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Agri-environment schemes - what have they achieved and where do we go from here?

Moorland management in Higher Level Stewardship: the evidence base for sustainable stocking rates

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Summary

This paper reviews how Higher Level Stewardship (HLS) moorland options were designed using the lessons learned from the predecessor 'classic' agri-environment schemes (AES) and other evidence, particularly regarding sustainable stocking rates. The evidence indicated that whilst classic AES had generally been successful in halting habitat deterioration, they had been less successful in restoring moorland habitats on sites in degraded condition. This in part reflected a lack of clarity about features, objectives and desired outcomes, and that restoration options were optional for the applicant rather than being determined by feature condition. In HLS, features and their condition and hence objectives and eligibility for options are more rigorously defined, prescriptions are more flexible and 'Indicators of Success' define the desired outcomes. Whilst it is too early to judge the success of HLS, these aspects offer the prospect of improved delivery, particularly of habitat restoration.

Key words: Moorland, grazing, stocking rate, agri-environment, Environmental Stewardship

Introduction

The uplands are highly valued for the provision of a wide range of ecosystem services including biodiversity, landscape, historic environment and opportunities for recreational access (Swanwick, 2009; Bonn *et al.*, 2009). For the purposes of agricultural support and agri-environment schemes (AES), the uplands are defined as the Severely Disadvantaged Areas (SDA) of the Less Favoured Areas (LFA). Moorland, as mapped by the revised Defra Moorland Line, covers 7,652 km^2 in the SDA.

Moorlands are largely cultural landscapes created by a long history of livestock grazing and burning (Birks, 1988; Stevenson & Thompson, 1993). Livestock have a major effect on the extent, condition and spatial distribution of moorland vegetation and many habitats and species benefit from low-intensity grazing (e.g. Yeo & Keenleyside, 2002). Several reviews and surveys in the early 1990s indicated that much moorland was heavily grazed and in relatively poor condition (e.g. Bardgett & Marsden, 1995). Addressing this became a priority in the new upland Environmentally Sensitive Areas (ESA) and new Countryside Stewardship Scheme (CSS) upland options. Overgrazing cross compliance controls were attached to the LFA and livestock schemes from 1992 (Condliffe, 2009). The early 'classic' AES were replaced by the Higher Level and Entry Level elements of Environmental Stewardship in 2005 (Radley *et al.*, 2005).

Higher Level Stewardship (HLS) is targeted primarily at nationally or internationally important habitats (particularly UK BAP priority habitats of upland heathland, blanket bog and upland calcareous grassland), species and other environmental features. Good condition for these and other habitat features is defined in the Common Standards Monitoring upland guidance (JNCC, 2009). It typically requires a diverse vegetation composition and structure and a lack of disturbance from impacts such as heavy grazing, burning in 'sensitive areas', drainage and erosion.

This paper reviews how sustainable stocking rates and regimes required in HLS moorland options were designed using lessons learned from the predecessor classic agri-environment schemes and other evidence.

'Classic' Agri-environment Schemes

The first English ESAs were launched in 1987–88 and included two in the uplands: the North Peak and Pennine Dales. These were followed by a further twelve in 1993–94, five of which were in the uplands: Dartmoor, Exmoor, the Lake District, Shropshire Hills and South West Peak. These voluntary schemes offered 10-year agreements that required farmers to manage their land according to a set of management prescriptions. On moorland these generally required no cultivation or the use of fertilizers or lime, no supplementary feeding, a programme of burning and cutting and the avoidance of "poaching, overgrazing or undergrazing".

Maximum stocking levels were usually specified for summer (generally 16 April to 1 October) and winter. These were similar across moorland ESAs with typical Tier 1 maintenance rates of 0.225 Livestock Units (LU) ha^{-1} (equating to 1.5 sheep ha^{-1}) in summer and 0.17 LU ha^{-1} in winter. Tier 2 restoration rates were typically 0.1 LU ha^{-1} in summer and zero in winter. In most cases all ewe hoggs and cattle were excluded in winter. These were blanket rates applied to whole moorland grazing units (GU) irrespective of habitat type and condition. The maintenance rates were based on the then Nature Conservancy Council's guidance for heather (*Calluna vulgaris*) moorland in good condition, rather than for the degraded habitats where they were often applied. This reflected the fact that the choice of tier was made by the applicant. Over time, some tailoring of stocking was introduced through grazing supplements, averaging of rates and moorland management plans.

CSS was introduced as a pilot scheme outside the ESAs in 1991. A wide range of upland options and a farm environmental audit, the Upland Survey, were introduced in 1999 (MAFF, 1999). Implementation became more flexible over time, reflecting the differing objectives of the various options (which were sometimes applied in combination in a GU to give the desired average rate), and including some tailoring based on habitats and their condition. Nevertheless, specified maximum rates were based on similar heather moorland rates to those in ESAs.

