Formulating review questions and the importance of a Protocol – an under-recognised element of meta-analyses

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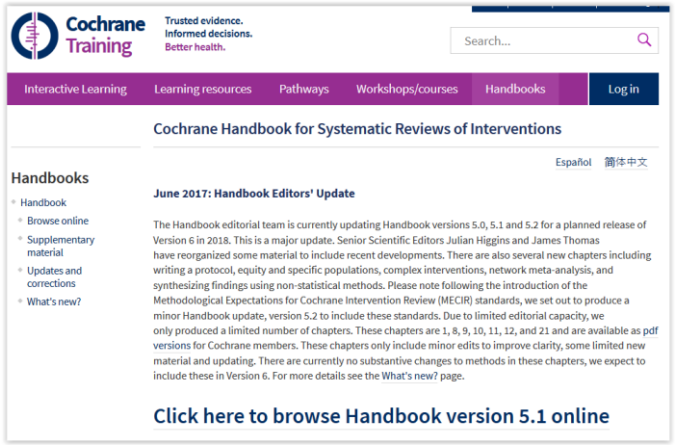
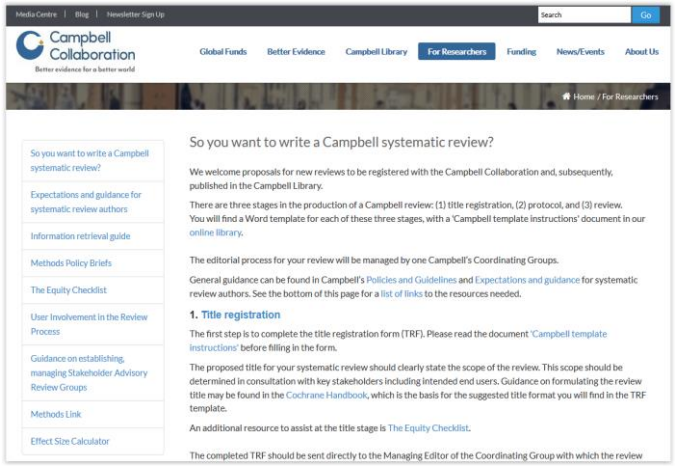
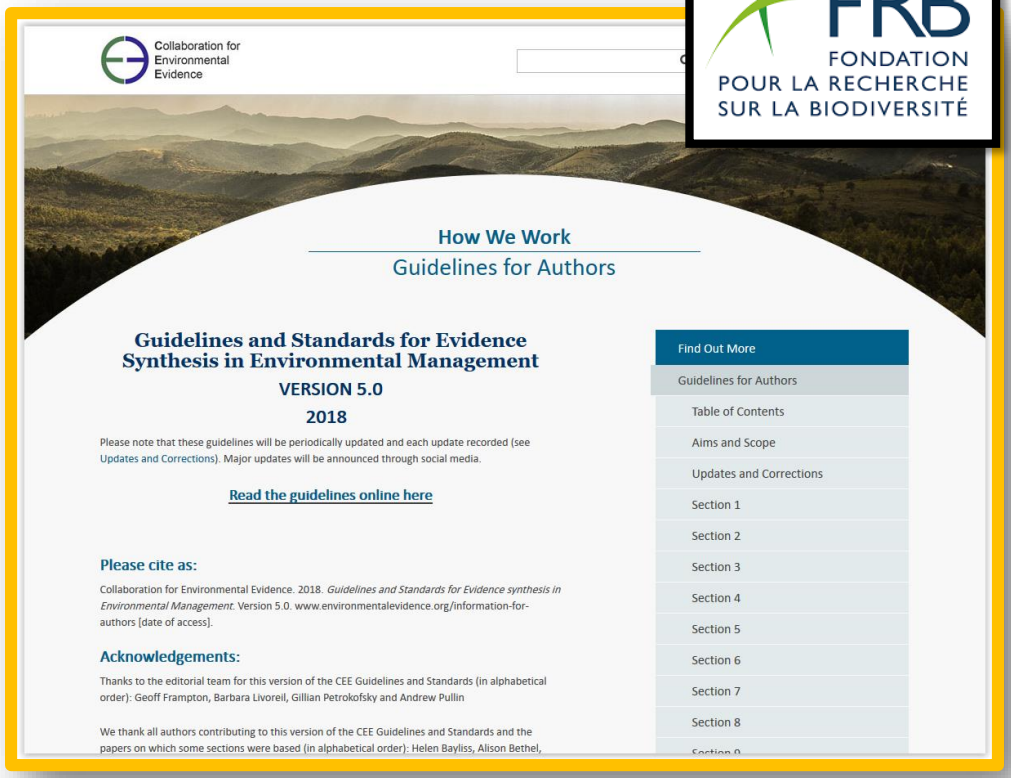
A common ground: a particularly robust and transparent method

