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The impact of BSE in cattle on high-nature value conservation sites in England

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Abstract

The BSE (mad-cow disease) crisis has had severe impacts on the beef sector in English agriculture, evident primarily through the low prices since experienced by farm businesses for beef cattle at market and the European Union (EU) ban on British beef exports. However, the extent to which resultant changes in beef cattle enterprises have affected conservation sites of high-nature value is less well-known. This paper reports on empirical research conducted into beef grazing on 50 Sites of Special Scientific Interest (SSSIs), England's best protected conservation areas. The crisis is found to have caused localized problems with overgrazing of Sites due to restrictions in stock movements after the crisis, undergrazing as farmers rationalize their beef enterprises and more subtle ecological changes associated with grazing habitats of different species and breeds of livestock. Direct impacts are not always clear, but BSE is undoubtedly making the delivery of nature conservation objectives more difficult in England.

Cattle and Conservation

Commentators on agriculture agree that the postwar period has witnessed a dramatic increase in the scale and rate of agricultural change. The passing of the 'productivist' 1947 Agriculture Act to increase levels of food self-sufficiency in Britain is frequently viewed by conservationists as the start of fundamental farming change and the root cause of many deleterious effects that can now be observed in the countryside. In particular, these include the loss of landscape features and habitat destruction (Westmacott and Worthington, 1974, 1984 and 1995; Shoard, 1980). During this period, many livestock farming systems involving cattle have become transformed into intensive operations. For some, the extent of their detrimental environmental impact on grassland systems is viewed as equivalent to a wholesale conversion of grass to arable production (Lovelace, 1998). In the dairy sector, intensification of grassland by the application of nitrogenous fertilizers, the trend towards silage making to produce a higher nutrient feed for cattle and the almost ubiquitous use of high-lactating black and white Holstein-Friesian breeds have seriously eroded biodiversity. Government policies have further encouraged processes of intensification, concentration and specialisation (Bowler, 1985). For example, the former Milk Marketing Board, a state sponsored producer group monopoly to which all farmers were obliged to sell their milk, discontinued collection of milk from churns in the mid-1970s in favour of large-scale bulk tanks which only the most specialised producers could justify installing. Similarly, the introduction of milk quotas to limit overproduction in the sector in 1984 encouraged large scale capital-intensive enterprises (Halliday, 1988). The extent of environmental damage resulting from modern dairy farming methods to field boundaries, trees, wildlife habitats and buildings has been well-documented and the decline of such features lamented. Even so, it is interesting to note that little attention has been paid to livestock themselves as elements of landscape (see Evans

and Yarwood, 1995). Yarwood and Evans (2000) have recently argued against underestimating the contribution made by individual livestock breeds, with all their peculiarities, to local landscape distinctiveness, local ecology and local identity.

Of all agricultural sectors, it is beef systems that have tended to be considered by conservationists as the most environmentally benign form of modern production. According to Bignal and McCracken (1996), beef cattle are pivotal to grazing regimes that produce a 'unique farmland biotope' in England. However, Entec (1996) note that the environmental impact of beef farming systems are dependent upon methods of waste disposal, stocking densities and whether or not animals are housed. Once again, the beef sector has been subject to agricultural intensification, but this has varied according to the type of system practised. In England, there are three common forms:

- i) suckler systems;
- ii) rearing and finishing systems; and
- iii) intensive beef systems.

The characteristics of each system are summarized in Table 1. To generalize,

TABLE 1: Main types of beef production system in the UK

BEEF SYSTEM	MAIN CHARACTERISTICS
SUCKLER SYSTEMS	<ul style="list-style-type: none"> • suckler herds consist of breeding animals and calves. • most herds of breeding animals are managed to calve in spring avoiding costs associated with housing and feeding over winter. • calves are weaned at 6-9 months then either sold or kept for 'finishing' depending on farm forage. • most are located in the north and west of England. • breed type is a major variable, influenced by environmental conditions. • state subsidies represent a high proportion of profit, especially in the uplands. • cattle can be left to 'fend for themselves', reducing the intensity of management.
REARING & FINISHING SYSTEMS	<ul style="list-style-type: none"> • cattle are bought in to the farm and fattened. • animals are either sold on as 'stores' after a short period on the farm or kept and 'finished' for the market. • there is a wide variation in the precise system used which will be influenced by periodic surpluses of resources (feed, housing, labour). • cattle tend to become relocated to south and east England with age. • breeds can be beef, dairy or cross-bred calves. • profits come from purchasing animals cheaply when non-purchased feed is abundant, fattening and then selling when feed is short or prices high.
INTENSIVE BEEF SYSTEMS	<ul style="list-style-type: none"> • intensive systems are those where animals are housed for all their lives. • there are 3 common enterprises: silage beef, cereal bull beef and veal. • silage beef is a profitable method of eliminating surplus dairy herd calves. • cereal bull beef almost always uses uncastrated Friesian male calves feed on concentrates and straw. • silage and cereal bull beef require large numbers and high levels of mechanisation as fixed costs are high. • veal production uses milk or milk replacer to produce white meat as quickly as possible (15-16 weeks is typical). • crate systems for veal are illegal in the UK for animal welfare reasons. • silage beef is more closely associated with grassland systems in western England whilst cereal and veal systems are more common in midland and eastern areas. • intensive stockmanship is required for feeding and disease control. • markets for veal and bull beef are limited, most being reared under contract.

