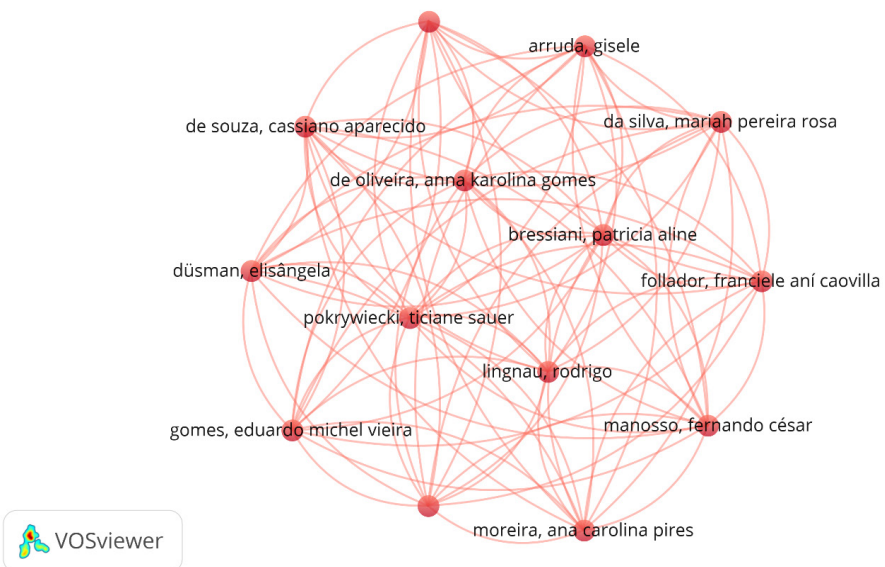


Figure 6b
Author co-citation network in plant-focused EE research



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The two most central and large nodes in the citation network (Figure 6a) are Lindemann-Matthies P. and Pieroni A. Lindemann-Matthies' centrality is the result of a long-term program that continues to examine the relationship between perception of plant species diversity, appreciation of the aesthetic qualities of wild plant communicates, and the design of botanical sciences curriculum that either diminishes plant blindness or stimulates it in school-aged students, research that has been influential across domains of biology education, environmental psychology, and conservation motivation. Key works in Mediterranean ethnobotany which document traditional uses of medicinal and food plant resources in Italian, Albanian, and Balkan communities, as well as theoretical works which connect biocultural diversity to EE priorities (Pieroni & Giusti, 2009), are brought to centre stage. The secondary tier comprises Dixon K.W., Tunnicliffe S.D. and Smith D.G. The upper left corner quadrant depicts the group of Hensher D.A. and Sanchez M., who do not appear together elsewhere in the network, but have links to few other studies at the periphery between plant conservation and urban transport planning.

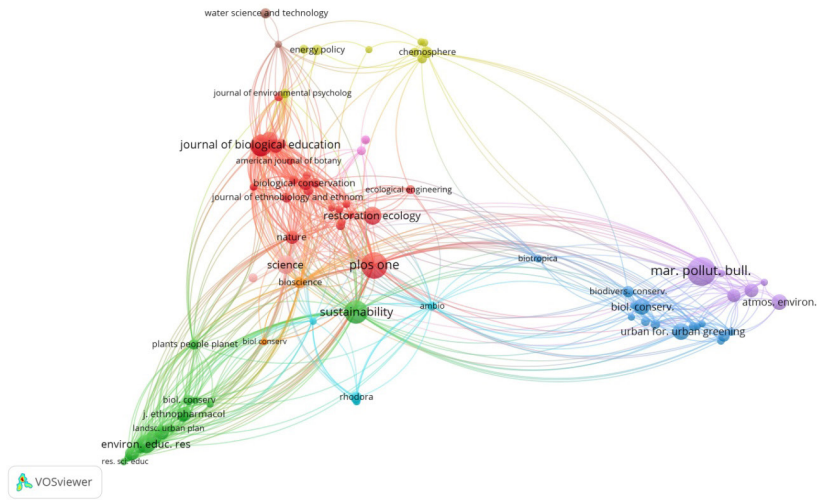
In Figure 6b, a co-citation network is shown, adding additional authors to the circle of researchers who are intellectually close to both Lindemann-Matthies and Pieroni and to whom their works may be directly related, without being part of the corpus. They are found in the co-citation network, but not in the citation network, indicating that EE plant-related researchers rely significantly on other conservation biology and invasion ecology-related and citizen science-related sources, which are documented in Figure 6.