The Evidence Base for Sustainable Moorland Stocking Rates

Classic scheme monitoring

Moorland vegetation was monitored in the six moorland ESAs between 1989 and 1998 (ADAS, 1997*a–d*, 1998*a,b*), but subsequently only on Dartmoor, in 2003 (Kirkham *et al.*, 2005). Prior to ESA agreements, heather in all ESAs, except Dartmoor, was subject to moderate grazing pressure typically in the range 10–25% biomass utilisation (BU, mean 23%) (Glaves, 2007). After 3 years, heather cover was generally maintained in all ESAs but there was no significant difference in BU between Tier 1 and non-agreement land. Grazing pressure was generally lower under Tier 2 and in a few cases this resulted in recovery in dwarf-shrub cover but the number of sites monitored under Tier 2 was small (reflecting low uptake). Grazing pressure on Dartmoor was much higher (mean BU 32%) and increased between 1994 and 1997 (when ESA uptake was still relatively low), while heather cover correspondingly declined. There was little evidence of any difference between tiers in the degree of change, nor any evidence of recovery, at least up to 2003 (Kirkham *et al.*, 2005).

Monitoring of CSS did not generate similar information on grazing impacts because it concentrated on appraisal of agreements and habitat mapping (Carey, 1998, 2000). However, there was some monitoring of individual CSS and ESA agreements. This showed varying responses, including some enhancement under restoration options (e.g. Darlaston & Glaves, 2004; Nisbet 2007), but little improvement under maintenance options (e.g. Dale, 2002; Darlaston, 2004).

Overall, monitoring suggested that classic AES had generally been successful in halting habitat deterioration. To a more limited extent, habitat had been enhanced, particularly through capital works such as bracken/scrub management, burning programmes and grip (drain) blocking, and in creating improved structural diversity through reduced grazing pressure (Ecoscope, 2003; Boatman *et al.*, 2008; NE, 2009*a*). This had also benefited some species such as black grouse (*Tetrao tetrix*) (Calladine *et al.*, 2002). They had generally been less successful in restoring habitats on sites entering agreement in degraded condition apart from a few examples of successful heath restoration (under higher tier ESA agreements and CSS). These were mostly associated with greater stocking reductions including off-wintering or stock removal).

Agri-environment scheme research and development

Defra funded a considerable amount of experimental research and development on moorland grazing, particularly using the ADAS research farms at Pwllpeiran and Redesdale. This culminated in a large collaborative project on the sustainable grazing of moorland (Critchley, 2007). Early studies were summarised by ADAS (2001) and subsequent work by Gardner *et al.* (2009). This research generally supported the findings from AES monitoring, with stocking reductions producing variable results, generally maintaining existing vegetation but being insufficient to produce an increase in dwarf-shrub cover and, in some cases, resulting in an increase in the extent and vigour of competitive grasses, most notably purple moor-grass (*Molinia caerulea*). Amongst other relevant findings from this programme were: spatial variation in grazing pressure in relation to, and impact on, vegetation types (Gardner *et al.*, 2001); a significant effect of the period and timing of stocking, even at the same annual rate ; differences in the grazing behaviour and impact of different stock types (but not breeds), in particular the benefit of cattle in managing purple moor-grass (Fraser *et al.*, 2007); and the benefit of the use of 'feedblocks' to help distribute sheep more evenly across moorland (Hetherington & Gardner, 2002).

Overgrazing and sustainable stocking rates

Overgrazing controls were introduced in 1992 and are now a cross compliance measure under the Single Payment Scheme. Maximum stocking levels are notified if vegetation-based grazing thresholds are exceeded,. In such cases, the sustainable carrying capacity of a moorland GUs is determined based on set rates for broad vegetation types, with the overall rate being based on the proportions of the vegetation types present. The rates are based on published information on the productivity (particularly from Kirkham & Hossell, 1999) and sustainable utilisation (Armstrong, 1990) of moorland vegetation and the dietary requirements of livestock. They are maxima set with the intention of halting further deterioration of vegetation composition. Surveillance of overgrazing cases provided additional evidence that vegetation recovery did not nor-mally occur under such maintenance stocking rates (e.g. NE, 2007*a,b*).

Similar approaches to setting sustainable stocking rates for GUs based on the carrying capacity of the constituent vegetation types have been developed by others, including in more sophisticated ways in the Macaulay Institute's models, the Hill Grazing Management Model and Hill-Plan (Armstrong, 1990; Milne *et al.*, 1998) and in a simple form in an ADAS advisory leaflet (MLURI, 1991).

