

CENTRE FOR EVIDENCE BASED CONSERVATION

Systematic review No. 6

Working title: Control of *Rhododendron* (*Rhododendron ponticum*)

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Review Protocol

1. Background

Rhododendron are shrubs from the family Ericaceae. A genus of over 600 species (Cross, 1975). First introduced into Britain in 1763 (Cross, 1975; Milne and Abbott, 2000), with many subsequent introductions having led to naturalisation (Milne and Abbott, 2000). Within Britain *Rhododendron ponticum* has proven to be the most prevalent threat to wildlife as it has few natural enemies (Milne and Abbott, 2000), and is able to grow on all acid soils, unlike other species that have more demanding cultivation requirements. It is an invasive species that threatens and suppresses native flora, often altering the entire ecosystem (Mitchell *et al.* 1997). Since the 19th century *R. ponticum* has spread from gardens and parks, where it was used for winter game cover or as an ornamental, into woodland, heaths, bogs and sand dunes (Thomson *et al.* 1993). The species forms evergreen vegetation that is impenetrable, allowing little light through the lower canopy, and, in combination with leaf litter, creates a sterile environment supporting little in the way of fauna or flora (Cross, 1981).

R. ponticum grows well on all peaty or sandy soils, but once established can grow on a wide range of acidic substrates. Burton and Carpenter (1999) have shown that an isolated clump in a permanent transect grew at a rate of 20 cm per year; this rapid growth becomes a serious problem when dealing with many uncontrolled bushes. *Rhododendron* is able to regenerate quickly from seeds, suckers or rootlets and once established the work needed to remove *R. ponticum* from an area is considerable and often detrimental to other flora and fauna within the area (Kelly, 1981). Controls have been attempted and documented on several occasions and include chemical, mechanical, manual, and combination control, but interventions often fail (Eşen and Zedaker, 2004).

Searle (1999) describes some of the problems that are associated with *Rhododendron*'s naturalisation in Britain including; the reduced access to woodland areas for harvesting timber as *Rhododendron* grows in dense thickets, reduction of native tree growth in areas that are densely colonised and unacceptable growth in public places. Further problems include the increased sodium concentration in soils where *R. ponticum* is found (Mitchell *et al.* 1997) and the release of polyphenols into the soil that have a deleterious effect on native species (Cross, 1975). These have led to *R. ponticum* becoming a major threat to native species and a cause for concern for statutory and other conservation organisations who have to control its distribution within SSSI's and NNR's.

A systematic review is proposed to determine the effectiveness of different *Rhododendron* control strategies and any potentially deleterious effects they may have. To focus the review, refinement of the question may be necessary by reducing the number of interventions or outcomes (see Table 1), and is currently under discussion with the appropriate organisations.

Table 1. The interventions and outcomes of relevance to the control of *Rhododendron*.

Subject	Interventions (management)	Outcomes		
		Primary	Secondary	Tertiary
Land with <i>Rhododendron Ponticum</i> control problem	Herbicides Handpulling Mowing or cutting Combination of techniques	Any change in the abundance of <i>Rhododendron</i> : Cover Stand density Frequency Biomass	Vegetation type (community composition) after intervention compared with vegetation type before intervention.	Any other outcome e.g. effect of <i>Rhododendron</i> control on other species

2. Specific object of the review

Primary objective

Do management interventions effectively control or eradicate *Rhododendron ponticum*?

Secondary objectives

- Will the habitat modify the effectiveness of an intervention?
- Is the effectiveness of control or eradication altered by the disposal method of cut material?
- Can the use of a follow up treatment change the effectiveness of the initial treatment?

