

| Section/sub-section | Topic | Description | Further explanation | Checklist/meta-data | Author response | Comments |
|------------------------------------|--|--|---|---------------------|---|--|
| Title | Title | The title must indicate that it is a systematic review, and should indicate | The title should normally be the same or very similar to the review | Meta-data | Climate change and the | |
| Type of review | Type of review | Select one of the following types of review: systematic review, | See CEE Guidance on amendments and updates [1] | Meta-data | systematic review | |
| Authors' contacts | Authors' contacts | The full names, institutional addresses and email addresses for all | | Checklist | Yes | |
| Abstract | Structured summary | The abstract of the manuscript must not exceed 500 words and must be | | Checklist | Yes | |
| Background | Background | Describe the rationale for the review in the context of what is already | A theory of change and/or conceptual model should be presented that | Checklist | Yes | |
| Stakeholder engagement | Stakeholder engagement | The actual role of stakeholders throughout the review process (e.g. in | | Checklist | Yes | |
| Objective of the review | Objective | Describe the primary question and secondary questions (when | The primary question is the main question of the review. The secondary | Checklist | Yes | |
| | 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 | Table 1 outlines all elements of the PECO framework for our study. Rubenstein, Madeleine A., et al. "Do empirical observations support commonly-held climate change range shift hypotheses? A systematic review protocol." Environmental Evidence 9.1 (2020): 1-10. | |
| 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 | Yes | |
| | Deviations from protocol | Describe any ways in which the final methods of the review deviate from | | Checklist | Yes | |
| Searches | Search strategy | Detail the search strategy used, including: database names accessed, | | Checklist | Yes | |
| | Search string | Provide Boolean-style full search string and state the platform for which the string is formatted (e.g. Web of Science format) | | Meta-data | TS=(("climate" OR "global 204 warming" OR "temperature" OR "precipitation") AND ("range" OR "distribution" OR "habitat 205 extent" OR "occupancy") AND ("species")) | |
| | Languages - bibliographic | List languages used in bibliographic database searches | | Meta-data | English | |
| | Languages – grey literature | List languages used in organisational website searches and web-based | | Meta-data | English | |
| | Bibliographic databases | Provide the number of bibliographic databases searched | | Meta-data | Included in our "search engine" section. We are using 2 bibliographic database - Web of Science and Scopus | |
| | Web-based search engines | Provide the number of web-based search engines searched | | Meta-data | Included in our "search engine" section. We are using 1 web based search engine - Google Scholar | |
| | Organisational websites | Provide the number of organisational websites searched | | Meta-data | Not performed | |
| | Estimating comprehensiveness of Search update | Describe the process by which the comprehensiveness of the search | | Checklist | Yes | |
| Article screening and study | Screening strategy | Describe any update to searches undertaken during the conduct of the | Compulsory (if update performed). A search update is good practice if | Checklist | Yes | |
| | Inclusion criteria | Describe the methodology for screening articles/studies for relevance. | | Checklist | Yes | |
| Critical appraisal | Critical appraisal strategy | Describe the inclusion criteria used to assess relevance of identified | | Checklist | Yes | |
| | Critical appraisal used in synthesis | Describe here the method used for critical appraisal of study validity | | Checklist | Yes | |
| Data extraction | Meta-data extraction and coding | Describe how the information from critical appraisal was used in | Optional, a map database can be included within a systematic review | Checklist | Yes | |
| | Data extraction strategy | Describe the method for meta-data extraction and coding for studies, | | Checklist | Yes | |
| | Approaches to missing data | Describe the method for extraction of qualitative and/or quantitative | | Checklist | Yes | |
| Potential effect modifiers/reasons | Potential effect modifiers/reasons | Describe any process for obtaining and confirming missing or unclear | | Checklist | Yes | |
| | Potential effect modifiers/reasons | Provide a list of and justification for the effect modifiers/reasons for | | Checklist | Yes | |
| 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 qualitative, narrative, qualitative and quantitative, narrative and mixed-methods) | | Meta-data | Narrative, quantitative, and qualitative | |
| | Narrative synthesis strategy | Describe methods used for narratively synthesising the evidence base in | | Checklist | Yes | |
| | Quantitative synthesis strategy | If data are appropriate for quantitative synthesis, describe methods for | Compulsory (if quantitative synthesis performed) | Checklist | Yes | |
| | Qualitative synthesis strategy | Describe methods used for synthesising qualitative data and justify your | Compulsory (if qualitative synthesis performed) | Checklist | Yes | |
| | Other synthesis strategies | Describe any other approaches used for synthesising data or combining | Compulsory (if other synthesis performed) | Checklist | n/a | |
| | Assessment of risk of publication | Describe methods for examining the possible influence of publication | This may be done for quantitative syntheses using diagnostic plots or | Checklist | Yes | |
| | Knowledge gap and cluster | Describe the methods used to identify and/or prioritise key knowledge | Optional | Checklist | n/a | |
| Results | 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 | The subset of authors who are reviewing articles for inclusion do not have any published studies included in the review. |
| | Description of review process | Describe the review process including the volume of evidence identified | | Checklist | Yes | |
| | Number of search results | Provide the number of search results from bibliographic databases | 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 | 94,672 | |
| | Number of search results after duplicate removal | Provide the total number of search results from bibliographic database searches following duplicate removal. | | Meta-data | See methods section | |
| | Full text screening excludes | Additional file containing list of and reasons for full text exclusions. | | Checklist | Yes | |
| | Title screening results | Provide the number of articles retained following title screening. | Optional if screening titles and abstracts together | Meta-data | 12,098 | |
| | Abstract screening results | Provide the number of articles retained following abstract screening. | Optional if screening titles and abstracts together | Meta-data | n/a | |