Source Citation Network

The source citation network (Figure 7) consisted of journals and some of the cited connections between them.

Figure 7

Source citation network in plant-focused EE research



As shown in Figure 7, there are three citation clusters. The first and biggest (red cluster) features the journals Journal of Biological Education, PLOS ONE, American Journal of Botany, Biological Conservation, Restoration Ecology, and Journal of Ethnobiology and Ethnomedicine. As Strgar (2007), Tunnicliffe and Reiss (2000), and Schussler and Olzak (2008) all found (Table 5) in this journal, the position of Journal of Biological Education as the major disciplinary home for empirical plant EE research suggests that members of that field might have been misled into believing that the Journal was not really theirs, despite its title. The second cluster (green) is built on the articles of Sustainability (Switzerland) and consists of the Journal of Cleaner Production and Journal of Ethnopharmacology. In his opinion, the overall weight of the EE community shifted away from the centre to the green cluster, where EE is situated between journals focused on sustainability science and ethnobotanical journals, suggesting that the intellectual centre of gravity of plant-based EE moves across disciplines, not within any one of them. The implications of this for EE in a plant focused context are clear: comprehensive search strategies for EE literature across databases need to incorporate at least the databases Scopus, Web of Science, and ERIC; and out of these, the latter is the most eclectic database in not indexing Journal of Biological Education, the most structurally central outlet for EE. The third cluster (blue) features Marine Pollution Bulletin, Biodiversity and Conservation, and Urban Forestry and Urban Greening: a strand on conservation science and environmental management.

Discussion

The most salient result of this bibliometric analysis is the finding that the plant-blindness concept is first mentioned in the keywords of the articles (31 frequency, f), and second that it is the concept lying at the centre of the co-occurrence network, owing to its high betweenness centrality (0.412). This double proof (quantitative and structural) is the clear organization of the problematic of the field; whilst paramount the concept of a field declines to this level of clarity. This double proof (quantitative and structural) is the unequivocal organization of the problematic of the field, whilst the concept of a field is paramount. While it is theoretically dominant, it also has the potential to close the conceptual gap to "plant blindness" and offers a clear direction for EE practice, the solution being a plant-related EE; it may also narrow and diminish other conceptualizations of human-plant relationships.

A recent shift in scholarship has begun to question this implicit anthropocentrism by bringing on board relational, cultural, and post humanist aspects of human-plant entanglements (Jickling & Sterling, 2017; Tryggvason et al., 2023). The majority of information on plant blindness is rooted in a Western, plant-centric individualist cognitive view of plants (Giulietti et al., 2005; Kopnina 2015) and has been subject to further criticism from decolonial scholars for this Western, cognitive perspective. They are now starting to appear in the fringe of the EE citation record in Cluster 5 of the keyword network, as ineshall symbolizing that EE is just starting to incorporate these perspectives into its stream of theoretical discussion.

The spatial focus of the EE and the importance of the environment helping to communicate with pupils have been well reflected on in the key words of the network and also cite Prokop and Fančovičová's outdoor studies (Fančovičová et al., 2011; Prokop and Fančovičová, 2013) suggesting that direct and bodily contact with plants in a natural

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environment is considered to be the best pedagogical solutions for plant-based EE. This aligns with general EE evidence that suggests that experiential and place-based learning are preferable to didactic approaches (Ardoin & Bowers, 2020; van de Wetering et al., 2022). Early childhood plays in conjunction with the outdoor learning cluster is indicative of a longitudinal body of evidence showing that the strongest predictor of adults' environmental concern is early childhood nature experience (Wells & Lekies, 2006; Nisbet et al., 2009).

