Collaboration for Environmental Evidence
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CEE review 07-008

THE EFFECTIVENESS OF PLANT INTRODUCTIONS AS A METHOD FOR MITIGATING EXTINCTIONS

Systematic Review Protocol

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1. BACKGROUND

Sixteen years ago the IUCN's Re-introduction Specialist Group devoted most of an issue of their newsletter 'Re-introduction News' to the topic of plant reintroductions. In the editorial, Dr Michael Maunder (1991) noted that compared with translocations of animals, plant re-introductions were 'relatively under-studied and little debated'. Today, this situation has changed greatly – translocations of plant seeds or individuals are now more widely discussed in the scientific and conservation press, and form the subject of an increasing volume of research work.

In the following year, Maunder (1992) wrote that reintroductions of plants could 'at present only be regarded as experimental'. Again, there has been a significant change since then, as re-introductions have now been absorbed into the 'toolkit' available to plant conservationists and are advocated in 41 of the 63 species action plans for vascular plants under the UK Biodiversity Action Plan (UK Biodiversity Group, 1999). Re-introductions have been proposed as options for overcoming habitat loss and fragmentation and reproductive isolation (Quinn *et al.*, 1994), and as a potential method for preventing extinctions due to climatic shifts too rapid to allow corresponding species' distribution changes (Hulme, 2005).

Despite the increased discussion and the expansion out of the purely experimental domain into applied conservation, plant re-introductions are still questioned in the literature (e.g. Hodder & Bullock, 1997; Pearman and Walker, 2004; Strahm, 2003; Sutherland *et al.*, 2006), and through meetings such as the Botanical Society of the British Isles' recent conference which highlighted the rise in application of plant introductions without an equivalent success rate. The use of translocations has been attacked for the lack of monitoring and central recording, inappropriateness of the action due to genetic considerations, a lack of knowledge of the demography of the donor populations and inadequate information on the habitat requirements of the species.

This review aims to evaluate whether re-introductions should be advocated as a conservation tool by using the available evidence to determine in which context plant translocations can improve the status of threatened species and which situations the technique might be inappropriate.

2. OBJECTIVE OF THE REVIEW

To evaluate the effectiveness of (re-)introductions as a method for mitigating extinctions of plant species by answering the following question:

2.1 Primary question

Are (re-)introductions an effective method of increasing the viability of endangered or vulnerable plant species?

3. METHODS

3.1 Search strategy

The following computerised databases will be searched:

1. ISI Web of Knowledge including ISI Web of Science (Science Citation Index expanded 1945-present) and ISI Proceedings (Science and Technology Proceedings 1990-present)
2. JSTOR
3. Index to Theses Online (1970-present)
4. Digital Dissertations Online
5. Dogpile Meta-search (internet search)
6. Google Scholar (internet search)
7. COPAC
8. Scirus
9. Scopus
10. ConservationEvidence.com
11. BSBI Introductions Database

The following search terms will be used:

- plant* AND re-introduc*
- plant* AND reintroduc*
- plant* AND introduc*
- plant* AND translocation*
- plant* AND establish*
- plant* AND re-establish*
- plant* AND restor*
- plant* AND reinstat*
- plant* AND regenerat*
- plant* AND assisted migration

The search terms may be too wide for search engines such as Web of Science; if these terms generate many irrelevant matches the search will be narrowed. Any substantive amendments will be flagged on the cover sheet of this protocol. The libraries of Natural England, Scottish Natural Heritage, the Countryside Council for Wales, the Joint Nature Conservancy Council and Plantlife will also be searched, by hand. The IUCN Species Survival Commission's Re-introduction Directory (1998) contains a list of practitioners that have undertaken re-introductions and the species they have worked with. This will be used to identify studies and if literature cannot be identified through the database search outlined above, the practitioners will be contacted directly. The Center for Plant Conservation have also produced a volume similar to the IUCN's directory. This will also be used to identify suitable studies and practitioners.

