The National Trust for Scotland

THE ROLE OF LARGE HERBIVORES IN SHAPING THE UPLAND LANDSCAPES OF BRITAIN

What does the science of herbivore ecology tell us?

Report of a seminar at Battleby, Perth, Scotland, 16th February 2005

Co-ordinated by The National Trust for Scotland
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The National Trust for Scotland
Wemyss House
28 Charlotte Square
Edinburgh
EH2 4ET

contact:

Richard Luxmoore rluxmoore@nts.org.uk

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Editors: R. Luxmoore & J. Fenton

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WELCOMING REMARKS

James Fenton, National Trust for Scotland

As a young research student in the 1970s, in discussion with the then Institute of Ecology, I remember that I once used the term ‘overgrazing’. I was immediately challenged by Bill Heal: “Overgrazing? what do you mean by that? There’s no such thing!” And of course, looked at objectively, this is true: a high grazing pressure will simply lead to a different range of plant communities than a low grazing pressure.

This then leads to the question: which plant communities are appropriate to the uplands? This can be a difficult question to answer, our answer perhaps more dependent on personal value judgements, or our mental images, than on an understanding of the history and ecology of the wider ecosystem. In the uplands, there is even a case for not asking the question at all: perhaps, instead, we should ditch our preconceptions and let nature decide what vegetation should be present – allow nature to be wild?

But this poses another set of questions: what are the appropriate animals to graze the upland ecosystems and at what density? Perhaps from a nature conservation perspective, we should be aiming for the animal species and populations that would be indigenous to that system. But what would these be? Would these have resulted in a high or low grazing pressure? The current mindset assumes it would be low, but is it valid?

A lot of questions, but these are some that we are hoping this conference will tackle.

INTRODUCTION AND REASONS FOR THE SEMINAR

Richard Luxmoore, National Trust for Scotland

While most people would agree that humans have had a major role in shaping the ecology and landscape of upland Britain, we often speculate on what the "natural" or "climax" vegetation would have looked like in post-glacial times. This can be used as a model for land management objectives for conservation purposes.

In predicting climax vegetation, the role of large herbivores has often been ignored. Through the work of Frans Vera and others, this is being challenged in mainland Europe, but primarily for lowland forests: theories are poorly developed in the uplands.

Deer are the main, if not only, native large herbivore in Scotland. If they are considered at all, it is frequently assumed that deer numbers would have been kept low by natural predators, notably wolves. This is at odds with traditional ecological theory, which suggests that predators do not control prey populations; in fact the reverse is true; bear in mind also that wolves were present in the Scottish Highlands until the 1700s, by which time woodland cover in Scotland was less than 10%

Humans have undoubtedly affected grazing levels through domestic animal husbandry and possibly by deliberate woodland clearance. In primitive pastoral systems, domestic livestock would simply replace wild herbivores and therefore not increase overall grazing levels. However, a number of husbandry techniques, such as supplementary feeding, transhumance and seasonal slaughter of excess animals, would increase the carrying capacity and therefore the grazing pressure, albeit seasonally.

The combination of these techniques with the incentives provided by the Common Agricultural Policy, means that domestic livestock levels (and therefore grazing pressure) were at historically high levels in the 1980s and 1990s. Such artificially high grazing pressure, possibly above the ecological carrying capacity, will have had a marked impact on the vegetation.

Economic pressures and the reform of the CAP have already resulted in a reduction in the numbers of hill sheep and this trend is likely to continue. The predicted result of this would be to allow an increase in deer numbers, though probably a decrease in overall grazing pressure. What effect will this have on the ecology and the landscape?

The aftermath of the Foot-and-Mouth crisis in the Lake District unearthed fears that the uplands would "scrub over". Can we expect the same to occur over a wider scale due to CAP reforms? This response also highlights differences in concerns in different parts of the UK. Here in Scotland we tend to be preoccupied with encouraging tree regeneration in the uplands while, in England, preventing scrub invasion is the common theme. Is this the result of ecological differences or cultural preferences?

There is increasing awareness of the value of the British landscape to society and the economy. Managing grazing levels in the uplands is seen as a means of shaping the landscapes and therefore has moved into the mainstream policy debate, rather than remaining the preserve of ecological cranks such as ourselves.

However many questions remain to be answered:

- What would the uplands look like under conditions of natural grazing?
- Would they be wooded, or would soil, climate and grazing conditions limit woodland growth?
- Is it necessary to reduce deer below the ecological carrying capacity to ensure that woodlands regenerate or, having started to regenerate, subsequently survive?
- Is it possible to manipulate deer population levels to achieve landscape objectives and what should those objectives be?

Grazing levels in the uplands are likely to be affected by two main policy instruments in Scotland:

- The Deer Commission for Scotland has a responsibility to ensure that deer are managed so as to prevent "Damage to the Natural Heritage".
- The allocation of Single Farm Payments depends on the maintenance of "Good Agricultural and Environmental Condition".
-

Neither of these is well defined in relation to the effects of deer in the uplands, and the discussion sessions this afternoon are intended to help clarify thinking on these issues.

Whatever happens, it is essential to plan for the management of the uplands in the presence of native herbivores and to view them as components of the natural ecosystem rather than as unwelcome complications that can be ignored. We hope that our discussions today will ensure that this is on the basis of sound ecology rather than assumptions and preconceptions.

THE EFFECTS OF LARGE HERBIVORES ON VEGETATION DYNAMICS IN TEMPERATE EUROPE

Dr. Frans Vera, Staatsbosbeheer (National Forest Service), The Netherlands

The conventional thinking is that the lowlands of northwestern Europe were covered with a closed canopy forest before mankind intervened with agriculture. Regeneration of the forest would have taken place in gaps in the canopy according to Watt's gap-phase model and Leibundgut's cyclical model, a model in which the regeneration of trees also takes place in gaps in the canopy. The conventional thinking is also that large indigenous herbivores, like aurochs, tarpan, European bison, red deer, elk, roe deer and wild boar, did not have a dramatic influence on the establishment of trees and shrubs, although they colonised the open landscape that was present after the ending of the last Ice Age long before the tree and shrub species that nowadays form forests. This closed canopy forest has long been considered the natural vegetation in lowland Central and Western Europe, and has strongly influenced the way we wish to manage our landscapes and how we perceive the role of large herbivores on the vegetation.

The theory of the closed canopy forests is based on observation of the development of fields and meadows that have been abandoned by mankind and his livestock. These areas are typically colonised spontaneously by trees and shrubs, eventually forming a closed canopy forest. According to the succession theory, this closed canopy forest is called the climax vegetation. Palynologists confirmed with their interpretation of pollen diagrams that the undisturbed primeval vegetation was a closed canopy forest. Pollen analysis also led to the theory that, in the Neolithic, man started to cut down trees in the forests to create open land to grow crops and to graze their livestock on this open land as well as in the remaining forest. In the forest, the people also cut branches to provide leaves as fodder for their livestock. The grazing in the forest prevented regeneration of trees. As a result, the forest became more open and eventually developed through a stage of a park-like landscape into open grassland or heath. This process was called a retrogressive succession. The succession theory also stated that if man's intervention ceased, the vegetation would spontaneously return to its natural state, a closed canopy high forest, as demonstrated by the spontaneous development of abandoned agricultural land.

The difficulty with postulating closed canopy forest as the primeval, undisturbed vegetation is to explain how light-demanding species, e.g. oak and hazel, would have persisted in a closed canopy forest. Both oak and hazel are very well represented in pollen diagrams in a high percentage of the so-called Atlantic period, in the presence of shade-tolerant tree species like lime, sycamore and/or field maple, ash and elm. This is the period dating from 9,000 until 5,000 BP (Before Present, i.e.1950), before man adopted agriculture in North-western Europe and the primeval forest would have been at its maximum extent. However, in non-intervention forest-reserves that are considered to be modern analogues of the primeval vegetation, oak and hazel do not regenerate in the presence of shade-tolerant tree species, including beech and hornbeam that arrived later; oak and hazel do not regenerate in gaps in the canopy nor in large wind-blown areas, and are ousted by shade-tolerant tree species.

