

How does the impact of grazing on lowland heath compare with other management methods?

Stewart, G.B., Newton, A., Myers, G., Diaz, A., Lake, S.,
Bullock, J.M. & Pullin, A.S. (2006)

Systematic Review No. 14.



Background

- The Policy context
- Systematic review



Sources of evidence

- Evidence that does not meet inclusion criteria (e.g. upland studies)
- Evidence that does meet inclusion criteria:
 - Studies with comparators (i.e. well-designed research studies)
 - Studies without comparators (e.g. monitoring data, poorly-designed research studies)
 - Observations made by heathland managers

Systematic search strategy

- Electronic database searches
- Web searches



Inclusion criteria

- Relevant studies- with a range of outcomes and quality
- With comparators
- Change over time
- Informal monitoring
- Opinion



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Search results

- 3431 references bibliographic databases (+ ~100 relevant references from web searches*)
- 92 (<3%) relevant of which 10 have comparators (to date)
- Burning (3), grazing (3), cutting (2), grazing & burning (2)

1. Studies with comparators

- Barker et al.(2004) Effects of habitat management on heathland response to atmospheric nitrogen deposition. *Biological Conservation* **120**: 41-52.
- Bokdam & Gleichman (2000) Effects of grazing by free-ranging cattle on vegetation dynamics in a continental north-west European heathland *Journal of Applied Ecology* **37**: 415-431.
- Brian et al. (1976) The change in ant species distribution during ten years post-fire regeneration of a heath. *Journal of Animal Ecology* **45**:115-133.
- Britton, A.J., Carey, P.D., Pakeman, R.J. & Marrs, R.H. (2000) A comparison of regeneration dynamics following gap creation at two geographically contrasting heathland sites *Journal of Applied Ecology* **37**: 832-844.
- Britton, A.J., Marrs, R.H., Carey, P.D., & Pakeman, R.J. (2000) Comparison of techniques to increase *Calluna vulgaris* cover on heathland invaded by grasses in Breckland, south east England. *Biological Conservation* **95**: 227-232.
- Bullock, J.M., & Webb, N.R. (1995) Responses to severe fires in heathland mosaics in southern England *Biological conservation* **73**: 207-214.
- Bullock, J.M., & Pakeman, R.J. (1996) Grazing of Lowland Heath in England: Management methods and their effects on heathland vegetation *Biological Conservation* **79**:1-13.
- Gallet, S & Roze, F. (2001) Conservation of heathland by sheep grazing in Brittany (France): Importance of grazing period on dry and mesophilous heathland *Ecological Engineering* **17**: 333-344.
- Lippe, E., De Smidt, J.T., & Glenn-Lewin, D.C. (1985) Markov models and succession: A test from a heathland in the Netherlands *The journal of ecology* **73**: 775-791.
- Vandvik,V., Heegaard, E., Maren, I,E., & Aarrestad, P.A. Managing heterogeneity: the importance of grazing and environmental variation on post fire succession in heathlands. *Journal of Applied Ecology* **42**: 139-149.

Comparative data: Burning- what can we extract?

Reference	Outcome	Management			
		no burning for >20 years		simulated management burn	simulated accidental burn
		cut 10cm	cut ground	no cutting for >20 years	
Barker et al.	Change in Cv cover (33months)	34	20	26	44
Brian		12 year post fire succession			
	Change in bare ground			-2.412	
	Ericoids			4.083	
	Ulex			-0.045	
	Graminoids			-0.534	
	Bracken			-0.34	
Bullock and Web		11 years post fire monitoring			
		Dry heath		Wet heath	
		Accidental burn	unburnt	Accidental burn	unburnt
	Calluna cover	83.4	79.8	80.8	75.6
	Graminoid cover	10.9	13.5	19.2	24.4
Lippe		17 years post fire succession			
	Change in bare ground			-51.7	
	Ericoids			52.8	
	Graminoids			2.8	

Burning

- Post fire successional sequence is validated but why and how does it vary?
- The studies themselves are too varied to tell us!



Grazing

- Grazing can achieve conservation objectives....
- but when where and how should it be applied?



Cutting

- Yes cutting arrests succession....
- But how does it compare to grazing?



2. Studies without comparators

- 82 studies identified without comparators
- More mentioned in Lake et al. (2001) (EN 422), Byfield & Pearman (1995) etc.
- Extraction of information from these sources still ongoing
- Are there any monitoring data available?

3. Observations made by heathland managers

- A questionnaire has been developed and is currently being circulated
- Questionnaire aims to assess impacts on key habitat variables, derived from JNCC Common Standards Monitoring Guidance, EN 271 and EN 497.
- Your help would be appreciated!

Habitat variables

Bare ground (%)

Ericaceous dwarf shrub cover (%)

Growth phase of ericaceous dwarf shrub cover (% in each phase)

Height of ericaceous shrubs

Spatial heterogeneity in ericaceous shrub structure

Ulex cover (%) and height

Graminoid cover (%) and height

Abundance of grass tussocks (% cover or density)

Structural continuity between heather and grass habitats

Forb cover (%)

Bryophyte cover (%)

Habitat variables

Lichen cover (%)

Cover of exotic species (%)

Cover of bracken (%)

Abundance of tree and shrub saplings (% cover)

Presence of accumulated decomposing vegetation or litter layer

Proximity to woodlands

Pond margins; number of ponds and pools present

Dung (type and frequency)

Presence of overgrazing indicators (trampling, paths etc.)

