

Item number	Section/sub-section	Topic	Description	Further explanation	Checklist /meta-data	Author response
1	Title	Title	The title must indicate that it is a systematic review, and should indicate if it is an update/amendment: e.g. "...A systematic review update."	The title should normally be the same or very similar to the review question.	Meta-data	The effects of shade tree species richness and functional composition on soil nutrients in cocoa agroforestry systems: A systematic review and meta-analysis
2	Type of review	Type of review	Select one of the following types of review: systematic review, systematic review update, systematic review amendment, systematic review from a systematic map	See CEE Guidance on amendments and updates [1]	Meta-data	systematic review
3	Authors' contacts	Authors' contacts	The full names, institutional addresses and email addresses for all authors must be provided.		Checklist	Yes
4	Abstract	Structured summary	The abstract of the manuscript must not exceed 500 words and must be structured into separate sections: Background, the context and purpose of the review, including the review question; Methods, how the review was performed and statistical tests used (specifically mention search strategy, inclusion criteria, critical appraisal, data extraction and synthesis); Results, the main findings, including results of search and assessment of evidence base; Conclusions, brief summary and		Checklist	Yes

			potential implications for policy/management and research.			
5	Background	Background	Describe the rationale for the review in the context of what is already known. Reviews must indicate why this study was necessary and what it aims to contribute to the field.	A theory of change and/or conceptual model should be presented that links the intervention or exposure to the outcome.	Checklist	Yes
6	Stakeholder engagement	Stakeholder engagement	The actual role of stakeholders throughout the review process (e.g. in the formulation of the question) must be described and explained (using a broad definition of ‘stakeholder’, including e.g. researchers, funders and other decision-makers; see [2])		Checklist	Yes
7	Objective of the review	Objective	Describe the primary question and secondary questions (when applicable).	The primary question is the main question of the review. The secondary questions are usually linked to sources of heterogeneity (effect modifiers).	Checklist	Yes
8		Definition of the question components	Provide reference to the question key elements, e.g. population(s), intervention(s)/exposure(s), comparator(s), and outcome(s).	For other question types see [3,4]	Meta-data	Population (P): cocoa production systems. Intervention (I): shade trees, agroforestry, shade tree species diversity, functional diversity, functional traits, monoculture.

						Comparator (C): Cocoa monoculture as a comparator. Outcome (O): firstly, studies with a stated clear outcome at abstract. Then at full text screening studies specifically reporting outcomes relevant to nutrient cycling, soil properties, and/or cocoa yields.
9	Methods	Protocol	Provide citation, DOI or open-access link to published protocol.	The protocol should be peer-reviewed and publicly available online (open access).	Meta-data	https://doi.org/10.57808/proceed.2026.13
10		Deviations from protocol	Describe any ways in which the final methods of the review deviate from those set out in the protocol along with a justification.		Checklist	No
11	Searches	Search strategy	Detail the search strategy used, including: database names accessed, dates of searching, institutional subscriptions (or date ranges subscribed for each database), search options (e.g. 'topic words' or 'full text' search facility), efforts to source grey literature, other sources of evidence (e.g. hand searching, calls for evidence/submission of evidence by stakeholders).		Checklist	Yes
12		Search string	Provide Boolean-style full search string and state the platform for		Meta-data	Formatted for Web of Science core collection (TS=Topic): ("Shade tree*" OR "agr? forest*" OR agr?forest* OR

which the string is formatted (e.g. Web of Science format)

agr?ecosystem* OR "inter? crop*" OR inter?crop* OR "mult? purpose*" OR mult?purpose* OR "mult? strata" OR plantation* OR "tree specie*") AND (cocoa OR cacao OR theobroma) AND (diversit* OR function* OR "functional diversit*" OR trait*) AND (litterfall* OR litter OR "leaf litter" OR "Nutrient Cycl*" OR nutrient* OR rhizosphere OR "soil fertility" OR "organic matter" OR "nutrient content" OR "soil propert*" OR "soil health" OR c OR n OR p OR k OR carbon OR nitrogen OR phosphorus OR potassium OR yield*)