This can be observed, for instance, in forest reserves like la Tillaie and Le Gros Fouteau in the Forêt de Fontainebleau in France, The Hasbrucher Urwald and the

Neuenburger Urwald in Germany, the National park Dalby Söderskog in Southern Sweden and the National Park in the Forest of Bialowieza in Poland.

These reserves were, until the middle of the 19th or the beginning of the 20th century, wood pastures, which are landscapes comprising a mosaic of grassland, scrub and thickets with trees, as well as solitary trees and high forest. They were grazed by domesticated animals like cattle, horses and wild animals like red deer and roe deer. Cattle and horses were removed when the forest reserves were established, because they were considered to be alien species introduced by man. Indigenous species like red deer were either lacking or culled to such densities that they would not prevent the regeneration of trees within the forest. Since then, new generations of oak and hazel have not appeared and both died out. For instance, since the reserve La Tillaie in the forest of Fontainebleau became established, around 1850, and grazing by cattle ceased, there has been no further regeneration of oak, while beech and hornbeam have regenerated and beech has gradually become dominant. From the oaks dating back to the 16th century the last ones are now dying. In other reserves, lime and or elm ousted oak and hazel. In all these reserves the last generation of oak and hazel was clearly related to the last known time of grazing.

Contrary to what happens in forest reserves, light-demanding oak and hazel do regenerate very well in the presence of shade-tolerant tree species in wood pastures. As mentioned above, these are landscapes comprising a mosaic of grassland, scrub, thickets with trees, solitary trees and high forest, and are grazed by domesticated animals like cattle and horses, and wild animals like red deer and roe deer. Thorny and spiny shrub species, like hawthorn, blackthorn and bramble, become established in open grazed grassland, being light-demanding species that are avoided by the large herbivores because of their thorns and spines. These shrubs act as so-called nurse species for trees; like barbed wire, they protect the seedlings, saplings and young trees against browsing and trampling by large herbivores, so that they can grow up successfully. They nurse all tree species as well as “unarmed” shrubs like spindle tree and hazel. In this way they enable the trees to regenerate successfully in the presence of very high densities of herbivores, as has been proved by historical data and in present day wood pastures like the New Forest in England and the Borkener Paradise in Germany. When the trees grow up the crown casts shade and kills the shrub underneath.

If the spiny shrub species spreads clonally, like the blackthorn, a scrub is formed that spreads vegetatively into the grassland. New seedlings establish themselves in the fringe of the scrub that advances into the grassland. When the trees grow up and their crowns overlap, a closed-canopy circular shaped grove (forest) develops. This grove expands into the grassland at the rate at which the outer edge of the scrub extends into the grassland. The closed canopy of the grove shades out the scrub underneath, creating a grove without a shrub layer. In this way a grove becomes established, surrounded and bordered by a spiny mantle and fringe vegetation that forms the transition between the grove (forest) and the grassland. The groves may have extended over several hundreds of hectares. Within the grove, no regeneration of trees can take place because of the shade cast by the closed canopy in combination with the trampling and browsing of the large ungulates. Even when trees have aged and die, forming a canopy gap, the large herbivores will prevent the regeneration of trees in the gap. In this way they prevent colonisation by shade-tolerant tree species which

would eventually oust oak, as happens in forest reserves. By preventing the regeneration of trees in the grove (forest), the large herbivores gradually change the grove into grazed open grassland via the so-called retrogressive succession. The opening up of the grove can be speeded up by fungi and drought. The grazed grassland within the grove will expand and eventually, after having reached a certain area, thorny and spiny shrub species will come in again. These shrubs will again act as nurse species for young trees and a cycle is completed. In this way the vegetation goes through the following cyclical succession:

Open grassland → thorny or spiny shrubs → thorny or spiny scrub → grove surrounded by mantle and fringe vegetation → open grassland → thorny or spiny shrubs etc.

I called this the cyclical turnover of vegetation. This cyclical, non-linear succession is driven by grazing large herbivores, such as horses and cattle.

Shrub species that do not spread clonally, like hawthorn and juniper, will nurse single trees or small clumps, which results in a more savannah-like landscape. Because of its unpalatability, *Calluna* can also act as a nurse species for single trees, but only in the absence of sheep.

In all these grazed grasslands where thorny, spiny or otherwise unpalatable shrubs appear, oak is rather numerous compared with the shade-tolerant tree species. The reason is that oak has an unique dispersal mechanism via the jay, a bird that plants great numbers of acorns in the open very near to the base of shrubs. Hazel has a similar facilitator in the nuthatch that plants nuts on the edge of the fringes of scrub that forms a mantle and fringe vegetation of the grove (forest). Shrubs species whose seeds are spread by means of fruits that are eaten by birds come up in the fringes because the birds defecate the seeds there while they roost in the shrubs.

On very fertile soils, no tree regeneration may take place in areas where very high densities of large herbivores graze. This has been observed in the Netherlands in parts of the Oostvaardersplassen (10,000 acres), an area with calcareous clay, producing up to 10,000 kg dry matter per ha. Due to the intensive grazing of wild cattle, wild horses and red deer that do not get supplementary feeding and tens of thousands of geese, not even thorny or spiny species seem able to establish successfully in parts of the area. The reason may be because the seedlings can be eaten during the first growing season when herbivores are in very high densities and before their spines harden.

In conclusion: in my opinion, the grazed mosaic landscape of open grassland, shrubs, scrub, solitary trees and groves is the closest analogue of the primeval vegetation. Cattle and horses, being domesticated descendants of aurochs and tarpan, acted in these landscapes as proxies of their wild ancestors. This ecosystem model can explain why both oak and hazel are represented in pollen diagrams at high percentages in the Atlantic period, together with the shade-tolerant tree species that oust them in mature forests. It can also explain how tree and shrub species became established in the presence of our European native fauna consisting of large herbivores such as aurochs, bison, red deer, elk, roe deer, beavers and wild boar in the first place; and also how they persisted with this wild fauna and, from the Neolithic onwards, with cattle, horses and pigs as proxies of aurochs, tarpan and wild boar. The high quantities of

hazel pollen in the past also indicate a park-like landscape, because hazel would have been there in the mantle and fringe vegetation, where, standing in full daylight it could have flowered abundantly, thereby producing much pollen. Hazel does not flower under a tree cover of 30% or more. The low relative percentage of grass pollen in both these landscapes can be explained by high pressure of grazing from herbivores which prevent them from flowering and therefore producing pollen; there is an inverse relationship between the density of large grazing ungulates and the amount of flowering grasses. The higher the density of large herbivores, the less grasses come into flower and the less pollen is produced. Therefore the very low percentage of pollen of grasses in, for instance, the Atlantic period can be explained by the presence of high densities of large herbivores. Modern park like landscapes grazed by large herbivores produce pollen diagrams very similar to those reflecting the Atlantic period.

Park-like landscapes with large herbivores steering the succession contain all the habitats we know from the agricultural and forestry landscape. Park-like landscapes are however not split into separate units for different ways of production: all habitats are integrated into a natural functioning ecosystem. Today farming and forestry mimic some parts of the original landscape but to a limited and ever decreasing extent as they become more dominated by monocultures. Therefore, more space must be created for nature to get on its feet again. We need to re-establish the effects of large herbivores on vegetation dynamics in temperate Europe so that we can restore natural processes and conserve biodiversity.

For more information and references see:
Vera, F.W.M. (2000). *Grazing Ecology and Forest History*. CABI Publishing, Wallingford
Vera, F.W. M. (2000). The Dynamic European Forest. *Arboricultural Journal* 26, pp 179-211.

f.vera@staatsbosbeheer.nl

QUESTION

Ron Summers, RSPB: Wouldn’t fire have been more important in boreal forests than you have described?

