# The Collaboration for Environmental Evidence Synthesis Assessment Tool (CEESAT)

## Version 2 for Evidence Overviews
## Updated 21st August 2025

An **'Evidence Overview'** is a review of primary research where a main objective is stated as assessing or mapping the distribution and abundance of evidence in primary studies (e.g. geographic and taxonomic patterns for identifying knowledge gluts and gaps), and/or exploring a specific topic of interest to configure bodies of evidence, on a specified question relating to effectiveness of an intervention or impact of an exposure.

The CEESAT checklist provides a point by point appraisal of the confidence that can be placed in the findings of an evidence overview by assessing the rigour of the methods used by the authors, the transparency with which those methods are reported and the limitations imposed on synthesis by the quantity of available primary data.

Note that CEESAT does not distinguish between reviews that do not employ methodology that reduces susceptibility to bias and increases reliability of findings and reviews that may have employed such methodology but do not report it.

### THE CEESAT CHECKLIST

**Tick or fill one 'O' for each question. Start with the 'Gold' definition and move down the list if it does not apply. When 'AND' is used all statements must apply and when 'OR' is used one of the alternative should apply.**

**Please make a single decision for each question (or hypothesis). Many reviews address more than one question. This may be reflected in the review title being broad whilst subsections address more specifically defined questions which involve different searching/extraction/data coding criteria. If this is the case please complete an assessment for each question and fill in multiple rows for the article on the assessment spreadsheet.**

**Please note that supplementary material to (and linked from) the article, including protocols, should be included in the assessment and are provided when noted by the Editorial Team. Please contact us if you have problems accessing supplementary material. Reference to methods of other original articles should not be included.**

**Please cite as: Collaboration for Environmental Evidence 2023. The Collaboration for Environmental Evidence Synthesis Assessment Tool (CEESAT) for Evidence Overviews. Version 2.1.**

## 1. THE REVIEW QUESTION

Rationale**:** A well-defined question (or hypothesis) is crucial for assessing the reliability of subsequent decisions on searching and screening for eligible studies, as well as forming the basis for data coding and configuration.

### *1.1 Are the elements of the review question clear?*

Tick whichever statement applies

- ○ Gold: The review question or hypothesis is clearly stated and clearly defines key elements, (e.g. PICO, PECO, PO, PIT, etc.) correctly, such as the subject or population of interest, the intervention or exposure type, the comparator and valid measures of outcome.
- ○ Green: The review question or hypothesis is clearly stated, and key-elements are mentioned although not formally defined in terms of PICO, PECO, PO, PIT, etc.
- ○ Amber: The question or hypothesis is stated in broad terms but key-elements are unclear or poorly defined.
  OR
  Question or hypothesis not stated but problem or issue is stated such that a question can be inferred
- ○ Red: A question, hypothesis or problem is not stated
  OR
  There is no stated objective to provide an answer to a question or test of a hypothesis.
  OR
  The article does not contain an evidence synthesis (e.g. primary research)

## 2. THE METHOD/PROTOCOL

Rationale: A protocol is a document describing the methods to be used, produced prior to the commencement of an evidence synthesis. It describes the background to the synthesis, the questions, the strategy that will be used to search for primary research articles, and the criteria for deciding whether or not an article is then relevant to include in the synthesis. The protocol should also outline the approach to assessing the quality of each included study, and to extracting and synthesising data from primary research studies. Writing a protocol is

therefore analogous with developing and documenting a methodology prior to conducting fieldwork or experiments and is similarly integral to producing a study that is robust against post hoc changes in methods and scope.

### *2.1. Is there an a-priori method/protocol document?*

- Gold: The review cites a separate a-priori protocol or documented pre-defined method containing details of proposed conduct of all review and synthesis stages (e.g. question, search, eligibility screening, data coding and configuration)
  AND
  It is linked from the synthesis (e.g. as supplementary material or hosted on a separate website)
  AND
  It was publicly accessible prior to the conduct of the review
  AND
  It was submitted to an independent body for peer review and publication.
- Green: The review cites a separate accessible a-priori protocol or documented pre-defined method containing details of conduct of all review and synthesis stages (e.g. question, search, screening, data coding and configuration)
  AND
  It is linked from the synthesis (e.g. as supplementary material or hosted on a separate website)
  AND
  It was publicly accessible prior to the conduct of the review.
- Amber: The review cites a separate accessible a-priori protocol or documented pre-defined method, but this does not contain all details of conduct of all review and synthesis stages or was not publicly accessible prior to the conduct of the review
  OR
  The review includes a defined methods section (not a-priori) listing the synthesis stages conducted and providing sufficient detail to enable the method to be replicated (therefore this standard is met only if all of criteria 3.1, 4.1, & 6.1 are rated green or above).
- Red: There is no protocol and the review methods are not clearly defined in the methods section of the review or there are no methods reported.