Source: Adapted from Entec (1996)

beef farming has tended to follow processes of modernization rather than be at the forefront of such processes. Grassland 'improvement' has occurred on farms with beef enterprises, though rarely has this been a direct consequence of the operation of beef production systems. Indeed, beef cattle are an important element within traditional mixed farming systems given that intensive bull beef, barley beef and veal production have failed to make the agricultural impact once expected. Even in the English lowlands where arable intensification has been at its most potent, farmers have kept beef cattle as a 'sideline' enterprise. For example, low-lying wet areas or steep banks have been utilised in this way, encouraging the retention of landscape features such as hedgerows and the maintenance of remnant habitats that have long since been lost on other parts of the farm. The precise geographical extent of this relationship between beef cattle and environment is difficult to ascertain. The crux of the problem is that few farms are solely reliant on beef production. As already indicated, in the lowlands beef enterprises are secondary considerations within arable and dairy systems, whilst in the uplands beef cattle typically supplement sheep enterprises. Nevertheless, there is sufficient circumstantial evidence to suggest that a relationship exists between the grazing of beef animals and the designation of sites of high nature value in England. This paper seeks to explore such a relationship in greater detail and examine the effects of one major event, the BSE (Bovine Spongiform Encephalopathy) or 'mad cow disease' crisis on the environmental dividends such a relationship produces.

Sites of High Nature Value

Having established that there is a link between farming practices based on beef production and the maintenance of important habitat and landscape features in England, there has been a growing recent trend to acknowledge these farming systems as being of 'high nature value' (HNV). In a recent review, Baldock (1999) identifies the entry of the term into common parlance as a result of agri-environmental policy (AEP) discussions and increased interest in the importance of 'wider countryside' as a habitat beyond areas targeted with AEP. He identifies five characteristics of HNV farming systems which assist definition of the term. They create or promote:

- i) a low intensity use of semi-natural vegetation;
- ii) an agricultural mosaic;
- iii) areas of land use which suit individual species;
- iv) sympathy towards fringe and linear habitats;
- v) specific 'in-field' habitats.

Baldock (1999) then addresses the question of how farming systems producing such characteristics can be identified. Three methods are proposed. First, environmentally protected areas and the agriculture practiced within them can be taken as a proxy of conservation interest. Baldock argues that this is the simplest approach, but suffers from limitations caused by variations in definition and designation when used at an international scale. Further, a protected area network will normally exclude many significant HNV farming systems, generating 'unnatural' results. Secondly, the land management requirements of lists of important species can be identified and related to farming practice. This is purported to be a more 'scientific' approach free from pre-conceived constraints of protected areas. Thirdly, low intensity farming systems

could be identified from data relating to quantities of agricultural inputs used. These can be expected to contain large HNV areas, but not all HNV agricultural land is low intensity and there is difficulty with using data on inputs which is typically aggregated at a local level.

This paper adopts the first approach by focusing on one type of protected area in England, namely Sites of Special Scientific Interest (SSSIs). The limitations of so doing are fully recognised, but this approach offers a tangible initial method to explore beef-conservation relationships across one known type of protected area. Additionally, the problem of international variability is overcome by using England as a case study area. The history and development of SSSIs in England has been very well-documented so that only a very short resume is necessary here (see Adams, 1984 and Evans, 1997 for full accounts). SSSIs came into existence with the passing of the 1949 National Parks and Access to the Countryside Act. They were intended to be highly protected small areas of floral, faunal and geological interest to complement the larger National Parks and Areas of Outstanding Natural Beauty whose designation was provided for in the Act. SSSIs proved generally effective at preventing destruction of habitats by urban development but, primarily due to the conclusions of the 1942 Scott Report (see Ilbery, 1992), it was thought unnecessary to control agricultural activities within their boundaries. By the late 1970s, it was apparent that most damage to SSSIs was being caused by changes in agricultural use, with intensification a particularly potent force. In 1981, the Wildlife and Countryside Act was passed to improve SSSI protection through a statutory regulation of agricultural use. Landowners were issued with a notification order which listed activities not permitted on the designated Site or for which prior permission was necessary (commonly but unofficially known as 'potentially damaging operations'). The administration and policing of Sites was the responsibility of the former Nature Conservancy Council (now English Nature in England), government's advisory body on nature conservation. A network of 4000 SSSIs has been established, containing many of England's rarest species and the greatest constraints on the ability of landowners to undertake farming practices of their choice. The combination of a high value conservation resource, discrete area and existence of precise data about land use management make SSSIs a particularly appropriate designation in which to investigate the impact of changes in the beef sector on a conservation resource.

Policies in the beef sector

The existence of beef animals on farms has been greatly influenced by the action of government in the sector to the extent that the analysis would be incomplete without a consideration of policy. As a predominantly secondary enterprise on farms, it can be argued that beef cattle are most vulnerable from policy changes which in turn affect the technical, social and economic conditions of production. Further, as a minor sector, the policies relevant to beef farming in England are among the least known.