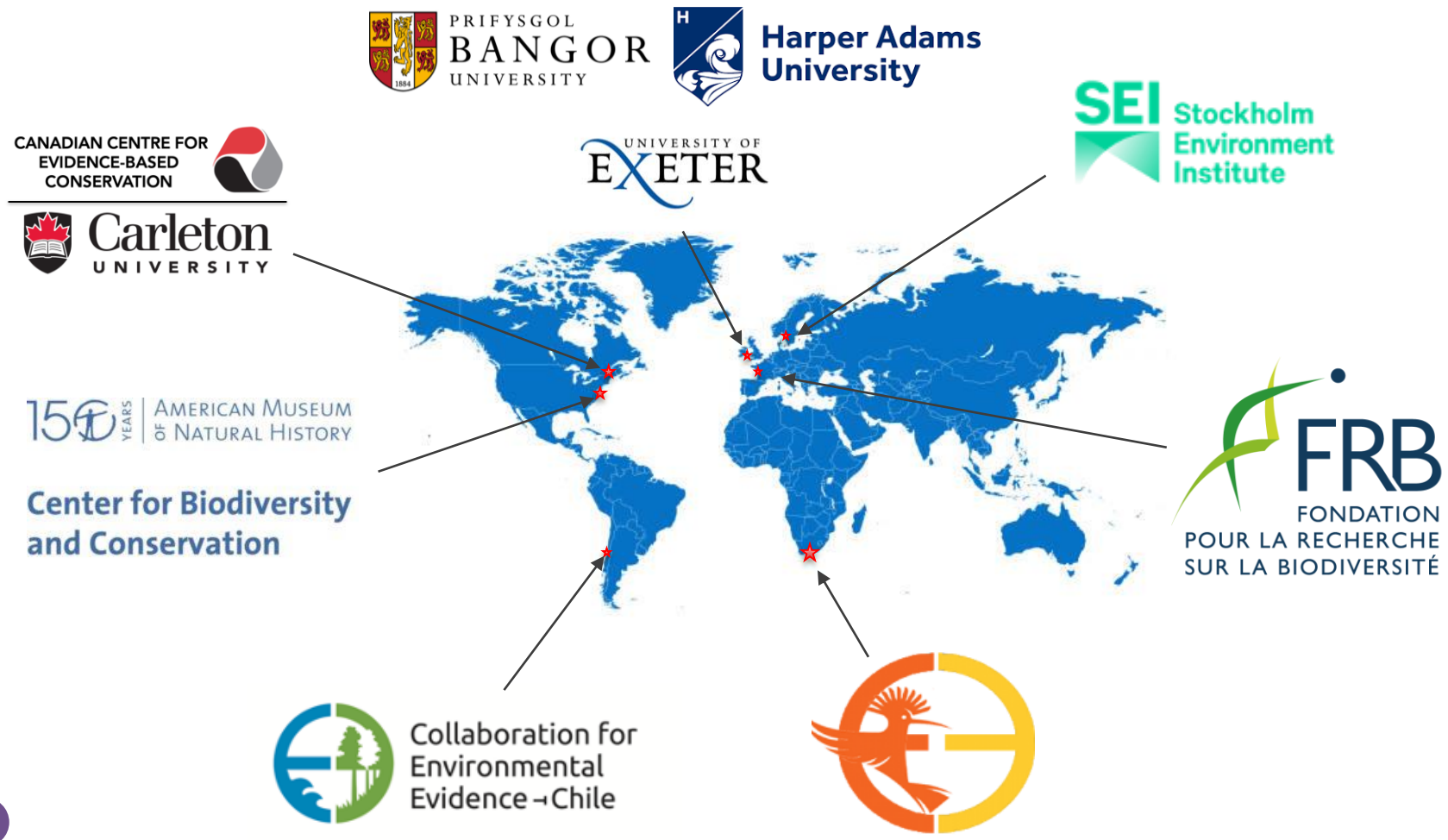




Guidelines and standards: a need for **rigour**, **objectivity** and **transparency**



The Collaboration for Environmental Evidence (CEE)



- Question Formulation
- Protocol (peer-reviewed and published)
- Searching
- Article Screening
- Data Extraction
- Critical Appraisal
- Synthesis
- Final Review (peer-reviewed and published)
- Communication

Collaboration for Environmental Evidence

Why invest time in question setting?

Framing and prioritising review questions

- Decide on the question that is of **greatest interest** (stakeholders, policymakers etc.)
- Maximise **cost effectiveness** - efficient use of time and resources
- Minimise **confusion** caused by inappropriate/vague phrasing
  - A poorly formulated question may cause problems down the track

How to formulate a review question?

