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CEE review 05-001

DO HABITAT CORRIDORS INCREASE POPULATION VIABILITY? PART A: DO HEDGEROW CORRIDORS INCREASE THE POPULATION VIABILITY OF WOODLAND SPECIES?

Systematic Review Protocol

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CENTRE FOR EVIDENCE-BASED CONSERVATION

SYSTEMATIC REVIEW NO. 8

WORKING TITLE: DO HABITAT CORRIDORS INCREASE POPULATION VIABILITY?

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REVIEW PROTOCOL

1. Background

To negate the effects of habitat fragmentation in the modern landscape, conservation biologists commonly advocate interventions that increase habitat connectivity in order to sustain, and enhance, the population viability of target species. The use of habitat corridors as a conservation tool to mediate such effects has been an area of considerable debate over the past two decades (Noss, 1987; Simberloff and Cox, 1987; Simberloff et al., 1992; Beier and Noss, 1998; Haddad et al., 2000).

Proponents of habitat corridors argue that they act as conduits, facilitating the movement of individuals between otherwise isolated habitat patches, thereby assisting the persistence of populations within the landscape. Sceptics have argued that habitat corridors may actually be deleterious to target species, potentially increasing edge-related predation risk, the spread of disease and the probability of catastrophic natural

disturbance. Are habitat corridors cost effective or would scarce financial resources be better spent maintaining and increasing the quality of remnant habitat patches? A systematic review of all available empirical evidence is proposed to determine what types of corridor represent effective conservation interventions. This will allow both policy makers and practitioners to make informed decisions with regard to habitat corridor preservation and creation.

Initially the systematic review will focus specifically on the effectiveness of hedgerows as corridors between fragments of woodland habitat within an arable matrix (Part A). Subsequently, it is envisaged that a series of sub-reviews, nested within this broad working title, will be conducted in order to examine the effectiveness of other types of habitat corridor *(please contact the lead reviewer should you wish to either suggest, or develop, such an addition to this protocol)*.

2. Specific Objective of the Review

To evaluate the utility and effectiveness of habitat corridors in promoting population viability of target species and biodiversity within fragments of habitat. The following questions will be addressed:

PART A

2.1.A Primary question

Do hedgerows increase population viability of target species occupying otherwise isolated fragments of woodland habitat?

Table 1: Definition of components of the primary systematic review question (Part A).

Subject (population)	Intervention	Outcome			Designs
		Primary	Secondary	Tertiary	
Mammal, bird, invertebrate and plant species	A hedgerow as a corridor of linear habitat, connecting 2 or more fragments of woodland habitat, embedded in a dissimilar matrix *vs* Isolated habitat fragments with no connecting corridor present	Any change in population density or population persistence within the woodland habitat fragments	Any change in the rate of movement of individuals between the woodland habitat fragments [*If proponents and sceptics agree on the value of habitat connectivity for species, the important result is then whether corridors do indeed facilitate species movement*]	Any other outcomes (e.g., any effects on non-target species populations)	Quantitative: primary, studies with comparators as defined in the intervention column. Qualitative: field evidence, descriptive studies and reports

2.2.A Secondary question

Does the presence of hedgerows increase biodiversity within woodland habitat fragments? [*This question is of secondary concern as measures of biodiversity may be confounded by an increase in the number of undesirable species (e.g., edge-related predators or parasitoids) which may have deleterious effects on species of conservation interest*].

Table 2: Definition of components of the secondary systematic review question (Part A).

Subject (population)	Intervention	Outcome	Designs
Woodland habitat fragment(s)	A hedgerow as a corridor of linear habitat, connecting 2 or more fragments of woodland habitat, embedded in a dissimilar matrix of arable land *vs* Isolated habitat fragments with no connecting corridor present	Any change in community composition and species richness within the woodland habitat fragments	Quantitative: primary, studies with comparators as defined in the intervention column. Qualitative: field evidence, descriptive studies and reports

3.A Methods

3.1.A Search strategy

The following electronic databases will be searched:

1. ISI Web of Knowledge
   - ISI Web of Science: Science Citation Index Expanded (1945-present)
   - ISI Proceedings: Science and Technology Proceedings (1990-present)
2. Science Direct
3. Directory of Open Access Journals (DOAJ)
4. Copac
5. Scirus
6. Scopus
7. Index to Theses Online (1970-present)
8. Digital Dissertations Online
9. Agricola
10. Europa
11. English Nature's "Wildlink"
12. JSTOR
13. BIOSUS via EDINA
14. Sigle via ARC2 WebSPIRS

The following English language search terms will be used:

1. Hedgerow* and corridor*
2. Hedgerow* and movement
3. Hedgerow* and connectivity

4. Hedgerow* and population*
5. Hedgerow* and communit*
6. Hedgerow* and mammal*
7. Hedgerow* and bird*
8. Hedgerow* and invertebrate*
9. Hedgerow* and plant*

Further taxa-specific terms may be added as the search progresses. Foreign language searches will also be conducted, using Austrian, Danish, Dutch, Finnish, French, German, Greek, Italian, Norwegian, Swedish and Swiss translations of the above terms.