Prior to 1992, the European Common Agricultural Policy (CAP) offered price support and intervention buying measures to beef producers, with a Beef Variable

Premium (BVPS) also paid on finished animals. The BVPS was discontinued in 1989 and replaced with a Beef Premium Scheme (BPS) which introduced a ceiling on the number of animals the EU Commission was willing to subsidize, limited to 90 male animals (steers) per holding. The MacSharry reforms to CAP in 1992 changed policy towards the beef sector in four main ways. First, prices paid to farmers transferring beef into intervention stores were reduced by 15% over three years from 1993/4, with ceilings on intervention purchases introduced progressively from this date until 1997/8. Secondly, a Beef Special Premium Scheme (BSPS) replaced BPS and was implemented to provide farmers with compensation for the price cuts just noted. It also applies to 90 steers per holding, is subject to reduction in value if there are excess claims (above 940,380 head in England and Wales) and is conditional on stocking densities being observed (reduced progressively from 3.5 'livestock units' (LUs) per forage area hectare in 1993 to 2.0 LUs in 1996). Thirdly, a Suckler Cow Premium Scheme (SCPS) paid to farmers rearing meat from beef breeds was made conditional on possession of a production quota. Quotas were based on the number of animals receiving SCPS payments in 1992 less a 1% siphon to form a national reserve quota. Most farmers have to use at least 70% of this quota or have it withdrawn. The amount of premium paid varies according to the location of the farm. In England, there are two 'ring-fence' areas, farmers in Less Favoured Areas (LFA - land in the uplands) receiving additional payments through Hill Livestock Compensatory Allowances (HLCAs) to acknowledge the greater difficulties of extensive production associated with their upland situation than experienced by non-LFA farmers. Fourthly, an Extensification Premium is available to any producer that stocks at a density below 1.4 LUs per forage hectare. This is payable on both BSPS and SCPS, although regional ceilings on premium claimed again apply. The purpose of these four measures were to safeguard farmers incomes whilst controlling budgetary costs, encouraging extensification (albeit as a crude environmental concession), reducing beef production in dairy herds (see below) and maintaining seasonal equilibrium in the beef market.

Neither SCPS nor BSPS proved particularly strong at directly curtailing production. Evidence from Gaskell and Winter (1996) shows that whilst structural surpluses in milk, cereals and sheepmeat had been dealt with by the 1992 reforms, the beef herd in England had grown from approximately 600,000 head in 1989 to around 800,000 head in 1995. A ban on live calf exports to the European continent for animal welfare reasons also contributed to such growth. This was counter to a trend of falling consumption of beef by consumers in the EU during this time. The increase is accounted for by a diversification of farming activity amongst lowland farmers and the aftermath of dairy quota imposition in which those exiting dairying could adopt beef enterprises with an easy transfer of capital items (Gaskell and Winter, 1996). Winter *et al.* (1997) interviewed 153 farmers in England with beef enterprises in 1995/6 and found that many coped easily within the rules on stocking rates so that stocking levels had barely been affected. Indeed, extensification payments had even been available to a majority of farmers without significant adjustments to stocking levels. Winter *et al.* (1998b, p.238) neatly summarize this situation in an upland context:

‘stocking rates ... cover only male cattle on which BSP has been claimed, dairy cows, breeding ewes on which SAP [Sheep Annual Premium - a headage payment for sheep similar in function to SCPS] has been claimed, and suckler cows on which SCP has been claimed. The stocking-rate figures do not include female animals being reared for beef, or any other animal not eligible for payments other than dairy cows. Consequently, neither stocking-rate rules on eligibility nor the incidence of extensification payments necessarily engender declining stocking rates in real terms, measurable by fewer animals on the ground. In reality, the main point of both the eligibility criteria and extensification is to offer an incentive to farmers to limit their claims on the European Community budget rather than necessarily to reduce stocking rates for environmental reasons.’

An additional feature of policy towards the beef sector worth noting is that the UK government, alone with Denmark, has ignored a provision under the accompanying measures Regulation 2078/92 (designed to ‘green’ the reformed CAP) to offer farmers support to keep local and often rare breeds of livestock (Lovelace, 1999; Yarwood and Evans, 2000). As Yarwood and Evans (2000) have argued, additional support for rare breeds would contribute to biodiversity in both cattle and the habitats they graze (see later), assist in the preservation of agricultural heritage and help maintain a sense of local identity in rural places. This ignorance of livestock is curious when there has been a growth in government commitment to conservation schemes, such as Environmentally Sensitive Areas (ESAs) and Countryside Stewardship (CS), in the UK. The Ministry of Agriculture, Fisheries and Food (MAFF) which administers agricultural policy in England cites the reason that no landscape or habitat in Britain is entirely dependent upon one breed for its continued existence. However, it can be postulated that the extra costs of administering such a scheme have reduced MAFF’s desire to implement it, and that rare breed conservation is already occurring in an effective way due to the interest shown by a powerful charitable organisation, the Rare Breeds Survival Trust (Evans and Yarwood, 1997).

