



CENTRE FOR EVIDENCE-BASED CONSERVATION

SYSTEMATIC REVIEW No. 17

WORKING TITLE: DO THE CURRENTLY RECOMMENDED MANAGEMENT REGIMES FOR CONSERVING SAPROXYLIC INVERTEBRATE POPULATIONS WORK?

Lead Reviewer: **Currently there is no lead reviewer.
Please contact Dr Gavin Stewart regarding this review.**

Postal Address: **Dr Gavin Stewart,
Centre for Evidence-Based Conservation,
School of Biosciences,
University of Birmingham,
Edgbaston,
B15 2TT.**

Email Address: **g.b.stewart@bham.ac.uk**

Telephone: **+44 (0)121 414 4090**

Facsimile: **+44 (0)121 414 5925**

REVIEW PROTOCOL

1. BACKGROUND

Saproxylic invertebrates particularly Coleoptera make up one of the largest groups of red-listed species in Fennoscandian, and European countries (Speight 1989, Berg *et al.* 1995, Jonsell *et al.* 1998, Martikainen & Kaika 2004). A lack of dead wood and low numbers of deciduous trees resulting from forest management practices have been identified as major factors contributing to the loss of saproxylic biodiversity especially in Fennoscandian forests (Esseen *et al.* 1997). More sympathetic management regimes have been advocated to address this decline. These include the creation of man-made stumps and retention of natural stumps (Jonsell *et al.* 2004), maintenance of over-mature trees (tree surgery, reduction of competition), leaving fallen wood under light Bracken or Bramble cover and lying in water, inducing decay in young trees where over-mature trees are absent (Alexander *et al.*), leaving large diameter fallen wood where possible, pollarding young trees, leaving woodpiles in preference to removing timber and creating large piles of tightly packed brash rather than small piles of open brashings (Kirby 1992). The National Trust (NT) is interested

in ascertaining the efficacy of these interventions for the maintenance of saproxylic invertebrate diversity.

The effectiveness of these management interventions may be modified by the species and age of timber, as well as the species of invertebrate (Jonsell *et al.* 2004). Light levels may modify invertebrate response to woodpile colonisation; with partial shade thought to be desirable (Alexander *et al.*, Kirby 1992). Diameter of wood source and size of brush piles are also important factors (Kirby 1992). The length of follow up period, scale and geographical location over which responses are measured are also likely to modify the impact of the interventions. The impact of these potential effect modifiers requires investigation.

An explicit systematic review methodology will be used to retrieve data pertaining to the impact of sympathetic management on saproxylic invertebrates. The review will limit bias through the use of comprehensive searching, specific inclusion criteria and formal assessment of the quality and reliability of the studies retrieved. Subsequent data synthesis will summarise empirical evidence guiding the formulation of appropriate evidence-based management guidelines and highlighting gaps in research evidence. The review should be of use to practitioners in government and non-statutory conservation agencies, informing decisions over regional and national management guidelines. It also has a wider international relevance with the potential to inform management decisions at European and Fennoscandian level.

2. OBJECTIVE OF THE REVIEW

2.1 Primary question

Do currently recommended management regimes for conserving saproxylic invertebrate populations work?

Table 1: Definition of components of the primary systematic review question.

Subject (Population)	Interventions	Outcome		
		Primary	Secondary	Tertiary
Woodland saproxylic invertebrates	man-made stumps, natural stumps, over-mature trees (tree surgery, reduction of competition), fallen wood ± Bracken, Bramble cover or Water, inducing decay, pollarding, woodpiles, brush piles	Change in species richness (number of species) of saproxylic invertebrates*	Changes in the abundance or diversity of saproxylic invertebrates, changes in the abundance of bird species eating saproxylic invertebrates.	Any other outcomes
	Vs			
	No treatment			

*Definition of adverse outcomes including ecologically significant magnitude must be agreed prior to data extraction.