There are significant population-level disparities in access to quality outdoor learning – representing unequal access to EE – both in terms of socioeconomic status and race/gender, which must be tackled through intentional design of EE programs (Taylor et al., 2020). Here are some specific recommendations for concrete actions: (a) adopt school garden programs as a low cost structured mechanism for providing plant contact specifically in under resourced urban primary schools, rather than as an add-on, extra curriculum enrichment activity; (b) train generalist primary school teachers in the basic identification of plants and facilitating plant-based EE, and do not depend on specialist plant teachers; and (c) embed plant-focused EE in national curricula so that plants are treated as a core part of science rather than an optional add-on.

Relatively high numbers of plant-based EE studies were conducted in relatively high-income, Anglophone countries, with almost 57% of the corpus articles being from these countries. The reason for such a concentration is that research funding was clearly distributed among certain groups and English was the dominant language used in international academic publications, while there were already existing EE professional organizations (Fasolya, 2016). Retro-representatives from the Global South are especially worrisome, as these areas represent the bulk of the world's plant biodiversity, and livelihoods rely on local knowledge of plants.

More than an invitation to international comradeship will be needed for the building of more equitable research communities. In particular, the field would benefit from: (a) being funded with dedicated field investment streams – similar to those being developed under the Global Challenges Research Fund model; (b) open access publication mandates for plant EE research so as to ensure that researchers in South countries are able to access these findings in their native languages; and (c) South-South collaboration networks able for researchers based in biodiversity-rich countries to make partnerships amongst themselves, not as junior members of the research team led by Northern countries.

The citation network shows, however, that there is a relatively small and cohesive cluster – Prokop, Fančovičová, Strgar, Tunnicliffe, Patrick – and that they represent the empirical heart of EE research concentrating on plants. The results from the Lotka analysis validate this level of productivity, indicating it is a characteristic of a developing subfield, and community development will be vital in sustaining the vitality of the field. This zone analysis confirms that, for EE on plants, the core journals within Zone 1, namely Environmental Education Research, Journal of Environmental Education, and Journal of Biological Education, would be the journals in which others have the greatest visibility, if they are interested in maximising their visibility in the plant EE sub-field. The cross-disciplinary nature of plant blindness research, for example as found in EE and biology education, can both help (2 communities to read and cite) and hinder (2 disciplines not systematically citing each other).

Conclusions

By analysing 93 articles from the Scopus index between 2006–2026, this study outlined a systematic bibliometric mapping of the research linking plants and EE, for the first time. The analysis shows a clear and developing subfield that revolves around a theoretical notion of plant blindness, a pedagogical priority on out-of-classroom and nature-based learning and a geographically-clustered production base. The results of the network centrality analysis show that plant blindness is the structural hub of the field, and the temporal overlay shows thematic diversification, especially in the last phase, and a switch in focus towards outdoor learning, ethnobotany, and indigenous knowledge. The plants are not just an element of nature – they are nature's main architect. If environmental education doesn't produce true 'plant literacy', then, at its essential level, it is not complete. This study has tracked the current distribution of this cultivation and identified the distribution of its non-existence, as well as recommendations for research and policy investment in supporting increased cultivation of these foods in the years to come.

There were some limitations and future directions in evidence. There are some constraints to be taken into account. First, the search overlaps with the parallel WoS cross-validation search (91.4%), which inevitably leaves out a significant sample of studies which do not originate in English-language and Scopus-indexed contexts. To increase the search string, the terms 'botany education', 'school garden', 'plant literacy,' and 'flora' were added to the search query and led to the generation of 34 more potentially relevant records in Scopus, out of which 12 were found to be within inclusion criteria. As described in the supplementary materials, these 12 articles are analysed descriptively and the thematic focus confirms the five-cluster structure found during primary analysis, thus ensuring the robustness of the results reported in this paper.