The BSE crisis

There has been much media coverage of the BSE crisis and two recent academic analyses of the discourse associated with BSE which need not be repeated (Winter 1996; Woods, 1998). Briefly, BSE, colloquially known as ‘mad cow disease’ due to the symptoms that infected cattle suffer, emerged in the UK in the mid-1980s. It is generally accepted that the disease originated as ‘scrapie’ in sheep, a condition identified around 1800. High protein feed based on the ground remains of sheep became a popular way for farmers to fatten cattle during the 1980s, resulting in accelerated growth rates. However, anti-pollution measures introduced in the early 1980s meant that protein feed was manufactured using a lower heat treatment

TABLE 2: Support measures for the beef industry introduced after the BSE crisis of March 1996

MEASURE	DETAILS
Over 30 Month Scheme	Introduced May 1996, OTMS was designed to slaughter cattle over 30 months of age to prevent their products entering the human food chain. By June 1999, £1.2 million had been spent, 70% of which coming from the EU budget. Nearly 630,000 animals were slaughtered in its first six months of operation, the UK total standing at almost 3.3 million by June 1999.
Top-up payments for heifers and	Designed to give £80 million immediate aid to slaughter heifers and steers over 30 months of age, ceasing in November 1996.

steers	
Additional Premia	An extra £19.70 paid on BSP and £23.13 on SCP payments during 1996.
Beef Marketing Payment Scheme	A one-off payment for adult cattle marketed between 20th March and 30th June 1996. More than 29,000 claims were made on 450,000 animals.
BSP payments	1997 BSP payments brought forward to ease financial problems.
Beef Assurance Scheme	Introduced in August 1996, BAS allows farmers to register and sell animals up to age for human consumption. Strict rules apply, including that the herd must be a specialist beef one with no dairy animals in it for the last 7 years, established over 4 years, had no case of BSE and has not been fed concentrates based on mammalian bonemeal for 7 years. By June 1999, only 77 herds had been approved under BAS, constituting 4445 cattle.
Calf Processing Aid Scheme	Nicknamed by some the 'King Herod Scheme', this is an EU scheme to slaughter male dairy calves (all calves by December 1996) of less than 20 days old which had no market due to the UK export ban. The total number of calves slaughtered by June 1999 stood at 1.9 million, of which 91% have been of dairy origin. The CPAS will close at the end of July 1999.
Selective Cull	A UK measure to hasten the eradication of BSE. Introduced in 1997, this targets animals considered to be most at risk from infection. Animals reared in the same batches or 'cohorts' as BSE victims between 1989 and 1993 are likely to have been exposed to the same BSE agent and are of high risk. Compensation at 90% for female animals and 100% for male animals is available, with top-up payments where more than 10% of the entire herd is removed. In the UK to date, 77,000 cattle have been eliminated under these provisions
Intervention Purchases	Higher annual ceilings were adopted for buying beef into intervention stores.
Aid scheme to dispose of stocks	£80 million given to abattoirs and cutting plants to dispose of unassailable stocks
Aid to abattoirs	£30 million compensation for abattoirs continuing to kill cattle
Aid to rendering industry	£118 million direct aid to ensure survival of the rendering industry

Source: Adapted from Gaskell and Winter (1996) and MAFF (1999a)

process. The infective sheep scrapie agent seems to have survived under these revised rendering conditions and jumped the species barrier to infect cattle. Dairy calves, a bi-product of the industry, reared for beef have consistently had the highest incidence of infection with BSE (according to MAFF (1999a), 81% of all cases by April 1999), but beef breeds have also contracted the disease. Fears were soon expressed about the possibility of the BSE agent possessing the ability to jump another species barrier and infect humans eating beef, but this was strongly and repeatedly refuted by government.

The ongoing exhaustive 'BSE enquiry' in the UK has revealed how government reacted inadequately to control the spread of BSE amongst the nation's herd. Amongst the measures implemented were a banning of bonemeal feed from sale to farmers and a programme was established to prevent brain and spinal column material entering the human food chain (the Specified Bovine Offal Ban, 1989). However, in these respective cases, farmers with stockpiles of feed could continue to feed it to animals and abattoirs were not always rigorous in their exclusion of nervous material from carcasses. An extensive programme of tracing cattle, slaughtering and compensation was not introduced for fear of damaging consumer confidence, farmers' livelihoods and government popularity. On March 20th 1996, after years of denial that consumers were at risk from BSE, government announced

through its Spongiform Encephalopathy Advisory Committee (SEAC) that a link between beef products infected with the BSE agent and the occurrence of a brain disease (new variant Creutzfeldt Jacob Disease or 'CJD') in humans had been established. In the immediate aftermath of the announcement, the price of beef crashed, soon to be exacerbated by a total worldwide ban on export of British beef and derived products (though not milk products). Government introduced a suite of emergency measures to support the beef industry during the crisis (see Table 2). All were short-term responses involving significant cost, but with the overall aim of rapidly scaling down the size of the beef sector.

The Impact of BSE on High Nature Value Sites

Having provided a discussion of SSSIs as sites of HNV, policy in the beef sector and the BSE crisis, the remainder of the paper explores the inter-relationships between them. The methodological starting point for analysis demanded information on those SSSIs principally dependent upon beef grazing as a land use management tool from all 21 EN Regional Teams with responsibility for the day to day administration of Sites. From the mass of data generated, 9 Teams representing three regional clusters in England (the north, south-east and west) were consulted and their advice sought on selecting five beef-dependent SSSIs in their areas for detailed case study. Selection was further refined by a desire to obtain a cross section of eight habitat types (Table 3) derived from amalgamation of those identified by

TABLE 3: Habitat type and numbers of case study SSSIs investigated.