13	Languages - bibliographic databases	List languages used in bibliographic database searches	Meta-data	English
14	Languages – grey literature	List languages used in organisational website searches and web-based search engines	Meta-data	English
15	Bibliographic databases	Provide the number of bibliographic databases searched	Meta-data	3
16	Web-based search engines	Provide the number of web-based search engines searched	Meta-data	0
17	Organisational websites	Provide the number of organisational websites searched	Meta-data	0
18	Estimating comprehensi	Describe the process by which the comprehensiveness of the search	Checklist	Yes

		veness of the search	strategy was assessed (i.e. list of benchmark articles)			
19		Search update	Describe any update to searches undertaken during the conduct of the review	Compulsory (if update performed). A search update is good practice if original searches were performed more than two years prior to review completion.	Checklist	n/a
20	Article screening and study inclusion criteria	Screening strategy	Describe the methodology for screening articles/studies for relevance. Methods for consistency of screening decisions (at title, abstract, and full texts levels) checking must be described.		Checklist	Yes
21		Inclusion criteria	Describe the inclusion criteria used to assess relevance of identified articles/studies. These must be broken down into the question key elements (e.g. relevant subject(s), intervention(s)/exposure(s), comparator(s), outcome(s), study design(s)) and any other restrictions (e.g. date ranges or languages).		Checklist	Yes
22	Critical appraisal	Critical appraisal strategy	Describe here the method used for critical appraisal of study validity (including assessment of individual studies and the evidence base as a whole). Describe how repeatability of		Checklist	Yes

			critical appraisal of study validity was tested.			
23		Critical appraisal used in synthesis	Describe how the information from critical appraisal was used in synthesis.	Checklist	Yes	
24	Data extraction	Meta-data extraction and coding strategy	Describe the method for meta-data extraction and coding for studies, providing lists of variables that will be extracted as meta-data and those that will be coded. Describe how repeatability of meta-data/data extraction and coding was tested.	Optional, a map database can be included within a systematic review	Checklist	Yes
25		Data extraction strategy	Describe the method for extraction of qualitative and/or quantitative study findings. Describe how repeatability of data extraction was tested.	Checklist	Yes	
26		Approaches to missing data	Describe any process for obtaining and confirming missing or unclear information or data from authors.	Checklist	Yes	
27	Potential effect modifiers/reasons for heterogeneity	Potential effect modifiers/reasons for heterogeneity	Provide a list of and justification for the effect modifiers/reasons for heterogeneity that will be considered in the review. Also provide details of how the list was compiled (including consultation of external experts).	Checklist	Yes	
28	Data synthesis and presentation	Type of synthesis	State the type of synthesis conducted as part of the systematic review (narrative only, narrative and quantitative, narrative and	Meta-data	Narrative and Quantitative	

29	Narrative synthesis strategy	qualitative, narrative, qualitative and quantitative, narrative and mixed-methods) Describe methods used for narratively synthesising the evidence base in the form of descriptive statistics, tables (including SM database) and figures. Study findings must only be narratively synthesised and vote-counting must be avoided. If data are appropriate for quantitative synthesis, describe methods for calculating effect sizes, methods for handling complex data, statistical methods for combining data from individual studies, and any exploration of heterogeneity and publication bias. If all studies were not selected for synthesis explain criteria for selection (e.g. incomplete or missing information).		Checklist	Yes
30	Quantitative synthesis strategy	Describe methods used for synthesising qualitative data and justify your methodological choices.	Compulsory (if quantitative synthesis performed)	Checklist	Yes
31	Qualitative synthesis strategy	Describe if and how you plan to analyse subgroups/subsets of data. If all studies were not selected for synthesis explain criteria for selection (e.g. incomplete or missing information).	Compulsory (if qualitative synthesis performed)	Checklist	n/a

32		Other synthesis strategies	Describe any other approaches used for synthesising data or combining qualitative and quantitative syntheses (e.g. mixed methods) and justify your choice of methodology.	Compulsory (if other synthesis performed)	Checklist	Yes
33		Assessment of risk of publication bias	Describe methods for examining the possible influence of publication bias on the synthesis.	This may be done for quantitative syntheses using diagnostic plots or statistical tests.	Checklist	Yes
34		Knowledge gap and cluster identification strategy	Describe the methods used to identify and/or prioritise key knowledge gaps (unrepresented or underrepresented subtopics that warrant further primary research) and knowledge clusters (well-represented subtopics that are amenable to full synthesis via systematic review).	Optional	Checklist	Yes
35		Demonstrating procedural independence	Describe the role of systematic reviewers (who have also authored articles to be considered within the review) in decisions regarding inclusion or critical appraisal of their own work.	Reviewers who have authored articles to be considered within the review should be prevented from unduly influencing inclusion decisions, for example by delegating tasks appropriately.	Checklist	Yes
36	Results (review findings)	Description of review process	Describe the review process including the volume of evidence identified from all sources and retained through each stage of the review. Must also		Checklist	Yes

		display the number of articles/studies included at all stages of the review in a flow diagram, including the number of articles/studies excluded at each stage.			
37	Number of search results	Provide the number of search results from bibliographic databases (including updates if conducted) prior to duplicate removal.	This number should not include web-based search engine or organisational website searches: this will help assessment of the efficiency of the primary search string. This number should not include web-based search engine or organisational website searches: this will help assessment of the efficiency of the primary search string.	Meta-data	939
38	Number of search results after duplicate removal	Provide the total number of search results from bibliographic database searches following duplicate removal.	This number should not include web-based search engine or organisational website searches: this will help assessment of the efficiency of the primary search string.	Meta-data	507
39	Full text screening excludes	Additional file containing list of and reasons for full text exclusions.		Checklist	Yes
40	Title screening results	Provide the number of articles retained following title screening.	Optional if screening titles and abstracts together	Meta-data	
41	Abstract screening results	Provide the number of articles retained following abstract screening.	Optional if screening titles and abstracts together	Meta-data	