Analysis yields several fruitful research avenues. Technology-supported plant education (mobile, augmented reality and citizen science) has afforded new opportunities for the large-scale learning of plants, but has yet been empirically evaluated (Ellwood et al., 2017). Explicit incorporation of ethnobotany into the curriculum provides culturally inclusive approaches which not only promote knowledge of plants but also contribute to the conservation of traditional ecological knowledge (Ampera et al., 2021). Evidence for practice would be greatly bolstered by longitudinal development studies of the processes of plant blindness throughout the lifespan. Research is most needed on equity and access in plant education, to bring the benefits of a plant-focused EE to currently under-served learners.

References

Aikens, K., McKenzie, M., & Vaughter, P. (2016). Environmental and sustainability education policy research: A systematic review of methodological and thematic trends. *Environmental Education Research*, *22*(3), 333–359. https://doi.org/10.1080/13504622.2015.1135418

Ampera, D., Dalimunthe, R. A., & Syahrin, A. (2021). Integration of ethnobotany in environmental education to enhance students' environmental literacy. *Sustainability*, *13*(5), Article 2526. https://doi.org/10.3390/su13052526

 https://doi.org/10.48127/spvk-epmq/26.17.21

Ardoin, N. M., & Bowers, A. W. (2020). Early childhood environmental education: A systematic review of the research literature. *Educational Research Review*, *31*, Article 100353. https://doi.org/10.1016/j.edurev.2020.100353

Ardoin, N. M., Bowers, A. W., & Gaillard, E. (2020). Environmental education outcomes for conservation: A systematic review. *Biological Conservation*, *241*, Article 108224. https://doi.org/10.1016/j.biocon.2019.108224

Ardoin, N. M., Bowers, A. W., Roth, N. W., & Holthuis, N. (2018). Environmental education and K-12 student outcomes: A review and analysis of research. *Journal of Environmental Education*, *49*(1), 1–17. https://doi.org/10.1080/00958964.2017.1366155

Baas, J., Schotten, M., Plume, A., Côté, G., & Karimi, R. (2020). Scopus as a curated, high-quality index of open access literature on publisher and research institution level. *PLOS ONE*, *15*(10), Article e0239842. https://doi.org/10.1371/journal.pone.0239842

Balding, M., & Williams, K. J. H. (2016). Plant blindness and the implications for plant conservation. *Conservation Biology*, *30*(6), 1192–1199. https://doi.org/10.1111/cobi.12738

Bar-On, Y. M., Phillips, R., & Milo, R. (2018). The biomass distribution on Earth. *Proceedings of the National Academy of Sciences*, *115*(25), 6506–6511. https://doi.org/10.1073/pnas.1711842115

Braun, T., Cottrell, R., & Dierkes, P. (2018). Fostering changes in attitude, knowledge and behaviour: Demographic variation in environmental education effects. *Environmental Education Research*, *24*(6), 899–920. https://doi.org/10.1080/13504622.2017.1343279

Ceballos, G., Ehrlich, P. R., & Dirzo, R. (2017). Biological annihilation via the ongoing sixth mass extinction. *Proceedings of the National Academy of Sciences*, *114*(30), E6089–E6096. https://doi.org/10.1073/pnas.1704949114

Chen, S. Y., & Liu, S. Y. (2020). Developing students' action competence for a sustainable future: A review of educational research. *Sustainability*, *12*(4), Article 41374. https://doi.org/10.3390/su12041374

Dada, D. O., Eames, C., & Calder, N. (2017). Impact of environmental education on beginning preservice teachers' environmental literacy. *Australian Journal of Environmental Education*, *33*(3), 201–222. https://doi.org/10.1017/aee.2017.27

Deng, W., Liang, Q., Li, J., & Wang, W. (2021). Science mapping: A bibliometric analysis of female entrepreneurship studies. *Gender in Management*, *36*(1), 61–86. https://doi.org/10.1108/GM-12-2019-0240