HABITAT TYPE	NUMBER OF SSSIs
neutral grassland / mire	18
calcareous grassland	15
grazing marsh	5
acidic grassland	4
upland moor and heath	3
lowland bog	1
lowland heath	1
lowland wood pasture & parkland	0

Source: Author's Survey.

the UK Biodiversity Steering Group (1995). This generated a final total of 47 Sites for investigation. To reduce variation caused by a possible time-lag in data collection during a rapidly changing situation, it was necessary to gather information as quickly as possible. Visits were made to five teams in late 1996 and early 1997 to hold face-to-face interviews with the Conservation Officers (COs) of EN having direct responsibility for overseeing the management of selected SSSIs. Discussions lasted approximately one hour for each Site under scrutiny. These adopted an open ended format with COs free to discuss Sites in a manner which suited their experience, although a list of key points to cover was used by the interviewer to ensure an element of consistency. A large quantity of qualitative data was generated in this way. The remaining four teams were sent a comprehensive list of information requirements and the relevant CO telephoned for interview. In such cases, all

interviews were supplemented by the distribution of a questionnaire to the landowner or occupier of the SSSI. Telephone interviews were then conducted with a sample of farmers about their cattle systems where necessary to fill key deficiencies in information supplied by COs. It is evident that the survey relied primarily on CO knowledge of case study sites and it is acknowledged that on occasion this differed from the information supplied by farmers. Nevertheless, the data collected proved sufficiently reliable to conduct an exploratory investigation of the links between nature conservation, cattle grazing and BSE in cattle.

Table 3 illustrates the number of Sites classified under each habitat type. The three most numerous types are considered in this paper together with upland heath and moor which is fifth in numerical frequency but a useful contrast to the main three types to be discussed. For reasons of confidentiality and conciseness, the following analysis combines findings on the impact of BSE on conservation from individual SSSIs and presents them according to each habitat type.

i) Neutral and Wet (Mire) Grassland (18 Sites)

The SSSIs investigated under this habitat type vary considerably in size from 4 to 2500 hectares. Nevertheless, recurring issues emerged in discussions about these Sites. The most obvious effect of the BSE crisis has been to reduce in beef prices dramatically, by between 23 and 29% according to Gaskell and Winter (1996), and so encourage farmers to evaluate other options. Dairy farmers grazing these Sites with dairy cattle offspring and selling them into the beef food chain expressed the view that BSE is a minor event for their business. The price of milk has not been influenced by the crisis and, in fact, the Calf Processing Aid Scheme has provided a capital injection for them. Indeed, such funds can be diverted into the purchase of additional milk quota to increase the scale of the main enterprise (see section on Coastal Grazing Marshes). Hence, there seems little financial impact on the business and initially no significant environmental consequences as cattle grazing continues. However, the wet grassland Sites reveal that grazing with dairy cattle offspring rather than with recognized beef breeds causes difficulties with the control of unpalatable grasses and rushes.

As has been reported by Small (1995), it is the traditional and often rare breeds of cattle that are best able to cope with and remove coarse wetland species of little nature conservation value (see also Yarwood and Evans, 1998). On one wet grassland Site in the north of England, Longhorn cattle (a breed of 'minority' status) have been used to restore and subsequently maintain diversity in a way that is commercially profitable for the farmer, a premium price for meat being paid by a local butcher. Despite no Longhorn bulls recorded by MAFF (1999a) as having contracted BSE, a direct threat to the continuation of this grazing regime has been the introduction of the over 30 month rule in an attempt to control the spread of BSE. Many traditional British beef breeds take longer to fatten than their modern continental counterparts, helping to explain the decline in their popularity to the extent where some are in danger of extinction (Yarwood and Evans, 1998). Sluggish growth rates are exacerbated in SSSI situations as the grassland has been designated of conservation interest by virtue of its unimproved condition and so it is less able to

fatten cattle quickly. Longhorn cattle often take 48 months to reach maturity and so are discriminated against by the ruling. The interest and enthusiasm of individual farmers cannot sustain uneconomic enterprises indefinitely. In fact, the survey found that the farmers expressing most ease at retaining their beef enterprises are those having an additional off-farm source of income.

More worrying is the evidence emerging that even competitive mainstream beef breeds are struggling for viability with the imposition of the over 30 month ruling (see Table 2), as the following example from western England demonstrates.

Mr. D. is a dairy and beef farmer with an 80 hectare farm. This includes 16 hectares designated as an SSSI which is grazed by 50 Hereford cross beef cattle between April and November. The 50 cow dairy herd is the backbone of the business, but Mr. D. stresses that his beef enterprise is very important to his operation because of the restrictions of milk quotas on dairying. His son has recently set up a suckler system and receives SCP on 60 cattle and BSP on approximately 50 cattle, together with additional extensification payments. The over 30 month rule means that more concentrates have to be fed to the beef cattle. Even with supplementary feeding, the SSSI grazing is inadequate for fattening in less than 30 months in many instances. Consequently, Mr. D. is now considering changing the beef system to one of selling stores instead. This will not have an immediate effect on the conservation grazing. Mr. D. felt that the SSSI grazing and his farm business did not work well together due to restrictions on grazing numbers and mowing times which affect the feed value of his fodder. He said that "the cattle would be much better off if they were not put on the SSSI" which he feels has "de-valued the livestock".

The conservation outcome is unaffected at present, but the example demonstrates the pressure experienced by beef farmers simply to maintain an interest in the enterprise. Indeed, the farmers most likely to replace their beef breed grazing with other grazing animals are precisely those managing the most interesting habitats but whose marginality is enhanced by the SSSI designation.

