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DOES SHEEP-GRAZING DEGRADE UNIMPROVED NEUTRAL GRASSLANDS MANAGED AS PASTURE?

Systematic Review Protocol

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CENTRE FOR EVIDENCE-BASED CONSERVATION

SYSTEMATIC REVIEW No. 15

WORKING TITLE: DOES SHEEP-GRAZING DEGRADE UNIMPROVED NEUTRAL GRASSLANDS MANAGED AS PASTURE?

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REVIEW PROTOCOL

1. BACKGROUND

Grazing is an important management issue affecting lowland grassland throughout the UK (Crofts & Jefferson 1999, UK BAP 2005). Cessation of livestock grazing on lowland grassland has reduced the conservation value of many sites (Preston *et al.* 2002) but inappropriate grazing intensities or stock types can also be damaging (Crofts & Jefferson 1999, UK BAP 2005). In the Countryside Council for Wales (CCW) rapid assessment exercise, grazing was the first listed management factor affecting habitat condition at 63% of lowland grassland features in unfavourable condition.

Unimproved neutral grasslands (specifically MG5 *Cynosurus cristatus* - *Centaurea nigra* grasslands) have high nature conservation value and are often grazed by sheep, including aftermath grazing of hay-meadows and summer grazing of pastures (Crofts & Jefferson 1999). The high nature conservation value of MG5 hay-meadows is widely recognised but former hay-meadows, managed as pasture can also have high nature conservation value due to the relict flora they contain. Casework concerns from local CCW staff have mainly focused on sites managed as pasture, where reductions in forb frequency and cover have been associated with summer sheep grazing. The Tir Gofal management prescription for unimproved grassland addresses these concerns

by providing financial incentives to graze with cattle at a minimum stocking intensity of 0.1 Livestock units/ha. Further payment is made if the cattle are Welsh blacks (Tir Gofal 1999). However, much of the evidence concerning the impact of sheep grazing on neutral grassland is anecdotal. The impact of sheep grazing on the floristic composition of neutral grassland must be compared to management with other stock types in order to develop and refine grazing practices to achieve conservation objectives.

A large number of variables add complexity to this issue. Grazing intensity, period, duration, breed of sheep and initial floristic composition have been identified by CCW as potential effect modifiers of decreasing importance. Grazing intensity has a large impact on biomass offtake and selectivity which are both important determinants of floristic composition (Armstrong & Milne 1995, Milne *et al.* 1998). The nutritional characteristics of swards vary seasonally thus grazing period also effects selectivity, whilst the duration of grazing relates to the magnitude of changes due to grazing intensity and period (Armstrong & Milne 1995, Milne *et al.* 1998). There are around 50 native sheep breeds in Britain (Crofts & Jefferson 1999). Selectivity, biomass offtake, and flock behaviour vary with sheep breed and influence the outcome of grazing interventions (Armstrong & Milne 1995, Milne *et al.* 1998). The initial floristic composition represents the baseline from which changes occur, and can have a strong influence on any subsequent successional modification. Likewise, floristic responses to grazing are dependent upon time. Short-term studies can miss potentially important vegetation responses (Bullock *et al.*, 2001). The impact of sheep grazing on the floristic composition of neutral grassland cannot be ascertained without concurrent investigation of the impact of these factors.

An explicit systematic review methodology will be used to retrieve data pertaining to the impact of sheep grazing on the floristic composition of neutral lowland pastures. 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 conservation agency ecologists and regional staff, agri-environment scheme developers and officers, non-governmental organisation management advisers and site managers informing decisions over national management guidelines and management of individual sites at a local level.

2. OBJECTIVE OF THE REVIEW

2.1 Primary question

Does sheep-grazing degrade unimproved neutral grasslands managed as pasture?