Frans Vera: Yes that is true, but my model does not apply to boreal forests because there are no large ungulates present.

LARGE HERBIVORES IN UPLAND BRITAIN: WHAT CAN THE PAST TELL US ABOUT THE FUTURE?

David J. Bullock, The National Trust

Background

The conventional view of the landscape in lowland temperate Europe in the Atlantic chromozone/Mesolithic culture period some 6000 years BP (Before Present) – and before farming – is one of closed canopy deciduous forest. Tree recruitment occurred in small gaps generated by natural perturbations. Vera (2000), noting the abundance of pollen of oak *Quercus* spp and hazel *Corylus avellana* from the Atlantic, questioned how these two light-demanding species could have thrived in such a forest. He proposed a model of the wildwood driven by an interaction between large herbivores, especially aurochs or wild ox *Bos primigenius* and the horse *Equus ferus*, and vegetation which resulted in a cycle from open grassland/heath to closed canopy woodland over large scales of time and space. Vera's model, which is hotly debated (see for example, Kirby, this conference; Mitchell 2004; Whitehouse and Smith 2004), only applied to the lowlands.

This article uses physiological, ecological and behavioural attributes of present-day large mammals in upland Britain (and elsewhere) to explore the functional ecology of species present in prehistory. I then use the information from past-natural and present-day faunae to consider options for the 'future-natural'. Interpretation of the ecology and behaviour of the large mammals of the Atlantic wildwood is deductive and inevitably speculative. However, an attempt has been made to keep within the known biological footprint of the species concerned. Much of the information on the prehistoric/early Holocene mammal fauna is taken from Yalden (1999).

The "uplands"

Large, mobile mammals do not respect an upland/lowland dichotomy. They move up and down according to season, weather, latitude, food requirements, predator pressure, sex, age and reproductive condition. For this reason, in interpreting the interaction between large mammals and vegetation in the Atlantic, it is not realistic to focus solely on the uplands. A networked upland/lowland continuum (as in Vulink 2001, page 350) is more appropriate and, given climate change influences, very relevant today.

The prehistorical and historical impoverishment of the large mammal fauna

In the early Holocene, of the ten native large herbivores in north-west Europe, only eight occurred in Britain and one or two in Ireland (Yalden 1999). Today there are only two in Britain and one in Ireland. Red deer *Cervus elaphus* may have arrived in Ireland as late as the Neolithic – perhaps by swimming or human introduction? So perhaps the only large herbivore there in the Atlantic was the wild boar *Sus scrofa*. Both reindeer *Rangifer tarandus* and the horse were present in early postglacial Britain but had gone by the Atlantic (Yalden 1999). These are steppe- and tundra-inhabiting obligate lichen and grass specialists respectively. In lowland temperate Europe (including Britain) the postglacial invasion of scrub/woodland may have left them with too little of their preferred open habitats, especially in the face of competition from other large herbivores. So in Atlantic Britain, the large herbivores were elk *Alces alces*, red deer, roe deer *Capreolus capreolus*, aurochs, boar and,

significant amongst the smaller mammals, the beaver *Castor fiber*. The wolf *Canis lupus*, lynx *Lynx lynx,* bear *Ursus arctos* and man were the large predators.

One species, the aurochs, is globally extinct. Its descendant, domestic cattle, is regarded as a good analogue. However, adult aurochsen were substantially larger (Davis 1987; Grigson 1982) making them relatively invulnerable to attack by large carnivores, which in turn may have affected their local impact on vegetation. Red deer from Scotland in the Atlantic were larger than the hill deer of today, with more compact bone in their antlers (A. Kitchener, Pers. comm.). Their food, shelter and macronutrients such as P and Ca may have been less limiting than in today's uplands. Alternatively they may have undertaken seasonal migrations to satisfy these needs (including those of macronutrients) as wildbeest *Connochaetes taurinus* do in the Serengeti (Murray 1995). In this scenario, the distinction between uplands and lowlands becomes blurred, emphasising once again the need to view them as a continuum.

In Britain only red deer and roe deer have persisted into modern times, and in Ireland only the former (if indeed it was native). The elk appears to have survived until the Neolithic in Britain. The beaver and the boar were extirpated, by hunting or habitat destruction, by Tudor times. Wolves persisted until the 17th Century in Scotland and Ireland, but may have become 'ecologically' extinct long before that time.

Ecology, behaviour and physiology of present day species/analogues

Herbivores

In assessing the impact of herbivores on upland vegetation both their feeding styles and intake rates need to be taken into account. Hoffmann (1989) divided ruminants into three categories based on gut anatomy and function:

'**Concentrate selectors'** – highly selective browsers of tree leaves and nutritious shoots, of which elk and roe deer are examples. Boar and beaver would also fit here as highly selective feeders. '**Intermediate feeders**' – able to graze and browse depending on availability, of which the only native example is red deer. '**Bulk roughage feeders**' – obligate grazers of grasses, sedges, rushes and herbs of which the only example in Atlantic Britain was the aurochs.

In the uplands, the ruminant 'concentrate selectors' (elk, roe deer) and beaver were probably restricted in large part to riparian woodlands. The boar, in continental Europe, avoids deep or ice-crusted snow and so would have needed extensive woodland habitat in the British uplands as it does elsewhere today (Okarma 1995).

In the uplands away from riparian woodland, only one 'intermediate feeder' (red deer) and one 'bulk roughage feeder' (aurochs) would have been present. Did populations of these two species have the enough impact on vegetation to drive a cycle of woodland through to grassland/heathland as proposed by Vera (2000)? To attempt an answer to this question, in addition to the physiological attributes of prehistoric red deer and aurochs, the behaviour and ecology of their present day analogues needs to be considered.

In mammals the relationship between intake rate and body mass is allometric: the bigger the mass the less energy per unit of mass required. Became of this, the known

intake rate of free ranging domestic cattle of >5 <10kg/Dry Matter/day (Van Wieren 1992) is probably similar to that of its giant ancestor, the aurochs. The same logic would apply to upland red deer from the Atlantic which, although bigger than those of the present day, would have had a similar intake rate of *c.* 2-4 kg/DM/day (Armstrong 1998) – similar to, but lower than, the elk (c 4-6 kg/DM/day)?

The high intake rate for cattle/aurochs is significant in an upland context. Can this be translated in to carrying capacity? Hulbert (2002) considered cattle grazing in an upland birch wood where they had an assumed off take of 10% of annual vegetation production (this is close to Milner, this conference, where off take by red deer in an upland oakwood was <15% of annual production). Given an intake rate of 8kg/DM/day, he estimated between 0.05 and 0.2 cattle/ha could be sustained in this habitat. This equates to between 5 and 20 cattle/km^2 similar to the maximum density of red deer at which tree regeneration can occur of <10 /km^2 (Langbein 1997; Milner this conference). Even in summer, when the stocking rate would have been highest at 0.2/ha (20/km^2) it is unlikely that cattle being grazers would have inhibited tree regeneration. Indeed their poaching, removal of graminoid biomass and gap creation could actively promote tree regeneration (Armstrong and Bullock 2004). Clearly the combined impact of cervids, a bovid and the beaver could have prevented local tree regeneration as does a high density of red deer and sheep today. Of the wild species, away from riparian woodland, the red deer probably had the most impact on trees. It is physiologically adapted to grazing and browsing, lives in herds and has a relatively high daily intake rate.

Red deer and aurochs in upland Britain in the Atlantic

Red deer are highly mobile 'intermediate feeders'. They would have used open and closed habitats for grazing and browsing, moving downslope in winter, showing seasonal sexual segregation and breeding as they do today (Clutton-Brock *et al.* 1982; Mitchell *et al.* 1977; Mysterud 2000). It is tempting to suppose that their ecology in the uplands today was the same 6000 BP. However, there is one fundamental difference: in the Atlantic there were four large mammalian predators rather than one today (man). The influence of these predators on the dispersion of their prey could have been variable and profound.