In wet and neutral grasslands, grazing with sheep or horses/ponies offer possibilities to substitute for cattle grazing and produce similar grassland management results to cattle. However, COs interviewed across all regions were in general agreement that sheep were not as suited to conditions on wet grasslands and that horses lead to localized nutrient enrichment within fields (see Gibson, 1995). On one Site in the west, BSE had accelerated the replacement of cattle grazing by sheep, a trend already in evidence as a result of the area drying out following the installation of a pump drainage scheme in the 1960s. The decline observed in bird numbers and aquatic species within the SSSI had therefore been established prior to the crisis and is not solely attributable to it.

ii) Calcareous Grassland (13 Sites)

The main ecological advantage of beef cattle to these SSSIs lies in promotion of diversity of grass sward heights and the wider range of invertebrate fauna encouraged. The ideal situation is one where cattle are grazed in conjunction with sheep, although sheep are often more readily available by tradition in chalk and limestone localities. Undergrazing leads to problems with incursion by common scrub species. Overgrazing is also undesirable, causing a decline in sward quality. In

this instance, high stocking rates of sheep are usually the greatest threat, although localized poaching by concentrations of cattle can be damaging. The BSE crisis has contributed to instability in this fine balance between under- and over-grazing on calcareous grassland SSSIs. An initial overgrazing immediately followed the crisis in the summer months of 1996 as animals could not be sold whilst they awaited culling. This was swiftly followed by undergrazing as the cull got underway and animals removed. Survey evidence shows undergrazing to have firmly established itself as the dominant problem in eight of the Sites investigated. However, it must be noted that withdrawal of grazing had been a well-established trend on Sites prior to the BSE crisis due to a general lack of profitability in beef compared with other enterprises, interference from recreational and road traffic use, and from a failure to exercise commoners rights.

The possession of an assured outlet for beef is a key influence on the continued existence of the correct grazing intensity on calcareous grassland SSSIs. On a Site in the west of England, grazing intensity had been maintained due to the fact that one business had a BSE-free herd which supplied beef products to a single farm shop outlet. This traceability of the product has insulated the farm business from the fall in beef prices (Morris and Young, 1997). Similarly, in the north:

Mr. G. owns a 20 hectare farm with beef (approximately 70 head) and 70-80 breeding ewes which graze adjacent salt marshes. However, beef is the main enterprise as he rents 500 hectares of upland limestone grassland, all of which is within SSSIs. Renting land makes the small 'home' farm more viable. Half this area is grazed by his beef cattle in a mixed suckler and rearing/finishing system. Traditional breeds are used, including North Devon, North Devon cross and Red Poll cattle. Specialization in these breeds has become a feature of the business in recent years as he feels it "makes life more interesting and they can do a better job with the SSSI and the farm set-up". Mr. G. argues that traditional breeds are better able to convert the low quality forage found on the SSSIs. Nevertheless, and somewhat surprisingly, he maintains that grazing one specific SSSI fails to benefit the business. He sees it as "a liability because it is a lot of work, a large area, difficult to access, no water on site, a high risk because of a lot of public access, difficult terrain, parasites, ticks and poor quality grazing" [!]. However, he grazes it because he sees "a need for it in terms of conservation, it is well established and I'm happy to do it on that basis to achieve the conservation objectives". He can do this because he retails the livestock himself as organic produce. An organic system helps him to claim extensification payments on cattle in addition to entitlements on 20 cattle from SCP and 20-25 head through BSP. The BSE crisis has meant that Mr. G. has to finish the cattle earlier with the help of supplementary feed (in accordance with organic production guidelines). The future is unsure. A 5-year tenancy on which much SSSI land is grazed is due for renewal, and if it is not on viable terms then his beef enterprise, or even the entire business, will cease.

The ability to exploit a market niche, in this case through organic production, has helped preserve an ideal grazing regime to meet nature conservation objectives. Nevertheless, the example illustrates that alone this is unlikely to prevent undergrazing and a decline in habitat value. The difficulties faced by Mr. G. are largely overcome by a highly positive attitude to nature conservation. As Morris and Potter (1995) have observed, this type of 'green behaviour' remains rare amongst farmers. The BSE crisis can only dissuade farmers further from moving

along Morris and Potter's (1995) adoption spectrum to engage fully with conservation practices and deliver appropriate SSSI management.

iii) Coastal Grazing Marshes (5 Sites)

The direct impact of the removal of cattle from coastal grazing marsh SSSIs is not always easy to ascertain due to the extensive area they typically occupy and the complex system of landownership evident within them. Having said this, it is clear that cattle produce a tufted grass sward and footprint hollows which other grazing animals, principally sheep, are unable to generate. Such micro-variations provide particularly valuable habitats for breeding bird populations and invertebrate fauna. In contrast, although sheep grazing maintains land in pasture, it tends to produce a 'bowling green' sward which is too uniform to encourage a diversity of species. Further, cattle are a more robust management tool in coastal areas subject to recreational pressure, being less susceptible to diseases transmissible by dogs and the tendency of dogs to worry sheep. Evidence suggests that the use of cattle on grazing marshes was in decline prior to the BSE crisis. Lack of profitability, mainly in beef suckler herds has led many farmers either to specialise in more intensive sheep and dairying systems, or to withdraw from farming and cease to exercise common grazing rights, a prevalent form of land tenure in these localities. Pre-BSE, agri-environmental policies such as ESAs and CS¹ appear to have acted as 'holding mechanisms' for the less intensive beef enterprises in coastal grazing marshes, helping farmers choosing to enter these schemes to meet the restrictions on grazing they commonly demand. Where farmers are not enrolled into schemes, they have frequently resisted joining because limits on stocking densities compromise their intensively-run livestock systems in which marshland provides an early spring 'bite'. However, the advent of the BSE crisis has placed additional pressure on the viability of beef enterprises, even within agri-environmental schemes. For example,