Common question types:

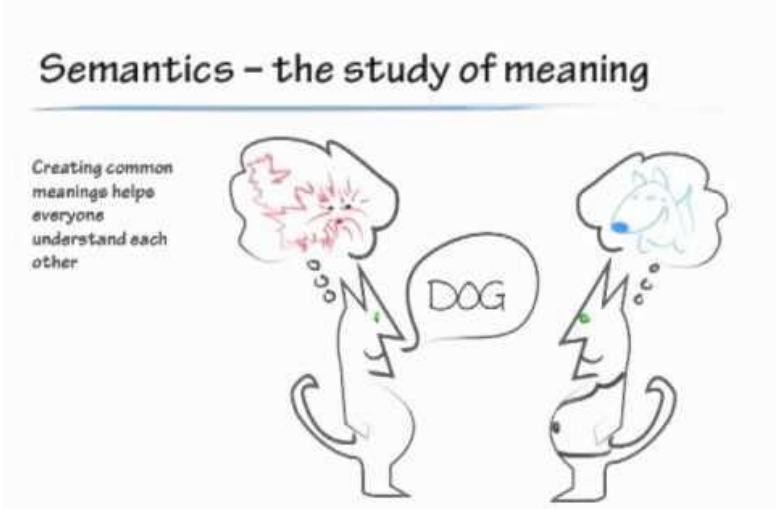
From health questions primarily concerned with **“How effective is”** to environmental questions resembling :

- “What are the impacts of”…
- “What is the evidence on”...
- “What are the barriers”…
- “What factors”...
- “What is the importance of”...
- “What are the effects of”....

How to formulate a review question?

Correctly framing the question helps to :

- Clarify the semantics, minimize misunderstandings
- Clarify the perimeter of the study (scope, scale)
- Ensure transparency
- Establish the “foundation” elements of the entire systematic review.



How to formulate a review question?

When you formulate a review question in ecology, you are effectively creating a **formula** that does several things:

- Focus the review question by identifying the different components or concepts.
- Define the concepts that will be used when performing a complex literature search.
- Ascertain which articles in a search retrieval best address the question.
- Determine if primary studies found address the components of the overriding question.

Guidelines and Standards for Evidence Synthesis in Environmental Management

Collaboration for Environmental Evidence

Section 3

Planning a CEE Evidence Synthesis

https://environmentalevidence.org/information-for-authors/3-planning-a-cee-evidence-synthesis/

What frameworks?

PICO

SPIDER

Sample, Phenomene et interest, Design, Evaluation, Research type

PIO

PEO

PECO

ECLIPSE

Expectation, Client group, Location, Impact, Professionals,

SPICE

Setting, Perspective, Intervention / Interest, Comparison, Evaluation

What frameworks?

PICO

SPIDER

PIO

PEO

ECLIPSE

PECO

SPICE

PEO-C

How to formulate a review question?

PICO and PECO framework :

Table 1 : definition of the question elements	
Question element	**Definition**
Population	This refers to the **study unit** i.e., the subject(s) of the review/map (e.g. a species, a species group, a habitat/ecosystem)
Intervention	The **act or action of intervening**. This can be a proposed management regime, policy action, etc.
Exposure	The fact or condition of **being exposed** (e.g., an anthropogenic activity/pressure to which the subject population is exposed).
Comparator	A comparator is needed to deduce an effect. This refers to **a control with no intervention/exposure** or an alternative intervention or a counterfactual scenario.
Outcomes	All **relevant measures** i.e., indicators, metrics (e.g., species richness, abundance, biomass, etc.) of the *study population* from which the effect of the *intervention* or *exposure* can be reliably demonstrated.

How to formulate a review question?

Table 2: applying the PICO/PECO formulation		
	…for an intervention approach	**…for an exposition approach**
Population (P)	*The study unit* on which we measure the effect/impact of the intervention.	*The study unit* on which we measure the effect/impact of the exposure.
Intervention ou Exposition (I/E)	The practiced *Intervention* itself having an effect on the population.	What the population is exposed to.
Comparator (C)	What is the effect of the intervention being compared to (control vs. intervention)?	What are we comparing the effect of the exposure (control) to?
Outcomes (0)	What indicator/metric is being measured in order to demonstrate an effect.	What indicator/metric is being measured in order to demonstrate an effect.
Context (C /T)	In what context (geographical and/or temporal)?	In what context (geographical and/or temporal)?

How to formulate a review question?