Using the Evidence to Develop HLS Moorland Options

The Farm Environmental Plan - a baseline audit

Monitoring of classic scheme agreements showed that land was often in a management option that was not appropriate for its condition. This was a particular concern in ESAs where it was suggested that Tier 1 "could be ineffective in enhancing or even maintaining moorland habitats that were in unfavourable condition" (Ecoscope, 2003).

HLS addresses this weakness by requiring an audit of the environmental features present and their condition: the Farm Environment Plan (FEP) (NE, 2008*a*). Each feature (Table 1) has a set of attributes and targets associated with it (usually four) and its condition is assessed on the basis of the number of targets met. For example, on upland heath the attributes are the cover, age structure and level of browsing on dwarf shrubs and the presence of burning in defined 'sensitive areas'. Moorland habitats are identified using a key that was adapted from others used for AES monitoring and overgrazing surveys (Glaves, 2003; Nisbet, 2004).

Table 1. *Indicative HLS maintenance and restoration stocking rates for moorland habitats*

Moorland habitat feature	Indicative maximum annual average stocking rate (LU ha^{-1})	
	Maintenance	Restoration
Mountain heath	0.017	0.008
Blanket bog	0.035	0.018
Flushes, fens and swamps	0.035	0.018
Wet heath	0.044	0.022
Dry heath	0.101	0.051
Western heath	0.044	0.022
Calcareous grassland	0.101	0.051
Fragmented heath	0.101	0.051
Improved grassland	0.674	0.4
Grass moorland	0.15	0.075
Dense bracken	0	-
Non-grazeable (scrub, rock, scree)	0	-

Setting objectives and identifying the appropriate option

Objectives were often unclear in classic scheme agreements, especially ESAs, because there was no audit or clear option eligibility. In HLS, the information from the FEP informs the choice of options and supplements (NE, 2008*b*).

Most moorland GUs contain many features with large-scale vegetation mosaics and will be managed under the moorland maintenance or restoration options. The maintenance option is applied where all key habitats are already in good condition, but if any of these habitats (or other key features) are in poor condition then the restoration option will be used. While feature condition dictates the HLS management option, this is not always straightforward when different features may be in differing condition. The priority features and long-term objectives for the site need to be agreed before detailed prescriptions are developed (Glaves *et al.*, 2006). Although large moorland GUs are normally covered by a single option, HLS allows management to be tailored to the priority features and objectives. Rigid prescriptions were recognised as a weakness in the classic schemes (e.g. Ecoscope, 2003; Radley *et al.*, 2005) and moorland HLS agreements are made site-specific through agreed programmes of rotational vegetation management (burning and cutting), a 'stocking calendar', a capital works programme and supplements for grip blocking and re-wetting, bracken management and stock types and management or exclusion.

Moorland stocking calendars

The stocking calendar is one of the main ways that management of a particular site is tailored to the objectives in HLS . It prescribes the overall grazing pressure, the seasonal (monthly) pattern of grazing and the types of animals grazing. The sustainable stocking rates for the habitats present (informed by the management objectives for those habitats) are combined with information on the proportion of the GU occupied by each habitat to produce an indicative maximum annual average stocking rate. This is the starting point for drawing up the stocking calendar. Table 1 gives the recommended maximum annual average stocking rates for different moorland habitats and different management objectives.

These stocking rates use livestock equivalents that are more finely tailored to differing breed sizes compared to those stipulated by the European Commission and used in classic schemes and overgrazing cross compliance (RDS, 2006). Therefore, direct comparison cannot be made between HLS and classic scheme prescriptions without taking into account these differences.

Whilst the calculation of an indicative average annual rate is a valuable starting point, it does not provide the fine-tuning necessary to achieve specific objectives, including for species. The maintenance rates for grass moorland are the maximum rates that will maintain sward height and structure. Such rates may be incompatible with the maintenance or restoration of other habitats in the GU and, on these sites, a reduced rate may be used when calculating the initial indicative rate. Some important and vulnerable vegetation types may be preferentially grazed (e.g. tall-herb flushes and upland calcareous grassland) and may occupy only a small proportion of a grazing unit. On some sites it may be necessary to apply appropriate rates for these features to the whole GU or in some other way manipulate stock distribution.

Minimum stocking levels

Some vegetation communities (e.g. blanket bog and mountain heath) may not need grazing (Backshall *et al.*, 2001; Glaves, 2009) and a minimum stocking rate may not be required if these communities dominate the management unit. A minimum rate may also be inappropriate where vegetation in is a poor condition as a result of past heavy grazing. Grazing is a desirable management tool for maintaining a range of early-successional vegetation communities and the absence of grazing can have adverse impacts on habitats and historic environment features (Nisbet & Shere, 2006). Grazing produces a structural heterogeneity that burning or cutting cannot and grazing animals interact with their habitat in a variety of positive ways (e.g. providing bare ground and animal dung). Moorland agreements in classic schemes did not normally have minimum stocking rate but these can be set in the HLS stocking calendar.