Family F. run 300 head of beef cattle on a coastal grazing marsh within an ESA. The BSE crisis has made beef grazing less profitable. In conjunction, there has been a change in the life cycle situation within the family business so that the daughter of the former head of the household has assumed control and is interested only in cereal production. The combination of these events has led to the rented grazing marsh area being surplus to requirements and to a removal of beef cattle. The land remained ungrazed for a significant period until a new grazier was found. The new grazier lives 30 miles from the marsh and has to engage another farmer to check the stock on his behalf. The ability to supervise appropriate grazing and the long-term sustainability of the new arrangement on the Site is questionable.

The example indicates that there are now fewer graziers in coastal localities with cattle able to deliver the nature conservation objectives of marshland Sites. The situation has been exacerbated considerably by the BSE crisis. Within some Sites, land is owned by wildlife trusts for the specific purpose of nature (usually bird) conservation. Investigation shows that this is no guarantee against a deterioration of

¹ The operation of ESA and CS schemes are not mutually exclusive of SSSIs. Indeed, Lovelace (1998) notes that more than 400 SSSIs (about 10%) are covered in whole or part by CS alone. If such schemes are warranted in SSSIs, many questions are immediately raised about the effectiveness of SSSI designations and delivery of AEP in the UK.

Site quality because trusts themselves are reliant upon licensing and letting arrangements with local beef graziers - rarely do trusts own their own beef herds.

The dualistic problem of undergrazing and overgrazing by cattle is not the only detrimental force of change evident within coastal grazing marsh SSSIs. An important factor is the type of grazing delivered by individual cattle breeds. Subtle changes in the keeping of breeds can be detected as a consequence of BSE, as illustrated in the following example from the north of England.

Farmer H is a dairy farmer with a subsidiary beef herd on a 77 hectare farm with coastal grazing marsh. He has approximately 20 beef cattle (including Hereford, Aberdeen Angus, Limousin and Charolais breeds) and 30 young dairy stock grazing the marsh between May and November. The stocking rate is less than one beast per hectare. He considered his beef enterprise as important to the farm business until the BSE crisis, but since then has reacted by purchasing additional milk quota to increase the dairy herd and compensate for the effects of the BSE crisis. Moreover, he now has to feed extra supplements to finish his beef cattle as a result of the 30 month rule. By spring 1997, he had removed his Friesian bull calves which grazed the marsh, a combined effect of the crisis and that the quality of the SSSI grazing was insufficient to fatten the beasts rapidly. Dairy followers have replaced these beef animals and Mr. H. will not increase the scale of his beef enterprise unless there is an improvement in the market to pre-March 1996 conditions.

Although no immediate risk of diminished grazing on this marsh is apparent, Mr. H.'s situation does raise questions over the commercial viability of some beef breeds for conservation grazing given the over 30 month rule. Replacement of beef by dairy breeds and changes made to breeds within beef systems themselves can have major habitat impacts, as demonstrated earlier in the paper.

iv) Upland Moor and Heath (3 Sites)

The limited evidence gathered from upland localities indicates that farmers are following one main strategy which has effectively been forced upon them by the lack of options for adjusting their enterprise mix. Farmers tend to contemplate change, in this case manifest as a movement out of beef enterprises, but show a general reluctance to actually 'take the plunge' and implement modifications. The BSE crisis has done little to alter this outlook, with many farmers seemingly prepared to take a medium-term perspective and sit out the short-term disadvantages experienced. For example, one farmer had contemplated moving out of sucklers but is reluctant to take such action whilst another is continuing as before and simply hoping and waiting for a revival in the beef market. The most logical change for farmers in upland situations to make is to compensate for a reduction in the number of beef animals by increasing the scale of sheep flocks, typically the main farm enterprise. Frequently, this involves intensification and grassland improvement, particularly using slurry spreading. However, due to the lack of options, many farmers had committed themselves to agri-environmental schemes prior to the BSE crisis which has prevented the possibility of expanding sheep through limits on intensification and conditional stocking management. If prices for beef continue to be depressed, farmers may well decide not to re-sign voluntary agri-environmental agreements unless government allocates more resources to such schemes. The impact on nature conservation is difficult to gauge. Landowning

patterns over the Sites investigated are highly complex involving large numbers of owner-occupiers. Ecologically, cattle grazing is rarely vital to maintain conservation interest in a particular Site, but contributes to diversity of habitat in a transitional area between improved in-bye pasture and heather fell. Indeed, cattle grazing provides opportunities for bird species to breed where agricultural intensification in the lowlands has already removed suitable habitats.