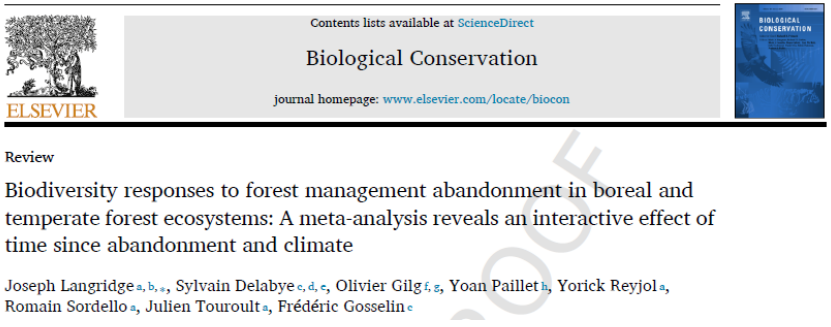
Question types – PICO / PECO :

Effect of intervention/exposure:

- Often a quantitative approach

P - population
I/E – intervention / exposure
C – comparator
O - outcome(s)
C - context

e.g. Q1 : what is the effect of forest management abandonment, compared to still managed stands, on biodiversity, in terms of species richness and abundance, in the world's boreal and temperate forest ecosystems?


Contents lists available at ScienceDirect
Biological Conservation
journal homepage: www.elsevier.com/locate/biocon
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Review

Biodiversity responses to forest management abandonment in boreal and temperate forest ecosystems: A meta-analysis reveals an interactive effect of time since abandonment and climate

Joseph Langridge[a, b, *], Sylvain Delabye[c, d, e], Olivier Gilg[f, g], Yoan Paillet[h], Yorick Reyjol[a], Romain Sordello[a], Julien Touroult[a], Frédéric Gosselin[c]

How to formulate a review question?

Question types - PO

Descriptive questions on prevalence/occurrence/incidence:

- **Often a qualitative approach**

P – population
O - outcome(s)

e.g. What is the prevalence (ppm) of neonicotinoid pesticides in fresh water ecosystems ?

How to formulate a review question?

Question types – PIO / **C**

P – population
I – intervention
O - outcome(s)

C- Context

e.g. What is the existing evidence on the outcomes of wildlife conservation-translocations in protected areas ?

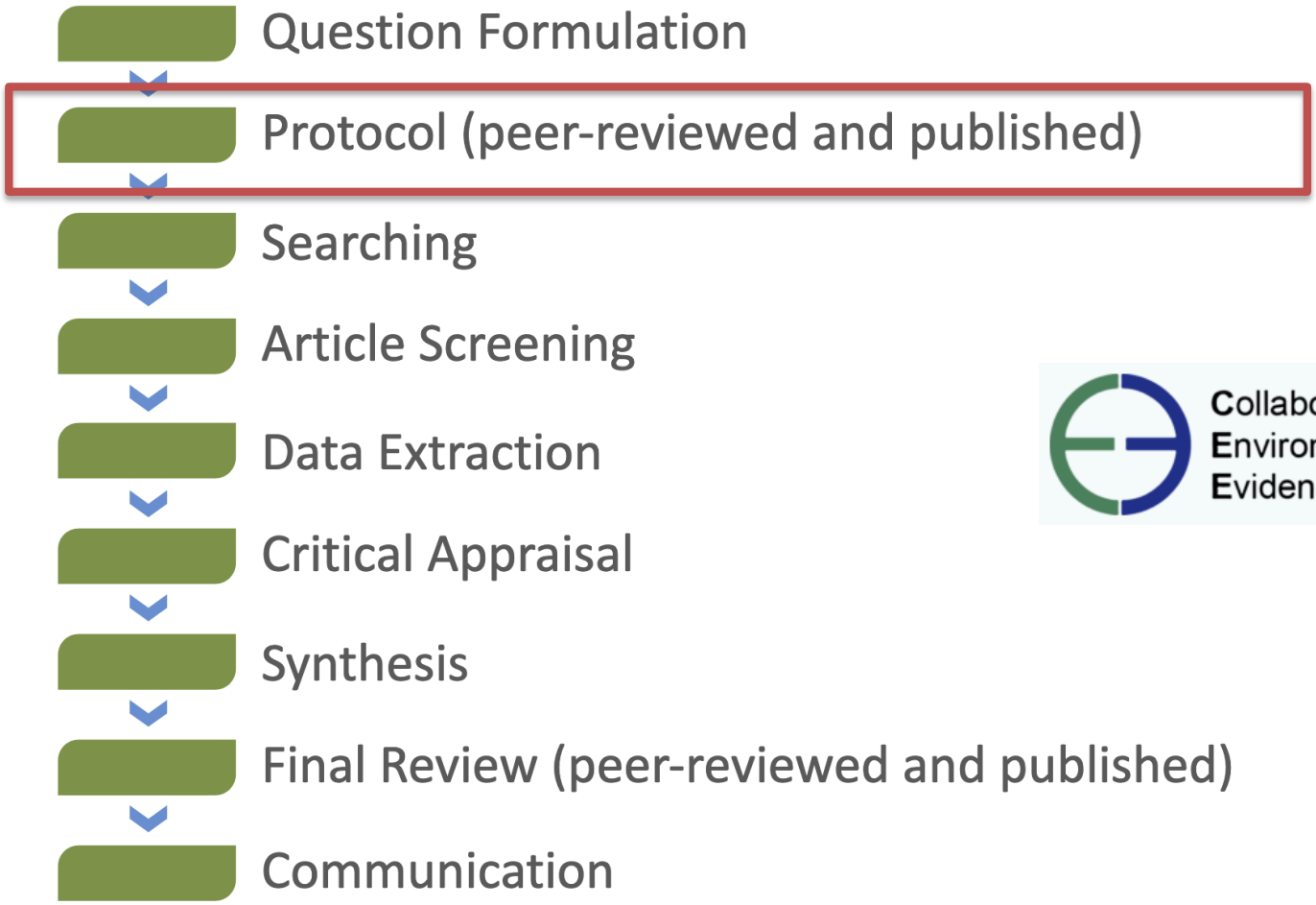
Langridge *et al. Environ Evid* (2021) 10:29
https://doi.org/10.1186/s13750-021-00236-w