2.2 Secondary question

What influence does intervention type, species and age of timber, species of invertebrate, light level, diameter of wood, size of brash piles, length of follow up period, scale and geographical location have on the impact of sympathetic management on saproxylic invertebrates?

3. METHODS

3.1 Search strategy

The following electronic databases will be searched:

1. ISI Web of Knowledge
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. BIOSIS via EDINA
14. SIGLE via ARC2WebSPIRS

The following English language search terms will be used:

1. Saproxylic
2. Coleoptera and conservation
3. Dead and wood
4. Overmature and tree*
5. Over-mature and tree*
6. Over and mature and tree*
7. Fallen and wood
8. pollard*
9. brash* and conservation

Further terms may be added as the search progresses involving combination of the existing terms and the use of taxa-specific terms if necessary. Foreign language searches will be undertaken to cover Fennoscandian and European countries with managed boreal forests including: Belarus, Denmark, Estonia, Finland, France, Germany, Latvia, Lithuania, Norway, Poland, Russia and Sweden.

Publication searches will be undertaken on conservation and statutory organisation websites (Countryside Council for Wales, Department of Environment, Food and Rural Affairs, Forest Research, Forestry Commission, English Nature, Joint Nature Conservation Committee, NT, Royal Society for the Protection of Birds, Scottish Natural Heritage) and using the meta-search engines Dogpile, Alltheweb and Google

Scholar. The first 100 word document or PDF hits from each data source will be examined for appropriate data. In addition bibliographies of articles viewed at full text will be searched. Authors, recognised experts and practioners will also be contacted for further recommendations and for provision of any unpublished material or missing data that may be relevant. Questionnaires will be circulated to practioners in order to collate experience.

3.2 Study inclusion criteria

- **Relevant subjects:** Woodland saproxylic invertebrates.
- **Type of Intervention:** man-made stumps, natural stumps, over-mature trees (tree surgery, reduction of competition), fallen wood \pm Bracken, Bramble cover or Water, inducing decay, pollarding, woodpiles, brash piles vs no treatment.
- **Types of Outcome:** The primary outcome is change in species richness (number of species) of saproxylic invertebrates. However studies will not be rejected on the basis of outcome and outcomes other than change in species richness will be catalogued.
- **Types of Study:** Type of study will not be used to define inclusion or exclusion criteria. It is envisaged that all information regarding the primary outcome will be collated within a Bayesian framework. Appropriate spatial or temporal controls are a prerequisite for studies to be included in inferential meta-analysis.

Where there is insufficient information to make a decision regarding study inclusion when viewing titles or titles and abstracts, then relevance to the next stage of the review process will be assumed. Reviewers will consider articles viewed at full text for relevance excluding or admitting them to different categories of relevance and quality. At least two reviewers will independently assess a random subset of 25% of articles viewed at full text. Disagreement will be resolved by consensus, or following assessment by a third reviewer.

3.3 Study quality assessment

Reviewers will consider articles viewed at full text excluding or admitting them to different categories of information quality. At least two reviewers will independently assess a random subset of 25% of articles viewed at full text. Disagreement will be resolved by consensus, or following assessment by a third reviewer.

3.4 Data extraction strategy

Data regarding 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 the data extraction process.

3.5 Data synthesis

It is envisaged that all information will be collated within a Bayesian framework. This will incorporate meta-analysis where appropriate data exists. Reasons for heterogeneity in results including intervention type, species and age of timber, species

of invertebrate, light level, diameter of wood, size of brash piles, length of follow up period, scale and geographical location will be investigated by meta-regression where appropriate data exists.

3.6 Reasons for heterogeneity

The following potential reasons for heterogeneity have been formally identified *a priori* in order of importance.

1. Intervention type
2. Species of invertebrate
3. Species of timber
4. Age of timber
5. Follow up period
6. Scale
7. Diameter of wood
8. Light levels
9. Size of brash piles
10. Geographical location

4. POTENTIAL CONFLICTS OF INTEREST AND SOURCES OF SUPPORT

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

5. REFERENCES

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