Conclusions

There is little doubt that commodity support available in the beef sector has retained herds on many farms with land of SSSI status. The compensation offered through BPS and SCPS for cuts in the support price for beef established under the 1992 CAP reforms has tended to fossilize the pattern of beef enterprises as a result of quotas on SCP in the face of creeping specialization in the farm sector. From the SSSI survey, the BSE crisis has had some direct influence on Site management where grazing has been withdrawn or modifications made to accommodate the constraints of the over 30 month rule. However, there are few signs that the crisis has led to a radical diminution of grazing in the majority of cases examined so that its long-term effects are unclear. There are four key factors that have mitigated against the BSE crisis causing unacceptable reductions in grazing on case study Sites.

i) There was a retention of large numbers of cattle on Sites following the BSE crisis as cows awaited slaughter or as farmers decided to attempt to sit out the immediate aftermath.

ii) Beef prices experienced a modest recovery after the initial crash.

iii) Structural rigidity in farming, a result of many postwar years of specialization, has left farmers with little option for agricultural enterprise change.

iv) Farmers have been enabled in the adoption of a 'wait and see' strategy because beef enterprises are usually supplementary to more profitable enterprises.

Overall, the survey demonstrates that BSE is an unwanted factor in the attempt to deliver nature conservation, making Site management even more difficult than it was before. The direct impacts of BSE are not always clear, being frequently bound up with other policy and market conditions in the agricultural sector which exert an influence over individual farm businesses. Analysis demonstrates that it is a complex web of policy, economics and ecology, further influenced by the social structure of family farm businesses, that delivers grazing 'on the ground'. The survey indicates a clear role for an enhancement of AEP payments and for the promotion of niche markets as ways to help counteract the worst effects of the BSE crisis on the habitats of SSSIs. Nevertheless, it must be remembered that SSSIs are highly protected areas of conservation in England where management is tightly controlled. If it is necessary to target measures to ensure that SSSIs remain in reasonable condition, many questions about the future conservation status of the wider unprotected countryside remain to be addressed.

Market and policy changes clearly take time to work their way through the agrarian system. It must be remembered that the research was conducted in the immediate aftermath of the crisis. Since this time, there have been three main developments affecting beef producers and the cattle-conservation link which are worthy of brief comment. First, MAFF reports that there has been an upturn in consumer confidence

in British beef. Consumption levels slumped by up to 40% after the SEAC announcement in March 1996, but by October sales had recovered to a level just 10-15% below those at the beginning of the year. In the four-week period ending May 2nd 1999, British household beef consumption was 3% up on the same period in 1998, although 2% down on the 1995 figure. Prices for producers remain lower than in 1996 and despite a poor year in 1998 they have stabilized at a level 15-20% less than before the crisis. Further, beef exports from Northern Ireland resumed in 1998 and a Cattle Traceability System has been established for England, Scotland and Wales as a move towards meeting the conditions for the resumption of exports under the 1996 Florence Framework. Farmers have some optimism for retaining their beef herds under these conditions, helping to ensure a continuation of the associated nature conservation benefits identified by the survey of SSSIs.

Secondly, the next round of CAP reform has been debated in the period after the crisis, starting with the Cork declaration in autumn 1996, through the announcement of Agenda 2000 in July 1997 to the final agreement on a modified Agenda 2000 package reached at the Berlin European Council in March 1999. As Winter and Gaskell (1998) note, reform of the beef regime was the least radical of the 1992 MacSharry reforms of CAP, and revision of the extensification criteria is the 'major challenge'. The 30% reduction over 3 years in intervention price originally proposed in Agenda 2000 has been watered down to a 20% one over the same period. Compensation using direct payments mainly through raised premia under BPS and SCPS 'seem likely to more than compensate producers for the reduction in prices they will face' (MAFF, 1999b, p.12), greater than the 80% initially anticipated (MAFF, 1999c). Significantly, at the discretion of member states, the Commission has moved to implement the payment of extensification premia based on actual stocking rates rather than on animals for which BSP and SCP are claimed. According to MAFF estimates, the Agenda 2000 reforms will have 'relatively positive effects on cattle and sheep farms both in the lowlands and hills' (MAFF, 1999b, p.13). MAFF (1999b) calculates that by 2008, beef and sheep farmers will have experienced a 5% increase in their returns compared with cuts of 7% in the arable sector and 2% in dairying. MAFF regards the latest reforms as favouring beef producers by bringing greater stability and protection to beef producers' incomes. If correct, this assessment means that Agenda 2000 should help to improve positively the relationship between beef farming and nature conservation. The worst excesses of farmers claiming extensification payments whilst grassland is overgrazed should be avoided, and there should be enough income incentive for farmers to retain an interest in beef enterprises. Nevertheless, such adjustments are yet to approach an even weakly decoupled 'cows and conservation' scenario in which farmers are paid a subsidy on their beef herds to produce nature conservation outcomes rather than beef. Full green recoupling in which payments to farmers are calculated according to environmental achievements, as outlined by Potter and Goodwin (1998), is considerably more distant.

Thirdly, there is always the possibility of a new crisis emerging which will undermine the incremental gains being made through policy adjustment. Following the publication of a report by the National Farmers Union (NFU, 1999), some

commentators have recently suggested that bovine tuberculosis (TB) will lead to an animal health and public confidence crisis in the cattle sector (Farming News, 1999; Farmers Weekly, 1999). Cases of bovine TB have doubled over the last two years and this trend is predicted to continue. This is likely to lead to a further reduction in the numbers of beef cattle available for grazing sites of high nature value. Its impact is potentially most acute where BSE has already weakened the beef grazing - conservation link and led to a replacement by dairy stock which are especially vulnerable to bovine TB infection. Research on the impact of this emerging problem would be timely.

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