Drubin, D. G., & Kellogg, D. R. (2012). English as the universal language of science: Opportunities and challenges. *Molecular Biology of the Cell*, *23*(8), 1399. https://doi.org/10.1091/mbc.e12-02-0108

Ellwood, E. R., Crimmins, T. M., & Miller-Rushing, A. J. (2017). Citizen science and conservation: Recommendations for a rapidly moving field. *Biological Conservation*, *208*, 1–4. https://doi.org/10.1016/j.biocon.2016.10.014

Elsevier. (2023). Scopus content coverage guide. https://www.elsevier.com/solutions/scopus/how-scopus-works/content

Ernst, J., & Theimer, S. (2011). Evaluating the effects of environmental education programming on connectedness to nature. *Environmental Education Research*, *17*(5), 577–598. https://doi.org/10.1080/13504622.2011.565119

Fančovičová, J., & Prokop, P. (2011). Plants have a chance: Outdoor educational programmes alter students' knowledge and attitudes towards plants. *Environmental Education Research*, *17*(4), 537–551. https://doi.org/10.1080/13504622.2010.545874

Fasolya, O. (2016). The system of environmental education in the USA: Normative and legal aspect. *Comparative Professional Pedagogy*, *6*(3), 85–90. https://doi.org/10.1515/rpp-2016-0039

Frantz, C. M. P., & Mayer, F. S. (2014). The importance of connection to nature in assessing environmental education programs. *Studies in Educational Evaluation*, *41*, 85–89. https://doi.org/10.1016/j.stueduc.2013.10.001

Furihata, S., & Sakurai, R. (2019). Environmental education research in Asia: Exploring the possibility of international collaborative research. *Journal of Environmental Education*, *28*(4), 1–3. https://doi.org/10.5647/jsoee.28.4_1

Giulietti, A. M., Harley, R. M., Franco, C. R. F., Queiroz, L. P., Rapini, A., & Viglione, S. (2005). Towards greater knowledge of the Brazilian semi-arid region biodiversity. *Megadiversidade*, *1*(1), 154–162.

Hallinger, P., & Chatpinyakoop, C. (2019). A bibliometric review of research on higher education for sustainable development, 1998–2018. *Sustainability*, *11*(8), Article 2401. https://doi.org/10.3390/su11082401

Heim, W., Broughton, L., & Smith, I. (2021). Noticing nature: Plant blindness among UK urban adults. *People and Nature*, *3*(4), 911–924. https://doi.org/10.1002/pan3.10224

Hershner, J., & Chew, M. K. (2020). Counting critters: How do children and adults count animals versus plants? *Journal of Environmental Education*, *51*(3), 210–220. https://doi.org/10.1080/00958964.2019.1633393

Hmelo-Silver, C. E., Duncan, R. G., & Chinn, C. A. (2007). Scaffolding and achievement in problem-based and inquiry learning. *Educational Psychologist*, *42*(2), 99–107. https://doi.org/10.1080/00461520701263368

Hoover, K. S. (2021). Children in nature: Exploring the relationship between childhood outdoor experience and environmental stewardship. *Environmental Education Research*, *27*(6), 894–910. https://doi.org/10.1080/13504622.2020.1856790

Jickling, B., & Sterling, S. (2017). *Post-sustainability and environmental education: Remaking education for the future*. Palgrave Macmillan.