Stock type, seasonality and spatial distribution

It is often the pattern of grazing through the year rather than the average annual ratethat is important. Research has shown that vegetation preference and grazing behaviour differ between stock types. Stocking calendars can be tailored to ensure that the right animals are used to achieve particular outcomes, e.g. cattle in summer used to reduce the dominance of purple moor-grass.

Similar grazing pressure can have very different impacts at different times of the year. Again, stocking calendars can be tailored to ensure that adverse impacts are avoided, e.g. ensuring grazing pressure, particularly from sheep, is low enough to avoid heavy grazing on dwarf shrubs in the autumn and winter. Some habitats such as calcareous grassland may benefit from higher winter grazing levels, but lower summer ones, resulting in reduced dominance of more vigorous grasses and allowing other species to flower and set seed.

Stock will not necessarily be distributed across a site in proportion to vegetation productivity. Instead they may seek out or avoid particular vegetation types, interact with other groups of animals or be affected by weather and topography. Manipulating the spatial distribution of stock is not accounted for in the calendar but, if considered significant, a shepherding supplement can be used to pay for stock management.

Monitoring the implementation and effectiveness of HLS on moorland

The lack of a baseline audit in the classic schemes meant that progress towards meeting objectives could not be easily assessed. Another criticism was that the desired outcomes were not clear to the agreement holder. These weaknesses are addressed in HLS by setting Indicators of Success for options. These specify attribute targets for the agreement (as well as interim targets during the life of the agreement if appropriate). The first HLS agreements began in 2005 and it is still too early to evaluate the effectiveness of the scheme. Natural England is gathering evidence to evaluate the implementation of HLS in a programme of assessments carried out by its staff. Data are collected on relevant indicators, current management and the likelihood of achieving the indicator targets.

In 2010, surveyors from CEH will independently assess a sample of HLS agreements containing moorland options following similar work on lowland agreements in 2009. These moorland assessments will provide information on the implementation, quality and likely effectiveness of agreements and will compliment the work being done in-house.

Sustainable moorland grazing – the challenges

The approach to setting moorland stocking rates in HLS is based on a considerable amount of evidence on the impacts of grazing on moorland vegetation. While HLS has much greater flexibility to tailor stocking regimes, the initial calculation of an average annual maximum stocking rate is still a crude process with guidance based on generic stocking rates for different vegetation types. The actual impacts of grazing on a particular site are influenced by a number of site-specific factors including the spatial distribution of vegetation types, animal behaviour, past management and site topography and microclimate. One challenge for Natural England and HLS agreement holders is to work together to better utilise local knowledge of grazing patterns and impacts to increase the likelihood of achieving management objectives and outcomes.

A second challenge is to reconcile the competing demands on moorland ecosystems and accommodate these within HLS agreements. Conflicting demands can come from different habitats or species, different environmental concerns (e.g. biodiversity and the historic environment) or environmental and economic objectives. Some species may favour more heavily grazed swards or even areas of poached ground. Adjoining habitats may have different needs, e.g. the stocking level needed to ensure that there is sufficient grazing within a valley mire may prevent the restoration of a neighbouring fragmented heath. The increase in sward height and dwarf shrub cover that may result from a reduction in grazing pressure may have an adverse impact on the visibility of a historic landscape.

Finally, the environmental objectives of HLS need to take into account the economics and practicalities of upland livestock farming. The production of food will continue to be important on upland farms and HLS can only use the grazing animals that the farming systems provide. Tradition, experience, economics and personal preference will all affect a farmer's choice of stock and ability to provide grazing animals. The long-term sustainability of moorland management needs to be considered and while destocking may be desirable for the restoration of some habitats, it may be necessary to continue with some grazing to ensure that agricultural systems and skills are retained.

Natural England has addressed these challenges in the development of its upland vision (NE, 2009*b*) which states that "grazing systems that produce food and much more" will be needed. It recognises the need to take an ecosystem services approach and to consider water quality, flood risk and climate regulation through carbon storage in addition to biodiversity, landscape, the historic environment and the provisioning services of food and timber (NE, 2009*c*).

Higher stocking rates will be appropriate on some sites but others will require lower, or sometimes zero, stocking. The concept of ecosystem services provides a context for long-term, sustainable stocking. This approach acknowledges that concentrating exclusively on the provision of one service can have adverse impacts on others. It argues that, at a landscape scale, we must seek the balanced provision of as many ecosystem services as possible.

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