Environmental Evidence

SYSTEMATIC MAP Open Access

Existing evidence on the outcomes of wildlife translocations in protected areas: a systematic map

Joseph Langridge, Romain Sordello and Yorick Reyjol



Collaboration for Environmental Evidence

Why is it important to develop a Protocol?

"Accurate, unbiased and concise synthesis of available evidence following clear methodology and transparent reporting is necessary to support effective environmental policy and management decisions" (Pullin et al. 2022).

Why is it important to develop a Protocol?

Traditional approaches to reviewing literature may be susceptible to bias and result in incorrect decisions.

Scientific principles:

A protocol :

- ✓ aims at objectifying conclusions (minimizing bias)
- ✓ …to favour objectivity:
  - Replicability
  - Transparency, archiving
  - Consideration of biases (internal, external)
- ✓ provides a framework to achieve the above.
- ✓ outlines a systematic approach

Maximizing reliability = published protocol + review (both peer-reviewed).

Why is it important to develop a Protocol?

COMMENTARY Open Access

Standards of conduct and reporting in evidence syntheses that could inform environmental policy and management decisions

Andrew S. Pullin[1,11*], Samantha H. Cheng[2], Josephine D'Urban Jackson[3], Jacqualyn Eales[4], Ida Envall[5], Salamatu J. Fada[6,7], Geoff K. Frampton[8], Meagan Harper[9], Andrew N. Kadykalo[9], Christian Kohl[10], Ko Konno[11], Barbara Livoreil[12], Dakis-Yaoba Ouédraogo[13], Bethan C. O'Leary[14,15], George Pullin[16], Nicola Randall[17], Rebecca Rees[18], Adrienne Smith[19], Romain Sordello[20], Eleanor J. Sterling[21], Will M. Twardek[22] and Paul Woodcock[23]

Table 1 Glossary of terms describing key characteristics of evidence synthesis conduct and reporting

Reliability	The extent to which an evidence synthesis can be trusted as an estimate of the truth
Replicability	The extent to which the conduct of an evidence synthesis is reported so that it could be replicated by a third party
Transparency	The extent to which the evidence synthesis methods, analyses, data, and limitations are reported openly
Potential for bias	The likelihood that the conduct of an evidence synthesis might provide misleading results or findings

From: Pullin et al. 2022 https://doi.org/10.1186/s13750-022-00269-9

Why is it important to develop a Protocol?

- A review protocol provides a step-by-step guide for conducting Evidence reviews.
- It is important for the review team to develop an *a priori* protocol before starting the literature review so that the process is **clear** and **consistent**.
- The protocol should contain specific guidelines to identify and screen relevant articles, and outline the methods for the entire process.
- The protocol can help the review team or other researchers to replicate the work:
  - **updating** the literature review when new research becomes available.