Presence of other disturbance (habitat erosion, presence of drains, fires, use by dog walkers)

Integration of evidence

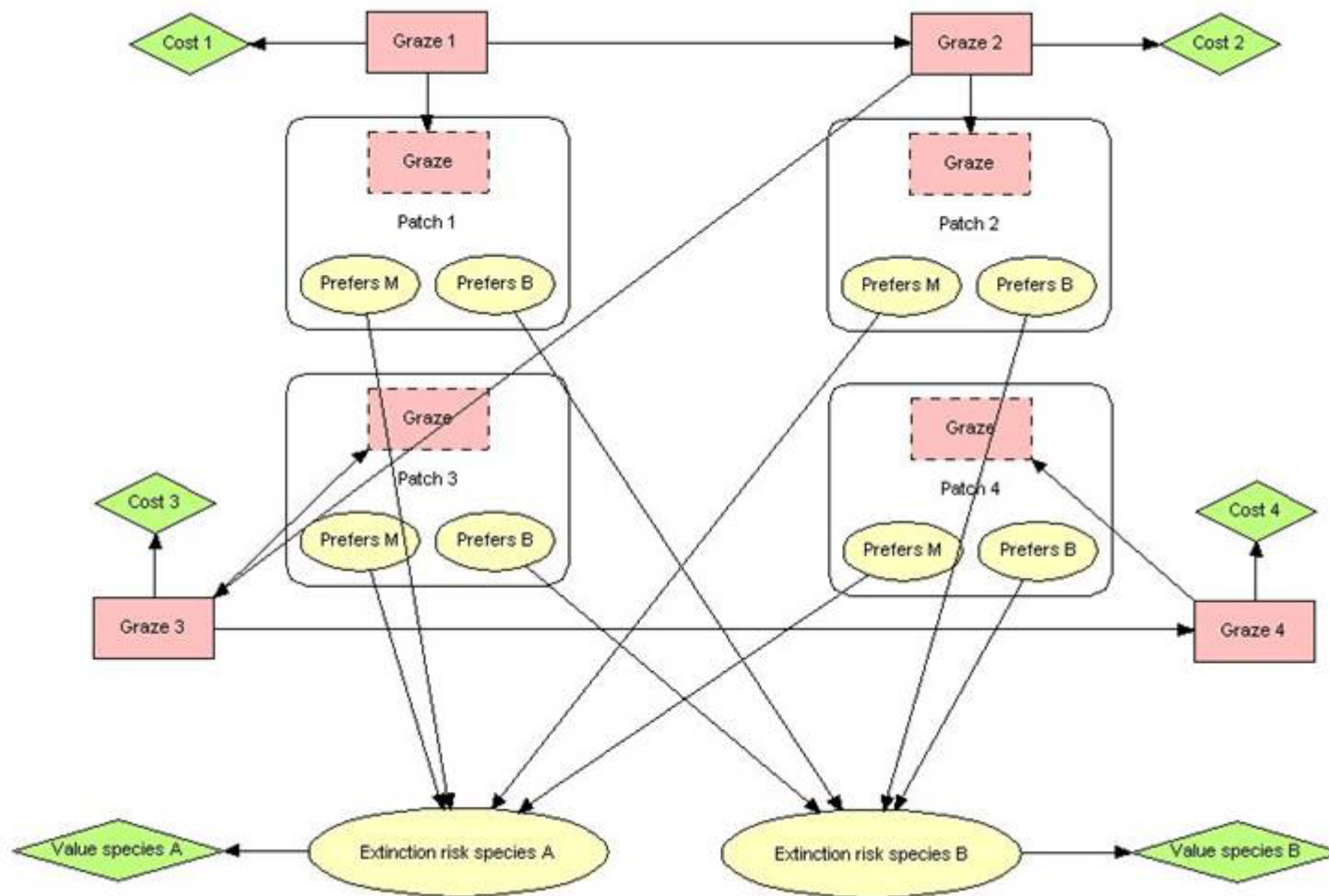
- Aim is to compare evidence from different sources
- Also to integrate different lines of evidence
- This can be supported by modelling approaches (e.g. Bayesian Belief Networks, BBN)



Development of a heathland BBN

- Bayesian Belief Network provides a tool for modelling relationships between variables as probabilities
- Useful method of integrating different sources of evidence
- Can also be used to support decision-making, by identifying outcomes of interventions

Development of a heathland BBN



Conclusions

- Systematic review methodology can be used to gather information on heathland management whilst minimising bias.
- There is insufficient “high quality” evidence to make firm conclusions about the impacts of grazing on heathland
- Other sources of evidence, such as experience of heathland managers, therefore important to collect

Conclusions

- Bayesian Belief Networks offer the opportunity to integrate and explore different sources of evidence.
- But why do we not have a single experiment that compares cutting, grazing and burning? Should there be one?

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