Publication searches will be done on conservation and statutory organisation websites, and using the meta-search engines Dogpile, Alltheweb and Google Scholar; the first 100 word document or PDF hits from each website will be examined for appropriate data. In addition, bibliographies of articles accepted at full text and secondary traditional review articles will be searched. Authors, recognised experts and practitioners will also be contacted for further recommendations and for provision of any unpublished material or missing data that may be relevant.

3.2 Study inclusion and exclusion criteria

The following criteria will be used to assess the title and abstract of articles for broad relevance:

- **Relevant subjects:** any species of mammal, bird, amphibian, reptile, invertebrate or plant.
- **Type of intervention:** a corridor connecting 2 or more fragments of habitat.
- **Types of outcome:** the primary outcomes are change in population density for a target species or change in species richness within communities. However, studies will not be rejected on the basis of outcome.
- **Types of study:** no comparator necessary for inclusion, although appropriate spatial or temporal controls (e.g. pre-creation comparators) are a prerequisite for studies to be included in subsequent meta-analysis.

Where there is insufficient information to make a decision with regard to whether the study should be included within the systematic review, it will be included into the next stage of the process. Reviewers will then consider articles accepted at full text for relevance, either excluding or admitting them to the review. Two reviewers will independently examine a subset of articles (approximately 25 % of the studies) accepted at full text; disagreement will be resolved by consensus, or following assessment by a third reviewer.

3.3 Study quality assessment

The quality of each study accepted into the systematic review will be assigned a score. The scores are adapted from the hierarchy of evidence quality used in the medical and public health sectors (e.g. a randomised control trail would be weighed higher than a site comparison study; Stevens and Milne, 1997; Pullin and Knight, 2003). At least two reviewers will independently assess a random subset of accepted

articles (approximately 25 % of the studies); disagreement on study quality, and the subsequent study weighting, will be resolved by consensus and referred to a third reviewer if required.

3.4 Data extraction strategy

Data regarding the study characteristics, quality and results will be recorded on a specially designed data extraction form. These forms may be amended after consultation with statisticians and piloting of data extraction process.

3.5 Data synthesis

A narrative synthesis will be produced, including summary tables of study characteristics, quality and results. Quantitative analysis will be undertaken on any data that is suitable for formal statistical treatment. The type of analysis will be dependent on the nature of the extracted data. Meta-analysis will be employed if suitable data is available.

3.6 Potential reasons for heterogeneity

After consultation with the user-community, the following potential reasons for heterogeneity have been identified.

Part A:

1. Physical structure of the hedgerow
2. Species composition of the hedgerow
3. Nature of the arable matrix
4. Size and quality of the woodland habitat fragments
5. Whether the hedgerow support a breeding population of the target species
6. Time of year of the study
7. Life history stage of the target species (e.g., dispersing juvenile)
8. Altitude and latitude of the study site

4 Potential Conflicts of Interest and Sources of Support

No conflicts of interest to be declared. This systematic review is funded by English Nature.

5 References

Beier, P., Noss, R.F. (1998). Do habitat corridors provide connectivity? Conservation Biology 12, 1241-1252.

Haddad, N.M., Rosenberg, D.K., Noon, B.R. (2000). On experimentation and the study of corridors: response to Beier and Noss. Conservation Biology 14, 1543-1545.

Noss, R.F. (1987). Corridors in real landscapes: a reply to Simberloff and Cox. Conservation Biology 1,159-164.

Pullin, A.S., Knight, T.M. (2003). Support for decision making in conservation practice: an evidence-based approach. Journal for Nature Conservation 11, 83-90.

Simberloff, D., Cox, J. (1987). Consequences and costs of conservation corridors. Conservation Biology 1, 63-71.

Simberloff, D., Farr, J.A., Cox, J., Mehlman, D.W. (1992). Movement in corridors: conservation bargains or poor investments? Conservation Biology 6, 493-504.

Stevens, A., Milne, R. (1997). The effectiveness revolution and public health. In: Progress in Public Health, ed G. Scally, pp. 197-225. Royal Society of Medicine Press, London.