The high daily intake requirement of aurochsen (cattle) is consistent with selection for highly productive habitats such as flood plains and other grasslands. Cattle drink every day so we should assume aurochsen shared this requirement. The uplands had and have lower annual primary production and availability of micro and macronutrients such as cobalt, P and Ca, and more steep or treacherous terrain and snow than the lowlands. They would have provided poor quality habitat for cow (with calf) herds of aurochsen and they were presumably at low density in much of the uplands for much of the year. The exception may have been in summer. However in this season, in lowland grasslands with their much higher primary production, it would have been easier to meet the high energy requirements of lactation, and allowed large group sizes to form (serving to reduce attack rate/individual by predators and flies). Cattle grazing solely on infertile heaths lose condition and exhibit pica behaviour (eating soils, bones of carcases) in an attempt to extract necessary Ca and P. When given access to riparian grassland and heath, their condition score is significantly higher (Wallis de Vries 1992).

Feral cattle can breed at any time of year (Hall 1991) but where there are lean and fat seasons and without supplementary feeding show a peak in spring (Bertaux and Micol 1992; Hall and Moore 1986). The constellation of factors such as high forage availability, large group size, open landscape would have made synchronised calving easier. This is an important prey saturation tactic of some large herbivores (such as wildbeest), and may have been used by aurochsen.

Inundation of floodplain grassland and coastal marshes would have prompted seasonal uphill movements, with bulls dispersed at any time of year away from the (probably traditional) cow herd home ranges. In similar circumstances to this speculative scenario, African buffalo *Syncerus caffer* show sexual segregation. Adult bulls, in small groups or alone, live in marginal habitats. Here they are in better condition than when in cow herds but suffer a higher rate of predation by lions *Panthera leo*, especially in ecotones (Prins and Iason, in Prins 1987).

What was the nature of the interaction between aurochsen and red deer – did the ranges of bull groups and deer overlap at mid elevation? The spectacular ungulate migration in the Serengeti follows an orderly progression from 'bulk roughage feeders' (such as wildbeest) to smaller and selective 'intermediate feeders' (such as gazelles). The 'bulk roughage feeders' removed much of the dead litter, leaving a smaller but more nutritious biomass of green shoots that were eaten by smaller antelopes. Gordon (1988), working on Rum, demonstrated a similar grazing facilitation of red deer grazing by cattle. Cattle grazing purple moor grass *Molinia caerulea* – dominated mires in winter removed a significant amount of necromass, and promoted a higher proportion of green shoots in the sward. The performance of red deer stags subsequently grazing mires used by cattle increased as a result of ingesting the better quality forage. Grazing facilitation by aurochs and red deer seems plausible and, of course, the same process could occur today with modern cattle.

Large mammal predators in upland Britain in the Atlantic

Wolf packs selectively prey on large cervids, attacking boar and roe deer only when their preferred prey of red deer is unavailable (Okarma 1995). They are conservative in their use of den sites and trails. Red deer and elk tend to avoid the cores of wolf territories which, as a result, may have prolific tree regeneration compared with where deer harbour. In Yellowstone National Park (USA) wolves, reintroduced in 1995, have facilitated a dramatic increase in regeneration of aspen *Populus tremula*. The result is a mosaic of aspen groves where wolf density is high and open ground where it is low and tree growth is suppressed by browsing wapiti (red deer) (White *et al.* 2003)). It would seem likely that a similar indirect influence of wolves on upland (and lowland?) vegetation in Britain would have occurred.

The lynx and bear were extinct in Britain by the Neolithic and, like the wolf, may have been ecologically extinct well before that time. Of these, the lynx (and wolf) may have had an influence on riparian woodland mediated by beavers. The lynx is a specialist predator of roe deer which, like the elk, is a 'concentrate selector'. Both would have been attracted to coppice regrowth of trees felled by beavers in riparian woodlands. Did lynx and wolves, stalking and chasing roe and elk respectively in these habitats, sometimes reduce local density of large herbivores sufficiently to allow tree growth? If so, this suggests that proposals for lynx (and possibly wolf)

reintroduction to Britain should look beyond the availability of its prey to its place in a trophic cascade.

The bison *B. bonasus*, formerly classified as an ‘intermediate feeder’ is actually a ‘bulk roughage feeder’ (in Vulink 2001). It is thus a wild *Bos* species model for an extinct congener, the aurochs. Bison are very large, horned and live in matriarchal groups. For these reasons, they are rarely attacked by wolves (Okarma 1995). Their diet of grasses, sedges, and herbs augmented by bark in winter (Gebczynska *et al.* 1991) is similar to that of free-ranging domestic cattle today. We can be confident that aurochsen also lived in groups based on cow/calf bonds. Given their long horns and huge size we can also assume that the frequency with which they were attacked by wolves was low, and similar to that recorded for bison. Compared with one for red deer, an argument for wolves or other predators influencing the distribution of aurochsen would be weak.

Looking back

I have argued that over much of the upland landscape of primeval Britain and Ireland red deer were likely to have been the predominant wild large herbivore as they are today. Their distribution could have been profoundly influenced by the dispersion of wolf packs and this, in turn, was one factor determining where woodland occurred. Vera (2000) did not consider the role of predators of large herbivores to be important in his model for lowland temperate forest. However, they could have had a similar influence on the extent and dispersion of open ground in the lowlands as I have suggested for the uplands.

Of the other factors producing gaps in woodland (and so allowing tree recruitment) some, such as fire, landslips and avalanches, are more relevant to the uplands than the lowlands. In the latter, floods may have been more important in creating or maintaining openness. Rackham (2003) considered that lowland deciduous woodland is virtually “fireproof” (although note that hollowed veteran trees in pasture-woodlands may burn furiously if there is a flammable understorey). Upland or boreal woodland dominated by pine *Pinus* spp., birch *Betula* spp, juniper *Juniperus* spp. and ericaceous dwarf shrubs is very flammable. Indeed many of the woody plant species in the uplands are adapted to fire regimes. Wildfires, and those lit by Mesolithic hunters to flush or encourage game, could have created open spaces some of which were very large. Successful reestablishment of pine, birch and other woody species such as dwarf shrubs on burn, landslip or avalanche sites depends on a variety of edaphic and topographical factors. It may also have been related to the hunting pressure (principally on red deer) by wolves and man.

Looking Forward

Vera (2000) has argued that in the primeval wildwood bulk-roughage-feeding large herbivores interacted with vegetation to generate a cycle of grass/heath through to woodland and back again. From this baseline the presence of cattle in future-natural landscapes in Britain is vital. In the British uplands the already species-poor native large herbivore fauna (compared with continental Europe) was even smaller and, away from river catchments, dominated by red deer (an intermediate feeder) as is the case today.

Aurochs, by analogy with cattle, would have been able to thrive in upland landscapes in summer but would have selected more productive habitats in the lowlands. This is not an argument for their exclusion on ecological grounds today. There are other "baselines", such as the Neolithic or Bronze Age cultures onwards to the present day, in which domesticated large herbivores (cattle, sheep and goats) made or make extensive (seasonal) use of upland British landscapes. We could, however, be more discerning. In north-west Europe, sheep and goats are well north of the natural range of their wild ancestors from which they were domesticated some 10,000 years ago in the Middle East (Davis 1987). Cattle in Britain (but not Ireland, Yalden 1999) are within the native range of their wild ancestor. Their grazing, poaching, trampling and dunging impacts on a range of vegetation types (including woodland) is considered to be beneficial compared with a similar grazing pressure by sheep, and they have the proven ability to drive a grazing facilitation with red deer (Gordon 1988). Additionally there is a specialist dung flora and fauna that will disappear in the absence of cattle. For these reasons the future-natural landscapes in the uplands should hold not just red deer, but also cattle.