Guidelines and Standards for Evidence Synthesis in Environmental Management

Collaboration for Environmental Evidence

3.5 Writing and registering a CEE-standard protocol

3.5.1 Purpose of the protocol

https://environmentalevidence.org/information-for-authors/3-planning-the-conduct-of-an-evidence-synthesis/

Reliability and replicability of evidence reviews

- O'Leary et al. 2016

92 environmental reviews were judged to be poorly conducted and reported (a median score of **2.5 out of a possible 39** using the Collaboration for Environmental Evidence Synthesis Appraisal Tool (CEESAT))

Contents lists available at ScienceDirect

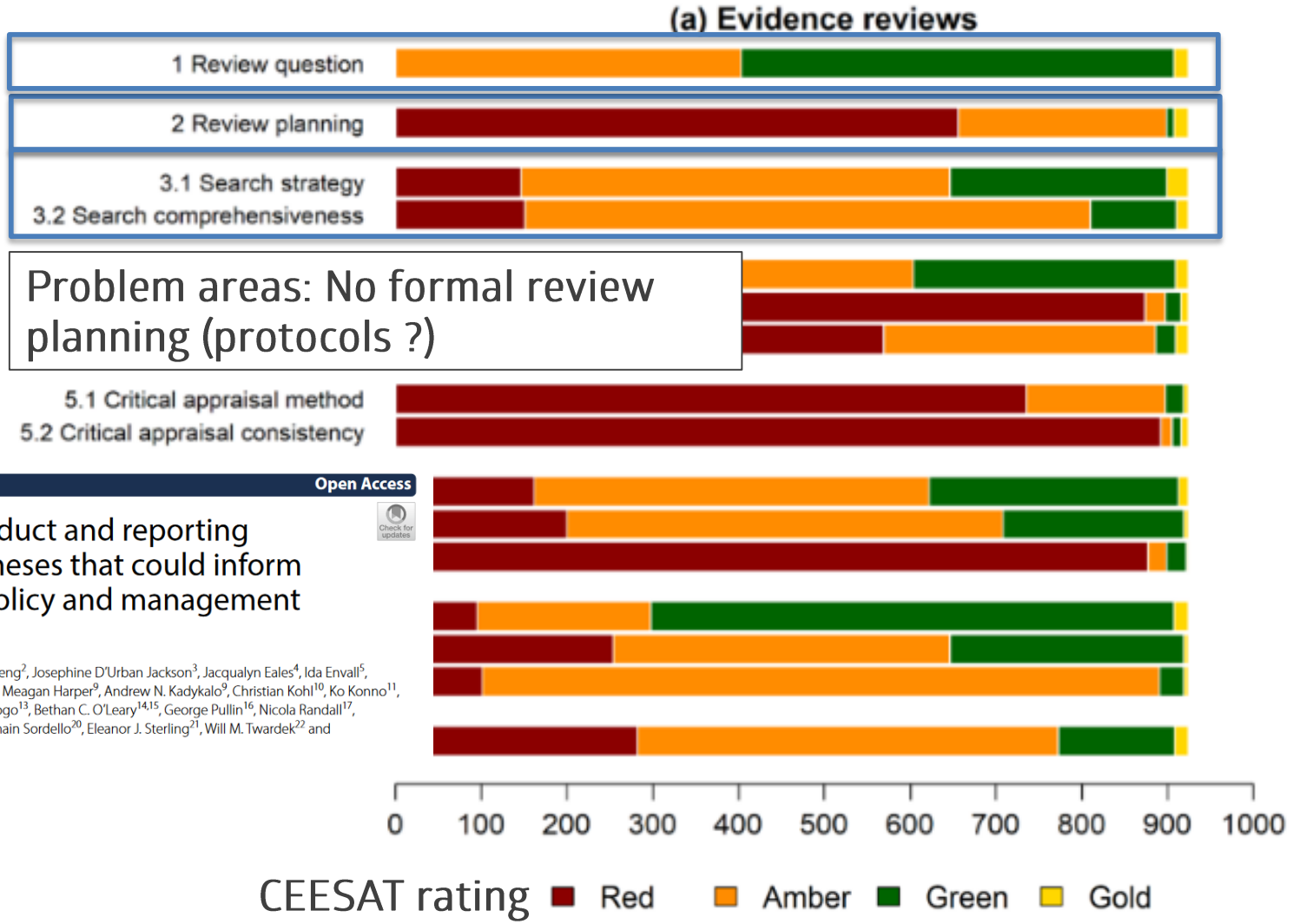
Environmental Science & Policy

journal homepage: www.elsevier.com/locate/envsci

The reliability of evidence review methodology in environmental science and conservation

Bethan C. O'Leary[a,*], Kristian Kvist[a], Helen R. Bayliss[a], Géraldine Derroire[b], John R. Healey[b], Kathryn Hughes[c], Fritz Kleinschroth[b], Marija Sciberras[c], Paul Woodcock[d], Andrew S. Pullin[a]

Reliability and replicability of evidence reviews



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(Pullin et al. 2022).

Problems without a protocol

1. Mission creep :

Occurs when the review deviates from the initial objectives.

