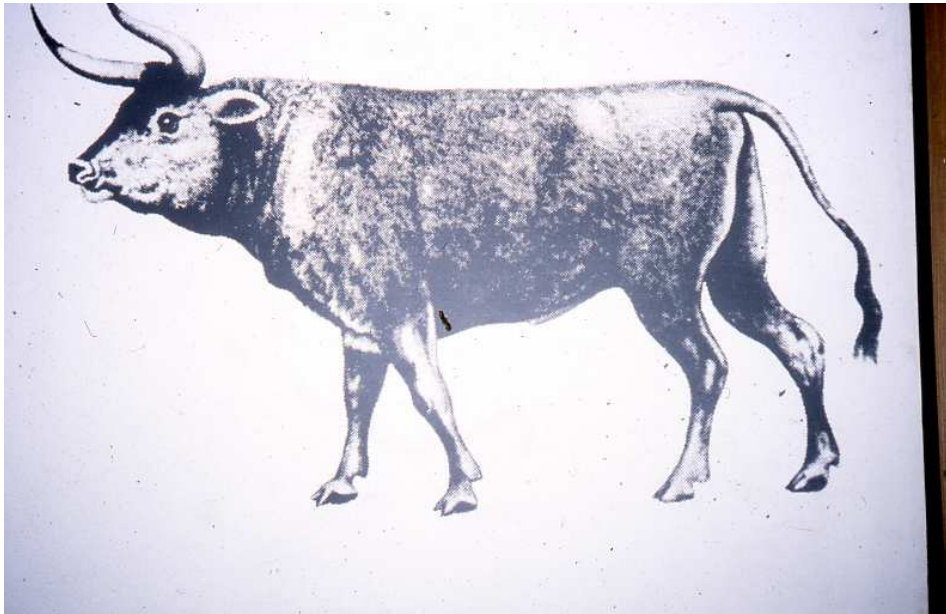


# **The importance of traditional cattle for woodland biodiversity in the Scottish Highlands**



**a personal view**

**Roy Dennis**

**1998**

“Mightiest of all of the beasts of chase  
That roam in woody Caledon,  
Crashing the forest in his race,  
The mountain bull comes thundering on”

Ballad of Cadzow Castle  
Sir Walter Scott 1802

Cattle are great makers of organic matter, plain muck, which raises the carrying power of both land and water for invertebrates.

Frank Fraser Darling in ‘Natural History in the Highlands and Islands’ 1947

“To me it is all so simple - there must be re-cycling of nutrients and the cow is the best available means of doing it. If you have cattle not only is there re-cycling through their dung but there is also the treading of paths, the standing in the burns, the correcting sweep of the cow’s tongue as she collects rough as well as fine grasses and herbs into her mouth”.

Letter from Reay Clarke, Edderton 26th January 1998

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## Introduction

An everyday association with traditional cattle farmed in a low-intensive way on natural grazing lands of mountain, moor and forest has given me a deep insight into their place in nature. This very land was once home to the wild ox or aurochs and about 5000 years ago the Bronze age people, whose circles show so clearly on this township's common grazings, brought Celtic shorthorns from the Mediterranean. To me, cattle are an integral part of the natural environment and its native fauna. To lose them is to lose a major player in the ecology of the Scottish hills and forests.

From watching hill cattle in Abernethy Forest, I have seen that their grazing keeps glades and flushes open, maintains flower meadows and trims the willow scrub. Their dung is a valuable habitat for insects and a food supply for birds; it enriches the soil and their heavy feet push tree seeds into the soil and produce a network of tracks of value to other woodland creatures, such as family groups of young black grouse and capercaillies. Their activities lead to a patchiness in forest floor cover and a richness of ecotones. The alternative without grazing is widespread leggy vegetation, which can be poor quality habitat for many forest dwelling flora and fauna.

To me nature conservation is more than the protection of species or habitats. It is to do with life on earth. It is the optimum use of the sun's energy to create plant biomass, which in turn is eaten and digested by herbivores, and thus by carnivores and secondary carnivores. Simply, it is called the food chain, although in reality, it is an incredibly complex array of life and death support systems, with which we are inextricably linked.

Of course, modern humans require the land for many uses but the conservation of biodiversity requires each country to maintain and enhance the best areas of its natural lands for the benefit of the earth. At this moment in time, we badly need to have more of Scotland in prime ecological condition. My premise is that it is impossible to restore our natural forest and moorland ecosystems without cattle, one of the most beneficially influential herbivores. Alongside beavers, moose and wild boar, they were key species in the primeval Scottish forests.