Cattle are relatively easy to manage compared with wild deer and, like aurochs, relatively impervious to disturbance by dogs/wolves. Given an objective to promote a more dynamic and structurally diverse upland landscape, or one that was part of the past-natural, red deer will have to be managed at least in some places, some of the time. There is a role here for an influence of its major large predator, the wolf. Consideration should be given to trials of the impact of wolf mimics on development of greater structural and spatial diversity in upland (and lowland) landscapes.

Finally, we need to manage for change. Tony Waterhouse's prediction (this conference) that CAP reform will serve to reduce the number of hill cattle does not bode well for the sustainable management of an appropriately diverse suite of upland landscapes. Add to this the unpredictable effects of climate change, and the best approach is likely to be intensive conservation management of a few cherished habitats/species in tandem with extensive grazing by red deer and cattle where environmental processes, rather than products, are the objectives.

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QUESTIONS

Dick Balharry, John Muir Trust: How important is the past in dictating the future?

David Bullock: If we can mimic major influences of the past, this could be useful for the future. For instance large predators that have now disappeared, had a major influence on the distribution of red deer and therefore of woodland.

Chris Smout, St. Andrews: Why are we fixated on the Atlantic period? Our knowledge of biodiversity depends on the work of 19th and 20th century scientists and we only tend to value what we had left in the 20th century. Wouldn't it be more sensible to use the last 400 years as the model?

David Bullock: It is not so much species that we should focus on but processes. We go back to the Atlantic period because this provides with evidence of processes. For instance modern day cattle can be useful to mimic processes from the past.

Toby Aykroyd, Wild Scotland: How can we use herbivore-based management to:

- facilitate the creation and management of natural wild areas on a landscape scale;
- as a means of cost-effective management; and
- as a means of maintenance of a high degree of biodiversity?

David Bullock: It is appropriate diversity we want and not necessarily highest biodiversity. We should be looking at whole catchments. If we just look at the uplands we will not deliver what people want. We must think of the uplands and lowlands as a continuum and we must look at processes.

WAS THE WILDWOOD CLOSED FOREST OR SAVANNAH – DOES IT MATTER?

Keith Kirby, English Nature

Frans Vera's ideas have sparked much debate and not a little controversy: but what is the relevance to English Nature? Most of what we have been interested in conserving are clearly long-standing cultural landscapes, such as coppice and wood pastures, and not natural landscapes. However we should try to understand where these habitats have come from: to what extent are they analogues of what may have been present in the Atlantic period, because this may help us decide where we want them to go. Vera's ideas have also encouraged the debate about whether, if we move towards 'wilder landscapes', there are ways in which we can still maintain, albeit in different ways, the small-scale mosaic of habitats that are often what conservationists value.

Vera's hypothesis in relation to the former landscape

A review project was set up with Centre for Ecology and Hydrology (CEH) and with Paul Buckland (then attached to Sheffield University) to look at how Vera's ideas about the past landscape have been received; and secondly to look at what his ideas might say about the use of free-ranging large herbivores in modern landscapes. A wide ranging literature review was combined with discussions with key individuals both in Britain and the Netherlands.

In considering the past landscape there are two separate questions: (a) was the landscape composition driven by large herbivores; and (b) if so would it have produced an open landscape over large parts of Britain. The conclusions from the report are likely to be that the role of large herbivores has been underestimated in the past, but the evidence that they were the predominant driver of the landscape pattern is weak. Similarly while there is evidence for openness from various palaeoecological studies the balance is toward a landscape where trees predominate and open space is the minority. The Vera hypothesis is we consider at best 'Not Proven'.

Naturalistic grazing and future landscapes

We cannot recreate the past: the former natural landscape has gone. The priorities for conservation, e.g. as set out in the UK Biodiversity Action Plan, are the remnants from the last 3000 years of cultural activity with their associated species. The conservation of chalk grassland in the form in which it has existed for much of the last 1000 years usually involves agricultural-types grazing regimes, not a reversion to 'more natural' grazing systems which might promote scrub invasion.

There are no situations in England where human influence can be withdrawn completely, although on the coast, sea-walls have been breached to allow the development of salt-marsh as part of managed retreat programmes. Inland, more limits are likely to be set on the degree to which natural processes are allowed to determine the outcome.

'Re-wilded' areas may end up bearing some resemblances to 'original-natural' landscapes but will be moving towards a 'future-natural' state. This will create new patterns and assemblages of species, which raises some interesting questions in terms of current target-driven approaches to nature conservation. What are some of the

issues, particularly with respect to the role of large herbivores in the re-wilding process: what animals would be used, how do we balance gains and losses of habitats, and how socially acceptable is the approach?

Domestic stock, particularly cattle, have been suggested as part of re-wilding projects as substitutes for lost herbivores such as the aurochs. If they are to be included in re-wilding projects their role needs to be clear. It is quite distinct from that in conventional farmland – where they are essentially a product or producer – but also from that in most nature reserves where they are used as management tools, for example to prevent tree regeneration on heaths or maintain short turf conditions on chalk grassland. If domestic stock are themselves to be part of the 'wild' system then we need more information about their ecology and impact under such low intervention conditions.

Landscapes under a Vera cycle are not necessarily open. Current areas of high value grassland and heathland areas may be lost to scrub and then woodland for tens or hundreds of years. The grazing area must be large enough for replacement areas to develop in an acceptably short time.

Some species may be lost permanently if the micro-habitats they depend on occur at too low a density or at too infrequent intervals under free-ranging grazing. For some species there may be other source populations near enough to allow for recolonisation when conditions do again become suitable.

In some conditions the Vera cycle may not function, e.g. if the area is very fertile and heavily used by animals, or alternatively if it is hardly accessible to them; such landscapes may move either toward permanent open habitat or to permanent woodland.

There are also issues relating to public acceptability, public safety and animal welfare that need to be considered before any proposal can be adopted. However, despite the challenges involved, there is scope for exploring naturalistic grazing regimes as an alternative to traditional farming or forestry practice in some areas. *Realistically there may be only one or two opportunities to do this on any scale in England.*

English Nature is going to follow up some of the areas where large scale grazing ideas are being considered with a particular interest in survey and monitoring to improve the research base for the concept.

The work referred to above is now available as:

Large herbivores in the wildwood and in modern naturalistic grazing systems
English Nature Research Report No.648

QUESTIONS

James Fenton, NTS: What was the Atlantic period like? We have not looked at the role of people. Could primeval hunters have kept herbivores at artificially low levels, hence indirectly resulting in increased woodland cover?

Roy Dennis, Consultant: If the Netherlands, a small country which is more densely populated than the UK, has managed to create two large areas with non-intervention, why is English Nature only considering one or two opportunities in England? Why worry about issues such as safety and animal welfare?

Keith Kirby, English Nature: The answer is the issue of public perception. The attitude of the public can create difficulties in carrying out deer management and there are frequently questions raised about the state of the ponies in the New Forest for instance.

Drennan Watson, Landwise Scotland: Is it worth looking outside the UK? For example in the Kalahari local people have informal agreements with elephants about the use of certain resources. We probably vastly underestimate how people in the past managed large landscapes.

Keith Kirby, English Nature: (relates also to James Fenton's point). There are again two separate questions: what did the former landscape look like, could it have been open through the activities of wild herbivores; but a separate issue is whether it was a natural landscape anyway. We addressed the former, not the latter.

DEER NUMBERS IN RELATION TO CARRYING CAPACITY

Jos Milner, Hedmark University College, Evenstad, N-2480 Koppang, Norway

There is perhaps a mismatch between the spatial scale at which ecologists work and the scale that is useful for deer managers.

Spatial scale can be considered:

- within vegetation communities (patch scale);
- between vegetation communities;
- on a landscape scale; and
- at a national scale.