- *Key definitions, search strategies and inclusion or appraisal criteria may alter over time or differ between reviewers*.

- The resulting set of articles will then **not be representative** of the relevant evidence base and **important studies may have been omitted**. As a result, the review may be highly inaccurate and misleading, and will be unrepeatable.

Haddaway et al. 2020. https://doi.org/10.1038/s41559-020-01295-x

Problems without a protocol

Mitigation strategies:

- ✓ Outline planned methods for searching, screening, data extraction, critical appraisal and synthesis **in detail**.
- ✓ Ideally be peer-reviewed, benefit from feed-back; avoid errors.

Where to publish ?

- ***Environmental Evidence***, ***Ecological Solutions*** *and* ***Evidence*** and ***Conservation Biology*** now accept registered reports/protocols.

- Preprint servers such as Open Science Framework Preprints (https://osf.io/preprints)

Haddaway et al. 2020. https://doi.org/10.1038/s41559-020-01295-x

Problems without a protocol

2. Lack of transparency/replicability:

An ability to repeat a review's methods exactly ('replicability').

- Methods used to produce reviews should be reported transparently in sufficient detail to allow the review to replicated or verified.

- If the reader can't understand either i) *how studies were identified, selected and synthesized* ii) nor *which were excluded*, then the risk of bias cannot be assessed, and **unclear subjective decisions may affect reliability** (Haddaway et al. 2020).

- **Can unreplicable reviews be truly trusted ?**

Haddaway et al. 2020. https://doi.org/10.1038/s41559-020-01295-x

Problems without a protocol

Mitigation strategies:

- ✓ Make use of high-standard evidence syntheses and guidance.
- ✓ Attempt to conform to **internationally accepted review reporting standards**.

What guidance ?

- *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* (PRISMA) https://www.prisma-statement.org/

- RepOrting standards for Systematic Evidence Syntheses (ROSES) https://www.roses-reporting.com/

Haddaway et al. 2020. https://doi.org/10.1038/s41559-020-01295-x

Help for planning

- Campbell Systematic Reviews: Policies and Guidelines (Campbell Collaboration, 2014).
- Higgins, J. P. et al. Cochrane Handbook for Systematic Reviews of Interventions (John Wiley & Sons, 2019).
- Shea, B. J. et al. AMSTAR 2: a critical appraisal tool for systematic reviews that include randomised or non-randomised studies of healthcare interventions, or both. BMJ 358, j4008 (2017).
- Freeonline methods training : https://synthesistraining.github.io/

Guidelines and Standards for Evidence Synthesis in Environmental Management

Collaboration for Environmental Evidence

Section 3

Planning the conduct of an Evidence Synthesis

https://environmentalevidence.org/information-for-authors/3-planning-the-conduct-of-an-evidence-synthesis/

How to develop a review Protocol?

1. Background/Purpose
2. Objectives/Review Question
3. Methods
    a. Selection Criteria
    b. Search Strategy
    c. Data Collection
    d. Displaying Data
    e. Analysis and Synthesis

Guidelines and Standards for Evidence Synthesis in Environmental Management

Collaboration for Environmental Evidence

3.5 Writing and registering a CEE-standard protocol

3.5.1 Purpose of the protocol

https://environmentalevidence.org/information-for-authors/3-planning-the-conduct-of-an-evidence-synthesis/

Preparing your Protocol manuscript - CEE

Title page

Abstract

Keywords

Background → background to the review

Objective of the Review → the primary question and secondary questions, the primary question components

Methods:

Searching for articles → Languages, Search strings, comprehensiveness of the search, Publication Databases to be searched

Article screening and study eligibility criteria → Screening methodology, Test(s) for consistency, Eligibility criteria

Study validity assessment → Critically appraise and assess validity

Data coding and extraction strategy → how to collect and record qualitative and/or quantitative

Potential effect modifiers/reasons for heterogeneity → a list of those effect modifiers to be coded

Data synthesis and presentation → Description of manipulation of the dataset (e.g. sub-group analysis)

PROCEED – « fast-track » the protocol

A global registration system for titles and protocols of environmental evidence reviews and syntheses

Collaboration for Environmental Evidence

What is PROCEED?

PROCEED is a global database of prospectively registered evidence reviews and syntheses in the environmental sector. It provides an open access resource of titles and protocols of environmental evidence reviews/syntheses. Authors can register and upload their titles and protocols using appropriate templates. The database is open-access and free to all.

Go to PROCEED

JKI Julius Kühn-Institut

https://www.proceedevidence.info/

PROCEED – « fast-track » the protocol

What is PROCEED?

- PROCEED provides an open-access resource of protocols and their titles that authors register using appropriate templates.