The recent loss of confidence in beef farming is of great concern to the rural population. But it is also imperative to understand that the continuing decline of cattle in upland Scotland is of serious detriment to biodiversity. We need more cattle, not less, so that they can fulfil their natural role in the Highland environment, less intensively reared, returned in summer to the natural pastures in the forests and hills, where they can contribute to ecological gains as well as produce the highest quality beef.

In this report, I have tried to simplify the discussion so that cattle breeders can appreciate wildlife ecology and a wildlife person can understand a cow's rumen as well as its husbandry. I have not attempted to write a scientific paper, for I believe that successful nature conservation is a skilful blend of experience, observation, knowledge and perception, rather than solely a science. It requires a strong working partnership between experienced country people, administrators, conservationists and scientists to make the principles of large ecosystem management work well on the ground.

Roy Dennis MBE  
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**1st February 1998**

## Summary

1. Traditional cattle are very important for the enhancement of biodiversity in semi-natural woodlands and regenerating hills in the Scottish Highlands.
2. The recent decade has seen a marked improvement in the status of native woods in Scotland; the future of the native Caledonian Forest looks more secure now than for centuries.
3. Traditional cattle rearing in the Highlands has declined this century and the trend is continuing. It could get even worse as farmers and crofters decide that keeping cattle is no longer economic and it involves too much bureaucracy. It is crucial to reverse this decline for ecological as well as social reasons.
4. The wild ox or aurochs was a native species in the post glacial forests of Scotland. The aurochs was the ancestor of domestic cattle, although domestication took place principally in the Middle East and these cattle first reached Scotland about 5000 years ago.
5. The aurochs, along with other, now extinct, mammals such as moose, beaver and wild boar, as well as fire, had profound influences on the structural and ecological diversity of the original Scottish forests.
6. Low intensity rearing of traditional cattle on large home ranges, including woodlands and hill pastures, replicates in many ways the activities of the extinct wild aurochs.
7. Examples of damage caused by cattle to small woods and moorland in recent decades are usually due to too many cattle being kept in too small an area, usually as a result of the farm or croft losing its access to extensive rough grazings and woods, or to the practice of winter feeding at the edge of the in-bye.
8. The ecological effects of cattle are extremely important for the functioning of the whole ecosystem.
9. The grazing of a large herbivore, like a cow, is important for recycling plant material, for increasing plant biomass and for diversifying plant communities.
10. The movements of cattle cause structural changes in plant communities, including tree growth, as well as creating pathways, open areas and disturbed water margins of benefit to a range of smaller wildlife.
11. Cattle dung is of supreme importance. It is not only a rich source of nutrients but is colonised by an incredible numbers of invertebrates, which are important food for many birds and mammals. One cow not only produces about 4 tons of dung per year but also an annual insect population weighing about a quarter of her own body weight.
12. Many birds and mammals benefit from low intensity cattle rearing in forests and moors, of particular importance in Scotland are capercaillie and black grouse.

13. Cattle rearing to produce beef originated in the British Isles and trade from the Highlands was important to the economy. In previous centuries, very large numbers of small black cattle were reared in the Highlands. They were summered in the hills and produced milk, butter and cheese, while their activities enriched the hill pastures.
14. The subsequent change to large numbers of sheep, and then to red deer, has removed much of that fertility and in much of the uplands has caused a degraded landscape.
15. A resurgence in the use of traditional cattle in woodlands and open range would be beneficial to biodiversity and soil fertility, as well as producing the highest quality stock and beef.
16. Cattle rearing for environmental benefits, has animal production, health and welfare advantages for the farmer and crofter.
17. There is a clear need to achieve a consensus that cattle and forest conservation are mutually beneficial and then to agree that something must be done about it.
18. Research into the beneficial effects of traditional cattle on the woodland environment is required and experimental work and demonstration sites are urgently needed.
19. The government requires to review the incentives for traditional cattle rearing and the level and tiers of special extensification payments. As cattle are native to Europe, environmental payments can be justified, unlike parts of the world where cattle are an exotic species in the ecosystem.

## Current issues

In this paper I have tried to bring together a range of issues involving cattle rearing and nature conservation. I believe there is the opportunity for an ever strengthening partnership between farmers and crofters and the environmental bodies to restore and enhance our natural environment. I also believe that we must urgently begin to reverse the decline of traditional cattle.

This past decade has seen a major reversal in the fortunes of the native Caledonian Forest. The RSPB, private land-owners and the Forestry Commission are restoring native forests. About 20,000 hectares of native woodlands have been planted or regenerated since 1991 in northern Scotland alone and the vision for big native forests is accepted. My argument is that traditional cattle will be required for the ecology of all these forests; that is a lot of cows!