42	Title and abstract screening results	Provide the number of articles retained following title and abstract screening.	Optional if screening titles and abstracts separately	Meta-data	137
43	Retrieval results	Provide the number of articles retrieved at full text.		Meta-data	137
44	Unobtainable articles	Additional file containing list of unobtainable articles.		Checklist	No
45	Full text screening results	Provide the number of articles retained following full text screening.		Meta-data	53
46	Consistency checking: screening	Results of consistency checking at all stages (screening, data extraction, critical appraisal) must be provided. Provide the number of titles, abstracts and full texts screened and checked for consistency by two or more reviewers as a fraction of the total (e.g. Title: 2000/20000; Abstract: 500/5000; Full text: 10/100).		Checklist	Yes
47	Critical appraisal exclusions	If any studies are excluded due to low validity, provide the number of studies excluded from further synthesis during critical appraisal.	Compulsory for any studies not included in synthesis due to validity. Reviews authors may prefer to perform a sensitivity analysis (repeating analyses to examine the influence of validity) rather than	Meta-data	n/a

			excluding studies from synthesis.		
48	Narrative synthesis	Describe the body of evidence identified using figures and tables, avoiding vote-counting (tallying of studies based on results; direction or significance). Each must be presented with descriptive information (meta-data) and extracted study findings. Describe the validity of individual studies and the evidence base as a whole.		Checklist	Yes
49	Extracted data	Additional file containing extracted quantitative or qualitative data (study findings) from included studies.		Checklist	Yes
50	Systematic map database	Additional file containing meta-data and coding for included studies.	Optional, a map database can be included within a systematic review	Checklist	Yes
51	Quantitative synthesis	Present results of quantitative synthesis of study findings (e.g. meta-analysis). Present results of qualitative analysis of study findings (e.g. summaries of identified themes or categories). Also provide additional file with the identified themes or categories for each study.	Compulsory (if quantitative synthesis performed)	Checklist	Yes
52	Qualitative synthesis		Compulsory (if qualitative synthesis performed)	Checklist	n/a
53	Other synthesis	Present results of any other synthesis methods used.	Compulsory (if other synthesis performed)	Checklist	Yes

54		Risk of publication bias	Describe the results of assessments for the possible influence of publication bias on the synthesis.	For quantitative syntheses this may be done using diagnostic plots or statistical tests	Checklist	Yes
55		Limitations of the review	Discuss possible limitations in the methods used.		Checklist	Yes
56		Limitations of the evidence base	Discuss possible limitations in the evidence base.		Checklist	Yes
57		Implications for policy/management	Summarise the state of the evidence base and discuss the way in which the identified evidence may inform policy/practice decision making in relation to the review question. Provide any measure of the uncertainty surrounding the outcome.	Reviews must not include practical environmental management recommendations or advocacy.	Checklist	Yes
58		Implications for research	Discuss the way in which the identified evidence may inform research including options for increasing the reliability of study design that could improve future research.	In this section some advocacy for future research on the reviewed topic is permissible provided it is clearly justified by the review outcome/critical appraisal of study validity.	Checklist	Yes
59	Declarations	Competing interests	Describe of any financial or non-financial competing interests that the review authors may have.		Checklist	Yes

Referenc

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- [1] Bayliss, H.R., Haddaway, N.R., Eales, J., Frampton, G.K. and James, K.L., 2016. Updating and amending systematic reviews and systematic maps in environmental management. *Environmental Evidence*, 5(1), p.20.
- [2] Haddaway, N.R., Kohl, C., da Silva, N.R., Schiemann, J., Spök, A., Stewart, R., Sweet, J.B. and Wilhelm, R., 2017. A framework for stakeholder engagement during systematic reviews and maps in environmental management. *Environmental Evidence*, 6(1), p.11.
- [3] Collaboration for Environmental Evidence. 2018. Guidelines and Standards for Evidence synthesis in Environmental Management. Version 5.0. www.environmentalevidence.org/information-for-authors.
- [4] Leeds Institute of Health Sciences. https://medhealth.leeds.ac.uk/info/639/information_specialists/1500/search_concept_tools. Accessed 12/11/2017.