## 3. SEARCHING FOR ELIGIBLE STUDIES

An optimal search for literature should possess three key properties. It should be: comprehensive (maximises the number of potentially relevant studies found), systematic (avoiding ad hoc search strategies reduces the susceptibility to bias resulting from e.g. no

defined endpoint of search) and transparent (readers should be able to replicate and evaluate the search).

### *3.1. Is the approach to searching clearly defined, systematic and transparent?*

Rationale: Search strategies should be outlined in the predefined protocol or review methods. An optimal search for literature should aim to maximise comprehensiveness (aiming to identify all relevant studies) and transparency (readers should be able to replicate and evaluate the search). This is to avoid 'cherry-picking' studies or assembling a biased or unrepresentative body of evidence. Where possible, advice should be sought from an expert such as an information specialist/scientist.

Gold: All search terms, Boolean operators ('AND', 'OR' etc.) and wildcards are clearly stated for each source (e.g. databases, search engines, specialist websites) so that the exact search is replicable by a third party
AND
There is information about the sources searched, together with dates of search and any limitations justified (e.g. languages, publication date, no grey literature searches).

Green: All search terms, Boolean operators ('AND', 'OR' etc.) and wildcards are clearly stated for each major source (e.g. databases, search engines) so that the exact search is replicable by a third party but search terms for minor sources (e.g. specialist websites), if used, may be missing.
AND
There is information about the sources searched and search options selected, together with dates of search but some limitations (reported or evident) not justified (e.g. languages or publication date or no grey literature searches)

Amber: The search is described but not adequately to be fully replicable by a third party either because the specific search terms are not stated or Boolean operators/wildcards are not stated (so it is unclear how the search terms are combined).
OR
There is information about the databases searched, but dates of search not given and no limitations justified (e.g. languages or publication date or no grey literature searches).

Red: No information regarding the search strategy (search terms and strings) used.

### *3.2. Is the search comprehensive?*

Rationale: The resources used to find relevant literature influence the comprehensiveness and reliability of the synthesis. The principal sources for locating peer-reviewed articles are electronic databases of scientific literature and academic search engines, with a range of supplementary methods. No single database indexes all peer-reviewed articles. Moreover, these sources are unlikely to capture potentially relevant grey literature (e.g., reports by governmental and non-governmental organisations, unpublished studies) and consequently can be complemented by searching thesis repositories, websites of relevant organisations and conducting internet searches. Other supplementary search strategies include citation chasing (backwards and forwards), and contact with experts in the field.

- Gold: Sources of articles searched are stated and capture both conventionally published scientific literature and grey literature using a combination of databases, search engines and specialist websites (may also be informed by stakeholders) or limitations are fully justified.
  AND
  Comprehensiveness of search is demonstrated by a series of tests using independent samples of the relevant literature to demonstrate adequate sensitivity.

NB. Statements such as *'We considered only peer-reviewed material because this is more reliable than grey literature'* without evidence that the methodological quality of potentially relevant grey literature was assessed do not indicate that grey literature was objectively considered.

- Green: Sources of articles searched are stated and capture both conventionally published scientific literature and grey literature using a combination of databases, search engines and specialist websites (may also be informed by stakeholders) or limitations are fully justified.

NB. Statements such as '*We considered only peer-reviewed material because this is more reliable than grey literature'* without evidence that the methodological quality of potentially relevant grey literature was assessed do not indicate that grey literature was objectively considered.

- Amber: Sources used are stated but limited, without justification, to conventionally published scientific literature or just one or two sources.

- Red: Sources used not stated or search is not systematic (i.e. studies appear to have been selected).

## 4. INCLUDING STUDIES

Comprehensive searches may generate a large number of articles that vary widely in their relevance to the synthesis. Authors must then determine whether or not each article is sufficiently relevant (eligible) for inclusion in the data synthesis stage. However, the choice of eligibility criteria can influence the conclusions of the synthesis, and the application of inadequately defined criteria can be subjective and lead to biases. Decisions over which studies are relevant for inclusion should therefore be based on clearly defined criteria, and should be replicable and transparent.