3. Methods

3.1 Search strategy

The following computerised English language databases will be searched:

1. English Nature's 'Wildlink',
2. JSTOR,
3. ISI Web of Knowledge,
4. ScienceDirect
5. www.Alltheweb.com
6. www.google.co.uk

Search terms used will be:

1. *ponticum* and control
2. *ponticum* and management
3. Rhododendron and control
4. Rhododendron and management

More specific terms for the interventions will be used when required. For example, the use of herbicides in the control of Rhododendron or *ponticum*, or search terms including the habitats such as heathland. The time spent searching is restricted by the time available for the review, so further searches in foreign languages may not be possible. Authors may be contacted for additional information if it is missing. Experts within the field and practitioners will be contacted for information and input.

3.2 Study Inclusion and Exclusion Criteria

- **Relevant Subjects:** The use of all interventions will be considered on a global scale, but geographical area will be noted to allow for interpretation of any patterns that may exist. This will also include geographical location within the UK as there may be differences in regeneration due to climatic conditions. All habitats will initially be included and recorded as the effect of an intervention may be dependent on the habitat. Also, the disposal method used in the removal of cut material will be noted as this may also prove to be an important factor in control.
- **Types of Interventions.** All interventions will initially be included, but if there is insufficient literature available the number of interventions reviewed may have to be limited; this will be achieved by scoping the literature and choosing the intervention with most relevant studies. Follow up treatments (e.g. herbicide application) will be included as this may alter the effectiveness of the initial treatment.
- **Types of Comparator.** The intervention, where possible, will be compared to an unmanaged control where no intervention is taking place, or where it is normal practice for that intervention to take place. Comparisons will be included that are temporal for the same area, or spatial where the experimental area is directly compared with another untreated area. Studies will also be included if there is a dramatic change following intervention in uncontrolled experiments, in accordance with the hierarchy of evidence.
- **Types of Outcome.** The primary outcome is change in the abundance of Rhododendron: cover, stand density, frequency or biomass, but studies will not be rejected on basis of outcome.
- **Types of Study.** All studies will be included if they contain primary data about a relevant subject, intervention and have a valid comparator or dramatic change in outcome.

One reviewer will apply the inclusion and exclusion criteria at the first instance to potential studies at the title or title and abstract stage. If there is not sufficient information to make a decision without referring to the text then the study will be included. Two reviewers will review the articles that are passed to the second full text stage. Any disagreement will be resolved by consensus and review by a third reviewer.

3.3 Study quality assessment

The quality of the study will be scored according to the hierarchy of evidence adapted from models of the systematic review process used in medicine and

public health (Stevens and Milne 1997; Pullin and Knight 2003). At least two reviewers will independently assess each accepted article, filling in an assessment form. Any disagreement will be resolved by consensus and referred to a third reviewer if required. Alteration of the protocol may be necessary once the review is underway.

3.4 Data extraction strategy

One reviewer will extract data with a subset being reviewed by another to ensure accuracy. Data regarding the study characteristics, study quality and results will be extracted using data extraction forms. These forms may be amended after consultation with statisticians and piloting the process of data extraction.

The strategy will also involve extracting data regarding 1) the characteristics of the subject (Rhododendron), i.e. the age (mature or seedling) and the stand density, 2) the characteristics of the intervention i.e. different methods used for cutting, different disposal methods and follow up treatments, and 3) the habitat characteristics, e.g. is the study in lowland heathland or woodland?

3.5 Data synthesis

Summary tables of study characteristics, study quality and results will be presented including a narrative synthesis. Quantitative analysis will be carried out on any data that is suitable, but is dependent upon the nature of the extracted data. Meta-analysis will be carried out if possible.

Potential sources of heterogeneity

The likely sources of heterogeneity will be recorded during data extraction to allow subset data analysis to occur if possible. The potential sources of heterogeneity may be due to 1) different habitats, as an intervention may be more effective in one habitat than another, 2) the disposal of cut material, as the different methods used are likely to affect the regeneration success of the Rhododendron, 3) interventions being carried out on stands on different ages, 4) the various methods of carrying out each intervention e.g. cutting can be done by a variety of tools such as chain saws or horizontal flails, or 5) different follow up treatments after the initial action to further control Rhododendron.

4. Potential conflicts of interests and sources of support

There are no conflicts of interest.

5. References

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