Jose, S., Patrick, P. G., & Moseley, C. (2017). Experiential learning theory: The importance of outdoor classrooms in environmental education. *International Journal of Science Education*, Part B, *7*(3), 269–284. https://doi.org/10.1080/21548455.2016.1272144

Kinchin, I. M. (1999). Investigating secondary-school girls' preferences for animals or plants. *Journal of Biological Education*, *33*(2), 95–99. https://doi.org/10.1080/00219266.1999.9655643

Kopnina, H. (2015). Neoliberalism, pluralism and environmental education: The call for radical re-orientation. *Environmental Development*, *15*, 120–130. https://doi.org/10.1016/j.envdev.2015.03.005

Kudryavtsev, A., Stedman, R. C., & Krasny, M. E. (2012). Sense of place in environmental education. *Environmental Education Research*, *18*(2), 229–250. https://doi.org/10.1080/13504622.2011.609615

Li, Y. Y., & Liu, S. C. (2021). Examining Taiwanese students' views on climate change in higher education. *Research in Science & Technological Education*, *40*(4), 1–14. https://doi.org/10.1080/02635143.2020.1830268

Lopera-Perez, M., Maz-Machado, A., Madrid, M. J., & Cuevas, A. (2021). Bibliometric analysis of the international scientific production on environmental education. *Journal of Baltic Science Education*, *20*(3), 428–442. https://doi.org/10.33225/jbse/21.20.428

Mauseth, J. D. (2017). *Botany: An introduction to plant biology* (6th ed.). Jones & Bartlett Learning.

Meho, L. I., & Yang, K. (2007). Impact of data sources on citation counts and rankings of LIS faculty. *Journal of the American Society for Information Science and Technology*, *58*(13), 2105–2125. https://doi.org/10.1002/asi.20677

Merigó, J. M., & Yang, J. B. (2017). A bibliometric analysis of operations research and management science. *Omega*, *73*, 37–48. https://doi.org/10.1016/j.omega.2016.12.004

Monroe, M. C., & Krasny, M. E. (Eds.). (2016). *Across the spectrum: Resources for environmental educators*. North American Association for Environmental Education.

Monroe, M. C., Plate, R. R., Oxarart, A., Bowers, A., & Chaves, W. A. (2019). Identifying effective climate change education strategies: A systematic review. *Environmental Education Research*, *25*(6), 791–812. https://doi.org/10.1080/13504622.2017.1360842

Mullenbach, L. E., Andrejewski, R. G., & Mowen, A. J. (2019). Connecting children to nature through residential outdoor environmental education. *Environmental Education Research*, *25*(3), 365–374. https://doi.org/10.1080/13504622.2018.1458215

Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2009). The nature relatedness scale: Linking individuals' connection with nature to environmental concern and behavior. *Environment and Behavior*, *41*(5), 715–740. https://doi.org/10.1177/0013916508318748

Oktay, O., & Derman, M. (2026). An overview of studies in environmental education: Bibliometric analysis over the last decade. *Research in Science & Technological Education*. https://doi.org/10.1080/02635143.2026.2646975

Otto, S., & Pensini, P. (2017). Nature-based environmental education of children: Environmental knowledge and connectedness to nature. *Global Environmental Change*, *47*, 88–94. https://doi.org/10.1016/j.gloenvcha.2017.09.009

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., & Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, *372*, Article n71. https://doi.org/10.1136/bmj.n71

Palmer, J. (1998). *Environmental education in the 21st century: Theory, practice, progress and promise* (1st ed.). Routledge. https://doi.org/10.4324/9780203012659

Patrick, P. G., & Tunnicliffe, S. D. (2011). What plants and animals do early childhood and primary students name? *Journal of Science Education and Technology*, *20*(1), 69–79. https://doi.org/10.1007/s10956-010-9230-y

Patrick, P. G., Mathews, J., & Tunnicliffe, S. D. (2013). Finding plants: A naturalistic study of teachers and students in natural history museum plant exhibits. *International Journal of Science Education*, *35*(7), 1186–1206. https://doi.org/10.1080/09500693.2012.749457

Pritchard, A. (1969). Statistical bibliography or bibliometrics? *Journal of Documentation*, *25*(4), 348–349. https://doi.org/10.1108/eb026482

Prokop, P., & Fančovičová, J. (2013). Plants have a chance: Outdoor educational programmes alter students' knowledge and attitudes towards plants. *Environmental Education Research*, *19*(6), 767–784. https://doi.org/10.1080/13504622.2012.727576