### *4.1. Are eligibility criteria clearly defined?*

Rationale: Clearly stated criteria for eligibility decisions minimise the potential for subjective decisions to influence which studies are included in the review, increase the transparency of the synthesis, and allow readers to assess the validity of the criteria to the review question. In addition to following the review question, eligibility criteria may define limits on the type of primary research to be considered in terms of (for example): geographic scope, type of data reported, type of intervention or impact, study design, date.

- Gold: Eligibility criteria are precisely defined (e.g. reliance on broad and potentially ambiguous terms should be avoided) and expressly related to each key element of the question (other criteria such as study design may also be considered)
  AND
  Criteria are consistent between a-priori protocol and review or differences are fully explained.

- Green: Eligibility criteria are precisely defined (e.g. reliance on broad and potentially ambiguous terms should be avoided) and expressly related to each key element of the question (e.g. PICO). Other criteria such as study design may also be considered.

- Amber: The questions/scope/objectives of the review are stated such that the type of primary research articles/studies to be included are broadly apparent, but the review **does not** explicitly identify criteria expressly related to each key element of the question (other criteria such as study design may also be considered).

OR
Some eligibility criteria are defined but either incomplete or no clear relationship to a review question (possibly because the question is poorly defined).

- Red: No to both amber criteria above (eligibility criteria are not stated).

### *4.2. Are eligibility criteria consistently applied to all potentially relevant articles and studies found during the search?*

Rationale: More than one person should screen studies for inclusion to reduce the risk of human error and to ensure that the criteria are applied consistently to the articles returned by the search. If more than one person independently evaluates the relevance of the same articles, the replicability of inclusion/exclusion decisions can be assessed. Piloting the criteria, and discussing and refining the eligibility decisions can also ensure they are consistently applied.

- Gold: The eligibility criteria are independently applied by more than one reviewer to all of the screened articles/studies (at title screening stage, pragmatic decisions about dual screening of subsamples is justified e.g. because large numbers of titles were screened)
  AND
  Replicability of eligibility decisions was measured and reported and all disagreements between reviewers discussed so that the resolutions informed subsequent assessments.

- Green: The eligibility criteria are independently applied by more than one reviewer to a sample of justified size of the screened articles/studies at title, abstract and full text.
  AND
  Replicability of eligibility decisions was measured and reported and all disagreements between reviewers discussed so that the resolutions informed subsequent assessments.

- Amber**:** The eligibility criteria are applied by more than one reviewer to a sample of the screened articles/studies at title/abstract and full text but reviewer independence is uncertain (i.e. not reported) or absent.
  AND
  Replicability of eligibility decisions was examined (but a measure may not be reported) and all disagreements between reviewers discussed so that the resolutions informed subsequent assessments.
- Red: Number of reviewers not reported
  OR
  Only one reviewer applied criteria at either title/abstract or full text stage,
  OR

Where two or more reviewers are used, consistency of decisions not tested
OR
No eligibility criteria provided (see 4.1)

### *4.3. Are eligibility decisions transparently reported?*

Rationale: Listing all articles that were screened for eligibility and indicating whether each was included or excluded in data synthesis (usually as supplementary material), makes it clear whether potentially relevant studies have been omitted according to the eligibility criteria or were not captured by the search. Documenting the reasons for article exclusion at full text is essential for transparency.

- ○ Gold: The total number of articles and number of unique articles found during the searches (after removal of duplicates) is presented
  AND
  The number excluded at each stage of the screening process is fully presented (e.g. in a flow diagram or table)
  AND
  Reasons for exclusion of each article/study considered at full-text are presented (e.g. in an appendix)
  AND
  A list of eligible (included) articles/studies is presented as a separate list or in tables (not just included in reference list).

- ○ Green: The total number of articles found by the search and numbers excluded at each stage of the screening process is reported but some other aspects missing (e.g. number of unique articles or articles unobtainable)
  AND
  Reasons for exclusion of each article/study considered at full-text are presented (e.g. in an appendix)
  AND
  A list of eligible (included) articles/studies is presented as a separate list or in tables (not just included in reference list).

- ○ Amber: The total number of articles found by the search and numbers excluded during the screening process is reported (or inferable) but some other aspects missing (e.g. number of unique articles or articles unobtainable)
  AND
  A list of eligible (included) articles/studies is presented as a separate list or in tables (not just included in reference list).