There are problems in scaling up from patch to landscape scale. Deer are mobile with a large range compared to plant community sizes. At what scale can we meaningfully estimate deer density? Deer densities cannot be estimated on a patch scale.

Two pieces of work are presented here – the first is at the local scale of a vegetation community from the Letterewe Research Project and the second tackles deer numbers and carrying capacity at the national scale.

LETTEREWE RESEARCH PROJECT, NW HIGHLANDS

This project studied deer in relation to habitat and aimed to answer the following questions:

1. What is the impact of deer on the regeneration of Atlantic oak woodland?

In an even-aged mature stand there was no regeneration of oak under closed canopy woodland, but there was good potential in gaps and at the woodland edges. However, tree regeneration was found to be inhibited by grazing.

2. What proportion of vegetation production is grazed by deer each year?

Overall grazing offtake was found to be less than 12% of the total annual production of vegetation. In addition, offtake of heather was low. Deer had little negative impact on most vegetation communities.

The lack of tree regeneration raised questions for deer management decisions at Letterewe. How many deer should be culled to allow regeneration to take place?

A low cull of about 5% of the hind population was carried out until 1998 and was found to have no real impact on deer numbers. Deer numbers were much too high to allow natural regeneration of trees.

Since 1998 the hind cull has been increased to 12% of the population. This level of culling would gradually reduce the population size but not sufficiently to allow trees to regenerate.

A suggested cull of 20% of the hind population could reduce population size sufficiently to allow some tree regeneration after about 15 years but even then regeneration is not guaranteed because local wintering densities on the low ground around the woodland will be far higher than average deer densities. This highlights

the problem of the appropriate scale to measure deer density. Deer densities of 5-8 deer/km^2 are thought to be needed to enable trees to regenerate.

Management options to enable trees to regenerate

1. Regeneration without fencing.

Winter deer numbers would need to be reduced from around 600 to 45-72 animals. This large reduction is incompatible with stalking objectives.

2. Regeneration with fencing

A rotation of small enclosures of 7% of the woodland area located in gaps and along the woodland margin would produce a mosaic of young and old stands.

All findings from the Letterewe Research Project are published in Milner *et al.* (2002).

SCOTTISH RED DEER NUMBERS

Deer numbers have increased over the last 40 years although there is some disagreement over recent increases in red deer population. Hunt (2003) writing for WWF and RSPB estimates a population of 454,500 including deer in forestry but Clutton-Brock *et al.* (2004) give a significantly smaller total of 382,700 deer for deer on the open hill.

Grazing pressure

The numbers of hill sheep are estimated to be eight times that of hill deer in Scotland. Grazing pressure of sheep is 4-5 times that of red deer.

Clutton Brock and Albon (1989) found that there is a strong negative relation between the numbers of sheep and deer due to competition.

Ecological carrying capacity

How much further will deer numbers rise?
How many deer can the Highlands support?

A preliminary analysis suggests that the ecological carrying capacity of deer in the Highlands may have increased dramatically, but why?

1. Climate – mild, wet winters have a strong positive effect
2. Vegetation productivity has a weak positive effect
3. In this study sheep numbers were found to have a strong positive effect.

The strong positive effect of sheep numbers on deer numbers is the opposite of that found by Clutton Brock and Albon (1989) and of what might be expected. One explanation could be that sheep grazing removes dead material and so facilitates the growth of grasses that benefit deer.

Sheep numbers on the Scottish hills are expected to fall with the introduction of CAP reforms, but will the carrying capacity for deer decrease as a result?

Summary

To achieve woodland regeneration we need:

- To reduce total grazing pressure (deer and sheep)
- Sensitive use of fencing
- A better understanding of spatial issues and scale dependent habitat selection.

The carrying capacity of deer in the Highlands appears to be increasing. This could possibly be mediated by sheep but we need to do some more detailed analyses and get a better understanding of the mechanisms involved.

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jos.milner@hihm.no

QUESTIONS

Dick Balharry, John Muir Trust: Enclosures had been set up in closed canopy forest at Letterewe in 1966 and were removed completely 25 years later. Had these been considered by the project? What was the sporting objective of the culls?

Jos Milner: Yes but much of the resulting regeneration was lost due possibly to poor maintenance of the fence allowing goats in and/ or perhaps 25 years was not a long enough period for grazing to be excluded. The sporting cull was in the order of 100 stags per year. The deer population was unnecessarily high to support this cull but although we were keen to reduce deer numbers to some extent there were practical difficulties at such a remote location.

Can I also add that in addition to the sporting cull, one of the landowner's other management objectives was to take a minimum intervention approach and he did not feel such a dramatic cull was compatible with such an approach.

Steve Palmer, CEH: There has been an increase in deer range and deer numbers in Scotland in the past 40 years. Had this been taken into account in the study?

Jos Milner: No not yet but it is a very valid point that we are aware of. This will be incorporated when a more detailed analysis is made.

DISCUSSION TOPIC 1

WHAT IS 'DAMAGE TO THE NATURAL HERITAGE' IN THE UPLANDS?

Introduction (with respect to deer)

Mike Daniels, Research and Data Manager, Deer Commission for Scotland (DCS)

Deer

- are key components of the natural heritage
- their exclusion is undesirable
- herbivores eat vegetation, but *what is the damage?*

What do we want?

- Do we want to revert to a historical period?
- What can grow on the uplands now?
- Are our objectives conservation or preservation?

We face an age old problem:

- Vegetation will consist of grass, heather or trees depending on grazing levels
- Different groups have different objectives
- We need clarity of objectives

Damage can be defined as impacts measured against legitimate objectives.

Summary of deer impacts:

- Browsing that impacts woodland regeneration
- Grazing that impacts grassland and heather habitats
- Trampling that may cause erosion to blanket bog

Summary of legitimate objectives:

- Public
  - European Union
  - Scottish Executive
  - Scottish Natural Heritage

- Private
  - Sport
  - Conservation
  - Amenity

DCS assess damage through:

- Authorisation processes to meet owners' objectives
- Priority site processes to meet public objectives through *Natura* 2000 legislation
- Biodiversity duty to meet public objectives through the Nature Conservation Act

The Deer Scotland Act 1996 states that:

5.-(6) "…the Commission may authorise the owner or occupier … or any person nominated … to take or kill … any deer … where … satisfied … necessary to prevent serious damage to … the natural heritage generally;"

Authorisation: Damage assessment

We need to take into consideration:

- Owner's objectives for the ground
- Owner's definition of damage that he/she is trying to prevent
- Will culling prevent the damage?
- Would culling in season prevent the damage?
- How do owners measure prevention of damage?
- If livestock are present how do owners take them into account in damage measurement?

Priority site process: Damage assessment

DCS has a three stage process in order to prioritise its resources:

1. Expression of concern
2. Site for assessment
3. Priority Site.

At each stage DCS must be satisfied that there is evidence and that deer are causing, or are likely to cause, damage.

Prioritised on basis of designations (Natura) or public safety threat.

DCS has to show prevention of damage measured against a baseline. But must also have regard towards the "integrity and extent" of designated features.

Biodiversity duty

The Nature Conservation (Scotland) Act 2004 states:

1(1) "It is the duty of every public body … to further the conservation of biodiversity…"

Scottish Biodiversity Strategy Implementation Plan asks DCS to:

- Review responsibilities to further biodiversity objectives (2006)
- Investigate ways to manage deer consistent with woodland HAP targets (2007)

Diffuse impacts

- Deer impacts outwith designated sites ('wider countryside')
- HAP/SAP/BAP
- Environmental
- Economic
- Social

Progress on diffuse impacts:

- Scoping study (July 2004)
- Research – policy framework (March 2005)
- Research – habitat criteria (Flexible Funding 2005-7)
- Collaborative deer management (new post)
- Incentives and Regulation

Policy Framework

This covers environmental, social and economic objectives:

Nature Conservation Act
Strategic Environmental Assessment
Water Framework Directive
Good Agricultural and Environmental Condition
Executive targets for Natura sites

Summary

What is meant by 'damage to the natural heritage' in the uplands?
We need to assess impacts against legitimate objectives:

- Private (sport/conservation/amenity)
- Public (designated sites/wider countryside)

Discussion topics:

- Legitimacy of objectives
- Defining public good
- Clarity for private owners

Roy Dennis, Consultant: If Frank Fraser Darling [who had carried out some work in the area in 1950s] was to visit Letterewe today he would see there is little change. I think he would be asking why hasn't someone done something about the long-term degradation?