My views have been talked over with colleagues and friends over the years, and the process of seeking change has involved colleagues from nature conservation and forestry organisations walking amongst our cattle on the hill as we discussed large ecosystem management. Last November, I had a rewarding day discussing these ideas with staff of the RSPB at Forest Lodge in Abernethy Forest. More recently, I took part in an inaugural conference in Poland on the conservation and importance of large herbivores organised by WWF.

At the same time, I had discussions with the Forest Authority and Highland Birchwoods about research proposals to test new methods of cattle grazing in nature conservation woods aimed at identifying the true range of ecological benefits and how this could help to maintain traditional cattle herds in the upland forests to the benefit of local people. This spring, McLURI is holding a seminar to discuss the options for stock management in natural areas.

Part of the problem for many conservationists is that few research findings have been published on the beneficial effects of low-intensive traditional cattle rearing on regenerating forests. It is not surprising really because there are very few places where cattle graze in large woodlands in real harmony with natural ecological processes. Sometimes the cattle may be kept in low density, but the same ground is over-grazed by sheep or red deer.

From an ecological standpoint over-grazing is common and thus it is difficult to put cattle grazing in context. Over-grazing by red deer and sheep is highlighted as a problem for regenerating native pinewoods in the RSPB report 'Time for Pine' but there is no mention of the beneficial effects of low intensity grazing by traditional cattle as a replicate of the original fauna.

The original forest in Scotland was subject to wild fires caused by lightning as well as the profound influence of wild boar, elk and beaver.<sup>7</sup> There is increasing interest in understanding the effects of mega-herbivores on forest ecosystems in Europe and a growing scepticism that the primeval forests were dark woodlands of densely growing trees. Instead, it is believed that fire and the large herbivores created mosaics on both large and small scales, and that in some places there were open 'savannah-like' wooded grasslands. Although I believe the reintroduction of the 'missing' mammals should take place, this study concentrates on the cattle. At least we can address this immediately.

There is much to learn (or re-learn) about the use of native cattle in forests. What are the special attributes of the different breeds? How to restore home range activity and maximise their beneficial effects?. Without cattle, our forest ecosystems will not be as successful for biodiversity conservation. We need to test different methods of cattle grazing in semi-natural woods in order to identify the true range of benefits. Human management of nature reserves does not replicate the actions of large herbivores. We need to quantify their ecological value and to suggest support systems which could help farmers and crofters to maintain and increase traditional cattle herds in the upland forests and hills. There is an increasing interest in naturally reared meat and this should give the consumer maximum confidence.

## History of cattle in Scotland

Wild cattle, of the genus *Bos*, evolved about 7 million years ago in Asia, from the tribe Bovini, which includes buffalo and bison. The aurochs, wild ox or urus, *Bos primigenius*, travelled north-westwards to colonise Europe and North Africa and remains found in Germany date back 250,000 years.

The aurochs colonised Scotland between the Ice Ages, crossing from Denmark or the Low Countries, when the British Isles was joined to mainland Europe. After the last Ice Age, the wild ox returned north to Scotland. Britain became an island again when the sea level rose some 5-6000 years ago, by which time the aurochs was a resident species. It was widespread in forests, marshes and grasslands and its remains have been found northwards to Caithness.

The aurochs was a large animal, standing 6 feet or more at the shoulder. It was dark reddish-brown in colour with a pale line along the back, short coat in summer, shaggier in winter. The long black-tipped white horns had cores a third larger than domestic cattle, they curved outwards and then forwards. The cows were 25% smaller and probably paler red than the bulls.

They lived in herds, with matriarch cows, the young bulls forming bachelor groups. Four other closely related species still live in Asia - the gaur, banteng, yak and kouprey. Wild banteng in Java live in light forest and glades, moving into wooded hills in the monsoon. Herd size is usually 10 to 20 animals, mainly related females and young, and a home range is about two square kilometres. Bulls are solitary or exist in small bachelor groups except at rutting time. Gaurs are the largest wild ox, weighing up to 900 kilograms and standing over six feet at the shoulder; they live in hilly forests in India and south-east Asia.

The first domesticated cattle are recorded from Turkey and Greece 8500 years ago. The Babylonians had cattle two thousand years before the ancient Egyptians. The Neolithic Bronze Age people brought domesticated Celtic shorthorns or long-fronted ox (*Bos longifrons*) with them across Europe, when they colonised Scotland about 5000 year ago. It is thought that these cattle resulted from the domestication of smaller sized wild aurochs living around the Mediterranean Sea or in the Middle East. Although domestication of wild mammals often leads to loss of bulk.