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

Subject (Population)	Intervention	Outcome		
		Primary	Secondary	Tertiary
Unimproved neutral grasslands managed as pasture (MG5 <i>Cynosurus cristatus</i> - <i>Centaurea nigra</i> grasslands)	Sheep grazing Vs No grazing, cattle grazing, horse grazing or alternative management including different sheep grazing (e.g. light Vs heavy sheep grazing).	Any changes in plant community floristic composition. Degradation is defined in terms of favourable condition (JNCC 2004). Overall assessment will be made by favourable condition site assessors.	Any changes in the abundance of: <i>Agrimonia eupatoria</i> , <i>Alchemilla</i> spp., <i>Anemone nemorosa</i> , <i>Centaurea nigra</i> , <i>Filipendula vulgaris</i> , <i>Galium verum</i> , <i>Genista tinctoria</i> , <i>Lathyrus linifolius</i> , <i>Leontodon hispidus</i> , <i>L. saxatilis</i> , <i>Lotus corniculatus</i> , <i>Pimpinella saxifraga</i> , <i>Polygala</i> spp., <i>Potentilla erecta</i> , <i>Primula veris</i> , <i>Sanguisorba minor</i> , <i>S. officinalis</i> , <i>Serratula tinctoria</i> , <i>Silaum silaus</i> , <i>Stachys officinalis</i> , <i>Succisa pratensis</i> (10% decline in frequency or abundance is considered degradation).	Any other outcomes

2.2 Secondary question

What influence do grazing intensity, period, duration, breed of sheep, initial floristic composition and follow up period have on the impact of grazing?

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. grass* and graz*
2. grass* and sheep
3. grass* and manage*
4. grass* and conservation
5. meadow* and graz*
6. pasture* and graz*

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 are not considered cost effective in view of the focus of this review.

Publication searches will be undertaken on conservation and statutory organisation websites (Agricultural Development and Advisory Service, CCW, Department of Agriculture and Rural Development, Department of Environment, Food and Rural Affairs, English Nature, Joint Nature Conservation Committee, National Trust, 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 practitioners 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 practitioners in order to collate experience.

3.2 Study inclusion criteria

- **Relevant subjects:** Unimproved neutral grasslands managed as pasture (Communities with affinity to NVC MG5 *Cynosurus cristatus* - *Centaurea nigra* grasslands).
- **Type of Intervention:** sheep grazing vs no grazing, cattle grazing, horse grazing or alternative management including different sheep grazing (e.g. light vs heavy sheep grazing).
- **Types of Outcome:** The primary outcome is change in floristic composition. However studies will not be rejected on the basis of outcome and outcomes other than change in floristic composition will be catalogued. Adverse outcomes have been defined by CCW as: reduction of forb cover by 10 % or more; reduction of forb diversity of 10 % or more; reduction in cover or frequency of any of the following 'desirable' species by 10 % or more: *Agrimonia eupatoria*, *Alchemilla* spp., *Anemone nemorosa*, *Centaurea nigra*, *Filipendula vulgaris*, *Galium verum*, *Genista tinctoria*, *Lathyrus linifolius*, *Leontodon hispidus*, *L. saxatilis*, *Lotus corniculatus*, *Pimpinella saxifraga*, *Polygala* spp., *Potentilla erecta*, *Primula veris*, *Sanguisorba minor*, *S. officinalis*, *Serratula tinctoria*, *Silaum silaus*, *Stachys officinalis*, *Succisa pratensis*
- **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 either qualitatively or 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 grazing intensity, period, duration, breed of sheep initial floristic composition and follow up period 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 by CCW.

1. Grazing intensity
2. Grazing period (i.e. season)
3. Grazing duration
4. Breed of sheep
5. Initial floristic composition
6. Follow up period

4. POTENTIAL CONFLICTS OF INTEREST AND SOURCES OF SUPPORT

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

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6. APPENDIX

Contacts: David Stevens, CCW Lowland Grassland Ecologist; also Clare Pinches, EN Lowland Grassland Ecologist.

Stakeholders: English Nature, Scottish Natural Heritage, Environment Heritage Services (Northern Ireland), Grazing Animal Project (GAP), Defra Rural Development Services, Wildlife Trusts, National Trust, National Assembly for Wales Department for Environment, Planning and Countryside, Scottish Executive Environment and Rural Affairs Department, Department of Agriculture and Rural Development (Northern Ireland).

Experts (researchers): Jerry Tallwin (IGER), James Bullock (CEH), Francis Kirkham.