Mike Daniels, DCS: We can only work within the framework of the Deer Scotland Act.

Rene van der Wal: Why not celebrate the native species and habitats for which Scotland is important? Why create a second Scandinavia? We need to find out what people want and why.

Drennan Watson, Landwise Scotland: These are value judgements and peoples' different views depend on their differing starting points. Natura 2000 and the Habitats Directive protect ecosystems. The Water Framework Directive marks a radical change as it requires that freshwater sites are returned to their former favourable conservation status; changes outwith the site are considered. The Directive requires that deterioration must be prevented and the status of aquatic ecosystems enhanced.

Roger Burton, Scottish Natural Heritage: At the present time SNH, DCS and FC work to bring different tools together, working more sensitively and bringing in

incentives. The key to tackling diffuse impacts is getting different disciplines together – economists, social scientists and ecologists to debate a shared view of what sustainable deer management means. When all have signed up to this, then a public objective can be defined and worked towards.

Philip Ashmole, Carrifran Wildwood: I am impressed by the need for a mosaic approach. Jos Milner emphasised the impossibility of reducing deer numbers to allow tree regeneration, but numbers could be reduced locally. This could help a mosaic of vegetation to develop.

Mike Daniels, DCS: In theory this is a good tool that could be tried.

Steve Albon, Macaulay Institute: We must get away from averages and totals. We must decide what we want and where we want it and set local objectives.

Frans Vera It is bad tactics to talk about going back in history. We must have a system that is robust enough for the future.

Keith Kirby, English Nature: It may be useful to take bits from the past when looking to the future. It is likely this can be done in a variety of ways.

Drennan Watson, Landwise Scotland: Deer are treated as Highland problem, but the extension of the deer range is now reaching lowland Scotland. I've seen deer coming into gardens at Alford and causing damage. Has anyone else experienced this?

David Jarman, Scottish Wildland Group: I know a fenced area where deer have been culled and now the sward is so high and dense that it is difficult to walk within it. What is the appropriate grazing level?

David Bullock, NT: A recent study in the Quantocks in lowland England found that there were too few deer to prevent regeneration and their impact on agricultural fields was also very low, usually 2-3% of the productivity of the field. Where sheep and deer numbers are reduced totally trees sometimes regenerate, but sometimes there is regrowth of dense *Nardus* or tussocks of *Molinia* which eliminate grazing animals. We must think carefully before removing all grazing animals from a site.

Bob Evans: The Water Framework Directive will bring changes in many ways. High livestock density causes damage to riverbanks and ecologists looking at soils and riverbanks can work out costs to remedy this.

James Fenton, NTS: The Highlands is one of the few areas in Europe with a native herbivore at near its carrying capacity. I don't consider Letterewe is a degraded landscape. I don't understand the definitions of ecological damage that we are talking about.

Helen Armstrong, Forest Research: Looking at game bags in Victorian times provides evidence of a much richer community living in much richer landscapes in the past. Shorter vegetation is valuable as an example of a degraded habitat but, in

general, people like a mosaic of woodland and open areas with increased productivity and biodiversity.

Jeanette Hall, SNH: I don't understand the concept of natural herbivore populations as their natural predators have disappeared. If a pinewood shows no regeneration for 100 years, what additional evidence do we need to call this long term damage?

Frans Vera: Trees are not going to regenerate without ground disturbance caused by herbivores. The wild boar is particularly good at this but has been eliminated now.

DISCUSSION TOPIC 2

WHAT IS MEANT BY 'MAINTENANCE OF GOOD AGRICULTURAL & ENVIRONMENTAL CONDITION' (GAEC) IN THE UPLANDS?

Introduction
Tony Waterhouse, Scottish Agricultural College (SAC)

We have to move on to talking about the future. Currently there are some uncertain views about an uncertain future.

Summary of CAP reforms in Scotland

- Decoupling
- Farmers get historic payment
- LFASS continues until 2007 followed by its successor
- Lots of complexity for farmers in Single Farm Payments (SFP) in year 1
- Land Management Contracts – start of a new era for Modulation money and Pillar 2
- Evolving process that is effective now
- GAEC is major new cross compliance

Maintenance of GAEC

Are good agricultural and environmental conditions compatible?
We need to create a new set of words and culture that allow farmers and civil servants to:

- farm
- manage land
- keep public subsidy going

How is cross compliance through GAEC to be defined? Farmers say they already have 18 sets of regulations that they must follow.

How can we give farmers the freedom to farm while still meeting the EC's rules on soil erosion, soil structure, woodland and scrub expansion, where appropriate, etc.?

To get the SFP, farmers need an eligible hectare. Eligible hectares include arable land and all forage area. They exclude land under permanent crops including forestry, horticultural crops or land used for non-agricultural activities. Farmers are free to use their land for any agricultural activity or other appropriate management that maintains the land in GAEC. All land subject to GAEC measures must 'be available' for agricultural use.

There will be 'farmed land' outside GAEC and probably formerly unfarmed land (deer forest) that will be used to claim SFP and thus be covered by GAEC.

England is defining rules for grazing of upland ecosystems very differently to Scotland.

Minimum level of maintenance

To avoid deterioration of habitats farmers need to:

- avoid undergrazing
- avoid overgrazing
- protect permanent pasture
- prevent encroachment of unwanted vegetation
- protect landscape features

There are three sets of pressures:

1. Attempts to maintain GAEC within a very wide set of goal posts.
2. Many constraining factors such as LFASS (and its successor from 2007) and Agri-environment Schemes/Natural Care that actively constrain what farmers will be able to do at least in the short term.
3. Dramatic changes in the economics of upland land use that will follow as a result of full decoupling (SFP and LFASS):

- Hill cattle will disappear
- Hill sheep are no longer viable

We must also remember that farmers have been farming uneconomically for years. They are traditionally slow to change, but can change rapidly when they decide to.

Here are four key questions for discussion:

Q1. Is Good Agricultural Condition compatible with Good Environmental Condition?

Q2. What might be the impact of adopting the rules and culture of GAEC in practice, bearing in mind the slow, but difficult-to-monitor characteristics of upland grazed systems?

Q3. If habitats/ecosystems change (for good or bad, agriculturally or environmentally), does it really matter? At what point can ecosystems not recover – (or fall outside a particular equilibrium range)?

Q4. Who decides on what is good or bad? What is wanted and what is not? What is a good case to enable (through relaxed rules or encouragement) woodland or scrub to regenerate, heather to become (overly) mature, or short grassland dominate? Is it already too late to influence the huge shift in policy that is very likely to lead to the biggest changes in management for decades?

Keith Kirby, English Nature: I'm intrigued to know when is spreading scrub considered a problem? Do farmers have to show they have the capacity to clear scrub? It can be cleared very quickly.

Ian Condliffe, DEFRA: In England scrub has to be cleared within five years if it's considered a problem. Research is being carried out on behalf of DEFRA to define undergrazing.

Tony Waterhouse, SAC: It may or may not make sense economically for farmers to clear scrub depending on their SFPs.

Ian Condliffe DEFRA: DEFRA is waiting to see the response of other EU countries and also looking at the possibility of bringing new land into agricultural production, although this is unlikely to be possible in Scotland.

Richard Luxmoore, NTS: If farmers use deer to reduce scrub regeneration, will they still qualify for payments in the future?