- Red: No to either or both of the amber criteria above

## 5. CRITICAL APPRAISAL (NOT ASSESSED FOR OVERVIEWS)

## 6. DATA CODING

The volume and type of data collected by primary research articles varies substantially, even when similar questions are addressed. Authors of evidence syntheses must make decisions on which data to code and on how to extract this information. These decisions may influence the findings of the synthesis, and so to minimise bias, the approach to data coding should be clearly stated and, wherever possible, the coded information should be comparable and consistent between studies.

### *6.1. Is the method of data coding fully documented?*

Rationale: Transparently identifying a consistent set of data to code and extract from each study, for example into a structured data coding sheet, allows the process to be replicated and evaluated by a third party, and reduces the potential for bias over which data are coded from individual studies. Typically, coded information from each study included in the review comprises: bibliographic details; study aims; intervention/exposure details, study design; population characteristics; comparator details and outcome metrics.

- Gold: The authors state in an a-priori protocol the type of data to be coded
  AND
  the methods by which data from each study will be extracted so that the process can be replicated and confirm these methods were ultimately used in their report or reasons for deviation.
- Green: The authors state in the methods (but not in an a-priori protocol) the type of data to be coded
  AND
  the methods by which data from each study were extracted so that the process can be replicated (In some cases methods may have been partially reported in an a-priori protocol but then modified or substantially developed during the review process).
- Amber: The authors state in the methods the type of data to be coded
  AND

although the review does not provide a fully replicable methodology for data extraction, it is possible to infer the broad method from the reported results (e.g. a table that lists all eligible studies and data extracted might be included).

- Red: No to either part of amber above. It is not clear what data were selected for coding and/or no consistent approach to data extraction is reported.

### *6.2. Are the coded data reported for each study?*

Rationale: Providing a summary table or spreadsheet in which the metadata on population, intervention/exposure comparator and outcome for each study are stated makes data coding transparent, and makes it easier for readers to locate the most relevant primary literature and conduct supplementary analyses if required.

- Gold: All data/meta-data selected for coding are provided in a table or spreadsheet as set out in the a-priori protocol.
- Green: All data/meta-data selected for extraction are provided in a post-hoc table or spreadsheet.
- Amber: The review provides a table/spreadsheet that includes some of the coded data for some or all studies (e.g. Table/spreadsheet only lists e.g. 1-2 pieces of data for each study but omits other information OR Table/spreadsheet lists coded data, but not for all studies or a combination of these. Note: It may be unclear if all studies are included since they are not listed anywhere in the article.
- Red: No to amber above. Data coded are not presented.

### *6.3. Were coded data cross checked by more than one reviewer?*

Rationale: Checking data coding improves accuracy by ensuring the correct data are extracted for each element and reduces the risk of errors due to interpretation or transcription

- Gold: It is reported that data were coded from each study by at least two independent reviewers and differences resolved through discussion (or similar).
- Green: An explanation is provided of how a sample of coded data was cross checked between two or more reviewers and differences resolved through discussion (or similar).

- Amber: A statement that cross-checking of coded data between two or more reviewers was carried out is provided but explanation unclear or incomplete (e.g. not clear if screening decisions were independent).

- Red: No report of cross checking is provided.

## 7. DATA SYNTHESIS (NOT ASSESSED FOR OVERVIEWS)

## 8. REVIEW LIMITATIONS

Rationale: All reviews will have limitations and it is important that authors are explicit about the known limitations of the primary data and the conduct of the review process. Here we acknowledge the subjective nature of this criterion and the appraiser must use some subjective judgement to decide on the adequacy of any statement on limitations.

### *8.1. Have the authors considered limitations of the synthesis?*

- Gold: An explicit section is devoted to an assessment of limitations of the review including limitations of the primary data (available evidence), possible sources of bias in their own review process,
  AND
  Recommendations are made for future syntheses and primary research.
- Green: An explicit section or identifiable passage of main text is devoted to an assessment of limitations of primary research/data (available evidence) and some possible sources of bias in their own review process but does not consider all major sources of bias in the review process, or recommendations not made for future syntheses and primary research.
- Amber: Some consideration of limitations is evident but not explicitly stated or not focus of specific section
  OR
  Consideration of limitations of primary literature incuded but limitations of the review method (possible sources of bias, conduct of the review process and recommendations made for future syntheses) not included.
- Red: No evident consideration of limitations of primary data or review conduct.