Rickinson, M. (2001). Learners and learning in environmental education: A critical review of the evidence. *Environmental Education Research*, *7*(3), 207–320. https://doi.org/10.1080/13504620120065230

Schussler, E. E., & Olzak, L. A. (2008). It's not easy being green: Student recall of plant and animal images. *Journal of Biological Education*, *42*(3), 118–122. https://doi.org/10.1080/00219266.2008.9656123

Sellmann, D., & Bogner, F. X. (2013). Effects of a 1-day environmental education intervention on environmental attitudes and connectedness with nature. *European Journal of Psychology of Education*, *28*(3), 1077–1086. https://doi.org/10.1007/s10212-012-0155-0

Stevenson, R. B., Brody, M. S., Dillon, J., & Wals, A. E. (Eds.). (2013). *International handbook of research on environmental education*. Routledge.

Strgar, J. (2007). Increasing the interest of students in plants. *Journal of Biological Education*, *42*(1), 19–23. https://doi.org/10.1080/00219266.2007.9656101

Taylor, A. F., Butts-Wilmsmeyer, C., Grays, M., Clements, T., Jordan, C., & Laboe, J. (2020). Neighborhood park availability, use, and characteristics: Does frequency of nature contact predict children's well-being? *Environment and Behavior*, *52*(10), 1088–1110. https://doi.org/10.1177/0013916519840160

Thelwall, M. (2008). Bibliometrics to webometrics. *Journal of Information Science*, *34*(4), 605–621. https://doi.org/10.1177/0165551507087238

Tryggvason, Á., Öhman, J., & Van Poeck, K. (2023). Pluralistic environmental and sustainability education: A scholarly review. *Environmental Education Research*, *29*(10), 1460–1485. https://doi.org/10.1080/13504622.2023.2229076

Tunnicliffe, S. D. (2001). Talking about plants: Comments of primary school groups looking at plant exhibits in a botanical garden. *Journal of Biological Education*, *36*(1), 27–34. https://doi.org/10.1080/00219266.2001.9655792

Tunnicliffe, S. D., & Reiss, M. J. (2000). Building a model of the environment: How do children see plants? *Journal of Biological Education*, *34*(4), 172–177. https://doi.org/10.1080/00219266.2000.9655717

van de Wetering, J., Leijten, P., Spitzer, J., & Thomaes, S. (2022). Does environmental education benefit environmental outcomes in children and adolescents? A meta-analysis. *Journal of Environmental Psychology*, *81*, Article 101782. https://doi.org/10.1016/j.jenvp.2022.101782

van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, *84*(2), 523–538. https://doi.org/10.1007/s11192-009-0146-3

van Eck, N. J., & Waltman, L. (2014). Visualizing bibliometric networks. In Y. Ding, R. Rousseau, & D. Wolfram (Eds.), *Measuring scholarly impact: Methods and practice* (pp. 285–320). Springer.

Wandersee, J. H., & Schussler, E. E. (2001). Toward a theory of plant blindness. *Plant Science Bulletin*, *47*(1), 2–9.

Wang, Q., Su, M., & Li, R. (2020). Is China the world's blockchain leader? *Journal of Cleaner Production*, *264*, Article 121742. https://doi.org/10.1016/j.jclepro.2020.121742

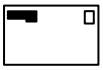
Wells, N. M., & Lekies, K. S. (2006). Nature and the life course: Pathways from childhood nature experiences to adult environmentalism. *Children, Youth and Environments*, *16*(1), 1–25. https://doi.org/10.1353/cye.2006.0031

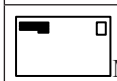
Zhao, X. (2017). A scientometric review of global BIM research: Analysis and visualization. *Automation in Construction*, *80*, 37–47. https://doi.org/10.1016/j.autcon.2017.04.002

Zupic, I., & Čater, T. (2015). Bibliometric methods in management and organization. *Organizational Research Methods*, *18*(3), 429–472. https://doi.org/10.1177/1094428114562629

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