3.2 Study inclusion criteria

- **Relevant subject(s):** any species of vascular plant.
- **Types of intervention:** deliberate translocation of plants (either seed or individuals) in order to mitigate further decline of the species in question to sites that were unoccupied at the time of translocation and where the sites were the locations of previously extant populations or judged to be within the former or historic range of the species. Habitat translocations or species translocations for reasons of habitat restoration will not be included.

- **Types of comparator:** not necessary for inclusion in review however pre-intervention data or site comparisons will be required for inclusion in subsequent meta-analysis.
- **Types of outcome:** survival of translocated populations for more than 5 years (may be restricted by time lapsed since intervention, translocations less than 5 years old will still be included in the review but not necessarily in the meta-analysis) measured either as number of individuals per population and/or proportion of population reproducing, abundance of species expressed as numbers of individuals per population and numbers of populations, successful recruitment, increased genetic diversity of population (measured as proportion of heterozygosity or polymorphism in a population, or number of genotypes) as compared to that of the species as a whole.
- **Types of study:** quantitative studies with pre-intervention comparators and/or site comparisons are pre-requisites for meta-analysis, field evidence in the form of descriptive studies/reports will also be collated.
- **Potential reasons for heterogeneity:** species life cycle (e.g. annual, biennial or perennial), scale of study (one site or more, how many propagules or individual plants introduced), habitat based on the National Vegetation Classification (UK only, for studies overseas information must be provided from literature), site management, time lapsed since intervention.

3.3 Study quality assessment

Full text articles will be considered for inclusion and if suitable, will be included in a qualitative review or quantitative meta-analysis based on the availability of comparator data. Sensitivity analyses will be run separating "high quality" from low quality studies. A high quality study would include (re-)introduced populations at multiple sites which have been surveyed after an appropriate time for the population to establish and stabilise. The studies included in the meta-analysis will be assessed on the quality of information using a scoring system (see appendix). A subset of the included studies will be scored by two independent reviewers and the degree of agreement on the quality of the data can then be tested statistically.

3.4 Data extraction strategy

A single reviewer will extract information from relevant studies, but a subset of studies will be checked to verify data hygiene and the repeatability of the data extraction process

3.5 Data synthesis

Where appropriate data are available, studies will be included into a meta-analysis of the effect size resulting from the intervention. If the information quality is not adequate for meta-analysis a narrative review will be produced.

4. POTENTIAL CONFLICTS OF INTEREST AND SOURCES OF SUPPORT

No potential sources of conflict declared. The project is supported by the British Ecological Society through an 'Ecology Into Policy' grant, number 921/1146.

5. REFERENCES

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Appendix: (Re-)introduction study quality assessment criteria

Bias and generic data quality features	Specific data quality features	Quality element	Quality score
Selection and performance bias: Study design		Pre-intervention data	50
		Site comparisons (≥ 5 sites)	40
		Site comparisons (≥ 2 but ≤ 5 sites)	30
		No site comparison	10
		Expert opinion / questionnaire / data without comparator	10
Selection and performance bias: Baseline data	Habitat type	Comparable between natural and (re-)introduction sites	2
		Not comparable or insufficient data	0
	Genetic diversity	Genetic diversity of parent plants or translocated individuals assessed	2
		Genetic diversity of above not assessed	0
Selection and performance bias: Inter-site variation	Habitat type	Comparable between different sites	4
		Not comparable or insufficient information	0
	Number of individuals introduced	Comparable between different sites	2
		Not comparable or insufficient information	0
	Time since (re-)introduction	Comparable between different sites	10
		Not comparable or insufficient information	0
Assessment bias: Measurement of outcome	Recruitment	Replicated measurements within each population	10
		Not replicated	0
	Genetic diversity	Replicated measurements within each population	10
		Not replicated	0
	Time since (re-)introduction	≥ 10 years	40
		≥ 5 years	30
		≥ 3 years	20
		≤ 3 years	0
Attrition bias: Assessment of treatment effect on sample number		No losses to follow up	2
		Minor (< 20 %) losses	1
		Major (> 20 %) losses	0