Why is PROCEED needed?

- A system for registration of protocols of evidence reviews or syntheses is widely regarded as important to avoid duplication of effort and to reduce risk of bias in their conduct and findings

https://www.fondationbiodiversite.fr/actualite/decryptage-un-veritable-tournant-en-faveur-de-la-synthese-de-connaissances-dans-le-domaine-des-sciences-de-lenvironnement/

[Décryptage] Un véritable tournant en faveur de la synthèse de connaissances dans le domaine des sciences de l'environnement

Parler de synthèse de connaissances c'est parler d'un ensemble de méthodes d'expertise qui permet de regrouper, de confronter les connaissances actuelles sur un sujet donné. C'est d'une certaine manière parler d'outils de transfert de connaissances. La finalité de ces méthodes ? Dresser un état des connaissances pour appuyer la prise de décision.

De la curiosité scientifique à l'élaboration d'une politique spécifique, le recours à ces méthodes intervient lorsqu'est identifié un besoin de disposer de "preuves", d'un état des connaissances relatif à une question préoccupante, d'intérêt sociétal ou scientifique. Les questions peuvent alors se présenter sous des formes diverses, dépendant de la réponse recherchée : quels sont les impacts de l'exposition aux facteurs de stress anthropogéniques ? Quelle est l'efficacité d'une intervention de gestion ? Quelle est la pertinence d'une méthode donnée ? Quelles options de gestion optimales existent ?

Dernièrement, la *Collaboration for Environmental Evidence* (CEE) – un réseau de structures et d'experts individuels créé en 2007 – a fait un grand pas en faveur d'une plus grande acceptation des différentes méthodes de synthèses de connaissances. Pour mieux comprendre le rôle de cette instance et cette actualité : entretien avec Joseph Langridge, chargé de mission à la FRB, spécialiste des "synthèses de connaissances".

PROCEED

Collaboration for Environmental Evidence

PROCEED
WWW.PROCEEDEVIDENCE.INFO

Rapid Review

Title
How effective are existing solutions to mitigate impacts of onshore wind farms on flying vertebrates and invertebrates? A Rapid Review

Citation:
Joseph Langridge, Louise Dupuis, Nicolas Hette-Tronquart, Hervé Jactel, Aurélien Besnard. How effective are existing solutions to mitigate impacts of onshore wind farms on flying vertebrates and invertebrates? A Rapid Review: a Rapid Review. PROCEED-23-00142 Available from:
https://www.proceedevidence.info/protocol/view-result?id=142
https://doi.org/10.57808/proceed.2023.15

Corresponding author's email address
Joseph.langridge@fondationbiodiversite.fr

Keywords
Renewable energy; flying vertebrates; flying invertebrates; mitigating measures; efficacy

Background
The negative impacts of anthropogenic climate change (e.g., global warming, extreme weather events, food insecurity, etc.), are among the driving factors behind the phase-out of fossil fuels and shift to renewable energies that do not emit greenhouse gases, such as wind (Msigwa et al., 2022). Consequently, wind energy is becoming a major component in national (and global) strategies to reduce carbon emissions. Indeed, it is a fast-growing industry as markets for renewable energy production have continued to increase over the past decade. For instance, total global wind power capacity measured 743 Gigawatts in 2020, having doubled since 2014 (REN21). However, wind energy is not free of impact on biodiversity: turbines can have substantial effects on both

Systematic / rapide review

Collaboration for Environmental Evidence

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WWW.PROCEEDEVIDENCE.INFO

Systematic Map Protocol

Title
What evidence exists on the potential of Technosols constructed from mineral wastes to host biodiversity?

Citation:
Dakis-Yaoba Ouédraogo, Romain Sordello, Yorick Reyjol, Thomas Lerch. What evidence exists on the potential of Technosols constructed from mineral wastes to host biodiversity?: a Systematic Map Protocol. PROCEED-22-00018 Available from:
https://www.proceedevidence.info/protocol/view-result?id=18
https://doi.org/10.57808/proceed.2022.3

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Keywords
Anthroposol; Anthrosol; Circular economy; Constructed Technosol; Ecological engineering; Excavated materials; Urban construction wastes

Background
In 2018, an estimated 55.3 per cent of the world's population lived in urban settlements. By 2030, urban areas are projected to house 60 % of people globally and one in every three people will live in cities with at least half a million inhabitants [1]. The development of cities and transport infrastructures will produce a large volume of excavated materials. For instance, in France, the construction of the Grand Paris Express transport infrastructure will generate 45 million tonnes of these materials. The management of excavated materials, considered as wastes, has a substantial economic and environmental cost (e.g. greenhouse gas emissions), as they are most often stored in

Systematic map