These were small, hardy cattle with a long red-brown coat and a rather long deer-like face with short horns. They were fast and agile, like deer in some ways; capable of avoiding predators, such as wolves and bears. They were probably half wild rather than tame, and the



evidence from bone remains at bronze age camps are predominately young beasts, suggesting that they were hunted.

When the new settlers reached Scotland with their domesticated cattle, the original and much larger wild aurochs was still common. It is unknown if they domesticated any of them, but it would be surprising if there was not at least some mixed breeding. These primitive people were capable of hunting and killing this great ox, which must have been a test of daring and courage. Remains in Sutherland and Caithness even suggest that the last may have survived until the ninth or tenth century. In mainland Europe, the remaining survivors were in the Polish forests, where the last female died at thirty years of age in the Jaktorow Forest in 1627.

When the Romans reached Scotland, the only domesticated cattle were the Celtic shorthorn. The Romans brought their own oxen for transport and possibly ornamental white cattle as well. The ancestors of the larger breeds such as Aberdeen-Angus and Shorthorn may have partly derived from them, or, more likely, from later imports of the domesticated ancestors of the larger wild ox of central Europe. They probably reached Britain with subsequent colonists such as the Anglo-Saxons or the Danes.

Thereafter, wild white cattle, possibly a remnant of Roman times, lived wild in the forests of eastern and southern Scotland and were hunted for sport. They were regarded as ferocious, very swift and great sport to hunt. By the 16th century, the dwindling numbers of these wild white cattle were protected by the aristocracy and enclosed in parks. In Scotland the Cadzow herd of white park cattle was renowned and in the north of England, the Chillingham herd was the most famous.

The white cattle of Chillingham have been at Chillingham Park in Northumberland for 700 years and have retained a pure breed and a wild nature. They are all white with a black muzzle and red-brown ears, while the commoner white park cattle have black ears. The shape of the skull and the direction of horn growth in Chillingham cattle suggests a closer link to aurochs than other old breeds and the blood grouping is apparently unique in western European cattle.

The population size at Chillingham has varied from 28 in 1692 to a peak of 80 in 1838, recently numbers have varied between 40 and 50 with a peak of 59 in 1982. In the past they ranged for winter fodder over a large area but are now confined to about 300 acres and require supplementary feeding.

The original domesticated Celtic shorthorn introduced some 5000 years ago became the Kyloe of the Highlands. They were small, hardy cattle, which were principally black, and were the breed stock of the world famous Highland cattle. Bulk was increased through breeding with Shorthorn cattle and in Victorian times, a fashion emerged for red Highlanders, which became the dominant colour over the last century. The fashion is turning back again to black and usually these individuals tend to be smaller. The Galloway and Welsh Black cattle are also derived from the Celtic shorthorn.

In the 1920s, Lutz and Heinz Heck carried out an experimental project to breed back to an aurochs-like cow. In Berlin, they used English Park cattle, Corsican cattle, Camargue and Spanish fighting bulls, while in Munich they bred with Highland cattle, Corsican cattle, Hungarian steppe cattle and Alpine and Frisia cattle. They produced a distinctive looking cattle, which is aurochs-like but smaller than the original. In Continental Europe there is

increasing interest in Heck cattle; there is an association and a herd book. They are used for grazing in nature reserves and for producing special meat. In the Netherlands and in Germany, free living herds of Heck cattle are being used to recreate herbivore-influenced woodland ecosystems as ecological reference sites. In France, meat from Heck cattle is sold as 'viand royale' or the 'meat of kings'.

## The Ecological Effects of Cattle

Long ago, the wild ox or aurochs was one of the largest herbivores in the ancient Caledonian Forest and through its grazing and its behaviour it had great influence on forest ecosystems. They could cause major structural change in woodlands and their presence was one of the major components of a fully functioning ecosystem. Large herbivores, like the wild ox, were capable of surviving on large amounts of poor quality herbage as well as dead vegetation in winter. Their activity often allowed smaller herbivores to take advantage of young plants or new growth. Once they became extinct, the introduced Celtic shorthorn, the traditional kyloe of our ancestors and the escaped wild white cattle, replicated to some degree the role of the wild ox in the ecosystem.

Few cattle now graze in native woodlands in harmony with biodiversity interests. In recent decades, there have been many examples of cattle damaging small woods and moorlands. This is nearly always due to have too many cattle in too small an area, and is usually the result of the crofter or farmer no longer having access to extensive rough grazings. In general, conservationists run scared of grazing animals. Perhaps they can be forgiven as the disastrous results of over-grazing by domestic animals are widespread in Scotland and in many other parts of the world. But in my view, with a different vision, traditional cattle rearing can provide important ecological gains in woodlands through their grazing and behavioural activities.