Tony Waterhouse, SAC: They would qualify under the present SFP scheme, but the future is uncertain.

Kate Holl, SNH: Might one of the advantages of the new scheme be the spread of scrub and woodland?

Tony Waterhouse, SAC: The presumption of EU policy is to prevent the spread of woodland although it has been agreed that there is an exception in the case of Scotland.

Roy Dennis, Consultant: Tony Waterhouse's comment about the predicted disappearance of hill cattle is serious as these are good for the environment. In general, there is a need for one cow per 10ha to maintain good woodland condition. What can be done about this?

Tony Waterhouse, SAC: It would be necessary to have Agri-Environment Payments directly targeted at hill cattle.

Ian Condliffe DEFRA: DEFRA has already proposed payments for cattle to the EU, but the EU would not allow this as it would be treated as a production subsidy.

Roy Dennis, Consultant: Red deer do not have the same ecological function as cattle and so cannot replace them.

Frans Vera, (Netherlands National Forest Service): My disappointment is that agriculture seems to be making the rules and these are not ecologically founded, although they pretend to be so. Grazing is needed to maintain biodiversity.

Meg Pollock, SAC: It is not realistic to say that every woodland needs one cow per ten hectares (quoted by Roy Dennis) as woodlands differ. We need to get away from average figures.

Philip Ashmole, Carrifran Wildwood: SEERAD has just announced increasing the maximum area per farm that can be converted to woodland from 40ha to 80ha under the Farmland Premium Scheme. This guarantees annual payments of £2,500 for 15 years.

Hugh Chalmers, Borders Forest Trust: BFT has been working with farmers in the region to regenerate 80ha of woodland per farm. As an ex-sheep-farmer, I am disappointed to learn that sheep do not have a place in good upland management, especially bearing in mind that they arrived in Neolithic times.

James Fenton, NTS: Sheep are a partial analogue for deer. NTS has been investigating grazing pressure in West Affric. In some places the vegetation is undergrazed while in others it is overgrazed. Would this qualify as GAEC?

Tony Waterhouse, SAC: This is very difficult to confirm on the ground and it is one of the issues to be dealt with. SEERAD cannot be expected to look at the full extent of all farms to assess the degree of grazing.

Chris Chesteron, DEFRA: In England there is a system whereby farmers can respond to complaints by inspectors. Our aim is to have a national standard.

Rene van der Wal: What are the objectives of the GAEC? Do these include biodiversity and, if so, is there any monitoring to detect changes in biodiversity?

Tony Waterhouse, SAC: There is no monitoring that I'm aware of and no funding to pay for such monitoring schemes.

Ian Condliffe, DEFRA: There is no biodiversity monitoring in England either. There is a general trend to lose cattle.

Sandy Coppins, British Lichen Society: I am concerned about the impacts of future land abandonment on some lichen species, especially those for which Scotland has international responsibility, such as those lichen communities that thrive in grazed pasture woodlands – they would be threatened by total cessation of grazing by domestic flocks. Deer do not have the same impact on the habitat.

Tony Waterhouse, SAC: Land abandonment is already happening. Some people think the impacts are good.

David Bullock, The National Trust: Frans Vera showed it is possible to decouple farming from nature management, e.g. at Oostvardersplassen. We have not discussed 'fallen stock'. Animals should normally be allowed to stay where they have fallen in order to complete the nutrient cycle. This is important for ecosystems and allows nutrient input into the soil.

Roy Dennis, Consultant: Conservation bodies often pay for biodiversity monitoring. We need a Department of Natural Resources in Scotland.

Dick Balharry, John Muir Trust: Does anyone have answers to Q4 posed by the discussion leader? Is it already too late to influence the huge shift in policy that is very likely to lead to the biggest changes in management for decades?

Tony Waterhouse, SAC: I think the general public should decide. There is already much more public consultation on a range of issues.

Ian Davidson, SEERAD: We consult widely on policy changes and now involve a much wider group of interests than previously, including the RSPB and Scottish Environment LINK. The LFA designation will be reviewed and, from 2007, land classification will be based purely on scientific and not on socio-economic data. The designation will then be based on natural handicaps.

Tim Brown, Scottish Wildlife Trust: There are differences throughout Scotland in the amount of income a farmer makes. There is a farm gate crisis that I am not sure can be solved by price increases. Bearing this in mind, is it already too late to make changes and so influence policy?

Tony Aykroyd, Wild Scotland: It is not too late as there are still far more CAP changes on the way and lots more to play for.

Peter Quelch, Forestry Commission: The Forestry Commission has been participating in the West Highland Grazing Project and we're just beginning to understand the value of wood pastures and the value of grazing woodlands. Now we are worried that there may not be enough domestic animals left to graze the woodlands in the future.

Tony Waterhouse, SAC: It's not too late and there is still potential for change. Farmers are sitting on their hands waiting to be told what to do; they can still make changes.

Drennan Watson, Landwise Scotland: Many people do not realise there are other large scale influences on agriculture in Europe, for instance we are still feeling the effects of the Marshall Plan in relation to animal feed imports.

SUMMING UP

Professor Jeff Maxwell

This seminar has highlighted that we need to understand the drivers of landscape change if we wish to determine specific outcomes. In addition to soil and the environment, we cannot afford to forget the impacts of climate change. Having an historical context provides us with clues as to what we might expect to happen in the future.

The presence or absence of large herbivores will continue to be a major influence on the way in which landscape change takes place. A range of factors, largely determined by the objectives of land managers and landowners, will determine the presence and density of deer, cattle or sheep in Scotland. These factors include the extent to which predator-prey relationships are allowed or encouraged to play their natural part: predators can be re-introduced or their effect can be mimicked. We have no absolute prescriptive policy regarding the landscape, but SNH has provided a basis for preferred scenarios for different parts of Scotland within the context of Scotland's Biodiversity Strategy, its rural socio-economic policies and initiatives for tourism, agriculture and forestry.

We have the knowledge to bring about some of the significant changes we want. However, more subtle changes may be more difficult and the experience of those managing and working on the land should not be under-valued. The extent of change in the landscape will depend on the objectives that land managers set for themselves but we must remember that the land in Scotland is managed by land managers who have fixed boundaries to their land. However, wild populations of red deer and other species can move and range over wide areas. To bring about change over extensive areas requires the cooperation of many people; it requires a recognition that some common objectives across the boundaries of different parcels of land have to be agreed and implemented. There is a crucial social dimension to bringing about change. Not only has there to be a political will but also the means of facilitating good management practices and where necessary providing incentives to do so.

We have missed out on the social dimension in this seminar. We need to consider how different interests can be accommodated in the overall context of habitat management, the prevention of damage, however defined, and enhancing the biodiversity of our landscapes where this can be justified. In relation to red deer, Deer Management Groups have the potential to provide a means of developing sensible outcomes. The task can be difficult, particularly if the objectives of adjoining landowners are very different – but this is the real challenge. The challenge has to do with people as much as it has to do with the protocols of management. Unless we are able to change 'mind-sets' and influence rural land-owning and land management culture, little of worth will be achieved either in terms of enhancing our biodiversity or conserving our natural heritage.

The seminar tackled the important question of how the Common Agricultural Policy will influence the uplands. We recognise too that we have to deal with the European Union's policies and directives. Regrettably too often the Commission, in attempting to apply European wide common policies fails to take account of regional variations and therefore does not always understand some of the issues in Scotland that bear

upon land management, for instance the importance of cattle in our environment. Again we need a fundamental change of approach in formulating and implementing policies that impact on land management. Our silo mentality in which we regard agriculture, forestry, and the environment as separate components of land use is damaging to the way we should be thinking about the sustainability of our natural and cultural heritage of which habitat and landscape are crucial to our very existence. The interdependence of each of these components is obvious. CAP reforms have given us about ten years to begin to put things right – so where will we be in 2015?