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| | Title and abstract screening results | Provide the number of articles retained following title and abstract | Optional if screening titles and abstracts separately | Meta-data | n/a | |
| | Retrieval results | Provide the number of articles retrieved at full text. | | Meta-data | | 842 |
| | Unobtainable articles | Additional file containing list of unobtainable articles. | | Checklist | Yes | |
| | Full text screening results | Provide the number of articles retained following full text screening. | | Meta-data | | 315 |
| | Consistency checking: screening | Results of consistency checking at all stages (screening, data extraction, | | Checklist | Yes | |
| | Critical appraisal exclusions | If any studies are excluded due to low validity, provide the number of | Compulsory for any studies not included in synthesis due to validity. | Meta-data | n/a | |
| | Narrative synthesis | Describe the body of evidence identified using figures and tables, | | Checklist | Yes | |
| | Extracted data | Additional file containing extracted quantitative or qualitative data | | Checklist | Yes | |
| | 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 | |
| | Quantitative synthesis | Present results of quantitative synthesis of study findings (e.g. meta- | Compulsory (if quantitative synthesis performed) | Checklist | Yes | |
| | Qualitative synthesis | Present results of qualitative analysis of study findings (e.g. summaries | Compulsory (if qualitative synthesis performed) | Checklist | Yes | |
| | Other synthesis | Present results of any other synthesis methods used. | Compulsory (if other synthesis performed) | Checklist | Yes | |
| | Risk of publication bias | Describe the results of assessments for the possible influence of | For quantitative syntheses this may be done using diagnostic plots or | Checklist | Yes | |
| Discussion | Discussion | Discuss the review results and suggest further enquiry or analysis (e.g. | | Checklist | Yes | |
| | Limitations of the review | Discuss possible limitations in the methods used. | | Checklist | Yes | |
| | Limitations of the evidence base | Discuss possible limitations in the evidence base. | | Checklist | Yes | |
| Conclusions | Implications for | Summarise the state of the evidence base and discuss the way in which | Reviews must not include practical environmental management | Checklist | Yes | |
| | Implications for research | Discuss the way in which the identified evidence may inform research | In this section some advocacy for future research on the reviewed topic | Checklist | Yes | |
| Declarations | Competing interests | Describe of any financial or non-financial competing interests that the | | Checklist | Yes | |

References

[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.