Hardy cattle, such as Highlanders and Galloways, have been used for maintaining grassland, heaths and marshland on nature reserves in various countries, where their valuable effect on the ecosystem is recognised, especially for maintaining floristic diversity, butterfly conservation and enhancing breeding conditions for wading birds. But there is little experience or published knowledge on the beneficial effects of low density native cattle on forest ecosystems in Britain.

Over the years I have watched our cattle in the old forests and on the hill, and have noted the many relationships between them and their activities and the flora and fauna of Abernethy Forest. In this section I have tried to bring together as many different aspects as possible using my own field experience as well as discussions with colleagues and searches of published material. Many of the relationships need further study and understanding.

**Grazing.** The most important action of cattle within the ecosystem is that they eat plant material and they are big. Most plants, particularly grasses, have evolved the capacity to re-grow after being eaten. Under optimum conditions, this greatly increases the production of plant biomass using the sun's energy through photosynthesis. Grazing has the potential to increase dramatically the production of biomass and in this way, herbivores can enhance the food chains. It is a direct link from the sun's energy to plants to herbivores to carnivores and

to secondary carnivores. Exclusion of grazing reduces biomass production and diminishes the vitality of the ecosystem.

Cattle and grazing in agriculture has been the subject of much experiment and study. Whole research centres have been dedicated to it and huge volumes written. It is an important subject. In this review, only the underlying principles are required to demonstrate the importance of traditional cattle in woodland ecosystems and areas of importance for nature conservation.

Andre Voison <sup>15</sup> said “Grazing is the meeting of cow and grass”. It is important to recognise the needs of the plant as well as the animal. A herbage plant is a plant which is capable, several times in the course of a year, of accumulating in its roots and at the foot of its stalks, sufficient reserves to allow it to grow again after it is eaten or cut.

In the case of grasses, once an individual plant has been grazed to ground level and then freed of grazing pressure, it experiences an early period of slow growth, a central period of rapid growth and a final period of slow growth. If suitable rest periods from grazing are managed on a 20 to 30 day rotation, depending on the season, the annual production of grass biomass on meadows can be increased ten fold.

This is, of course, under optimum farming conditions, but, equally, within natural ecosystems an optimum level and frequency of grazing can greatly increase the amount of biomass entering the system. Other plants follow similar processes but the productivity will vary. Increasing biomass production increases the productivity of the whole ecosystem. The principle of compensatory growth after grazing is now recognised as well as the relationship between some herbivores and their favoured plant food. There is an advantage to the herbivore, whether it is a cow or a capercaillie, to return on a regular basis to graze the regrowth which is larger and more nutritious than normal shoots.

Cattle have a broad mouth, eight lower incisor teeth, but no upper incisors, and they feed by drawing in vegetation with their mobile tongue, either tearing it up or biting it with their lower teeth against the hard pad of their upper palate. As they pull up vegetation they aerate the roots. Because of their heavy lips they can only graze to half an inch of the ground. Sheep and deer have smaller, narrower mouths and mobile lips allowing them to graze closer and more selectively. European bison have harder upper palates than cattle and frequently eat woody plants and the bark from trees like willow, aspens and ash. Horses have upper and lower incisors so they can crop vegetation very close to the ground as well as eat twigs, bark and leaves from shrubs and trees.

Cows are ruminants. They have four-chambered stomachs, including a big first chamber called the rumen. Large quantities of vegetation enter the rumen where rumination starts and is followed by cudging, the cow re-gurgitating the partially digested material to chew it further before it re-enters the rumen. In the rumen two microbial actions are taking place concurrently. One is the synthesis of plant material to supply proteins and the second is the breakdown of plant material, including proteins, into more simple nitrogenous substances and finally into ammonia. The cow can break down the cellulose in the plant.

In the old days, cattle breeders in the hills talked of ‘guttie cows’, those with large guts or big bellies in relation to their size. They were capable of eating large quantities of poor quality

forage and surviving. They also laid on extra stores of fat to help survive winter hardship. This distinctive ability to survive hard times has been bred out in modern cattle.

Cattle graze for about 8 to 10 hours a day, in 6 to 8 periods, interspersed with periods of ruminating. The members of the herd graze, ruminate and rest simultaneously. In long patches of grazing they graze as a herd from one end to the other, while in larger areas they tend to travel in circles. In hot weather, especially when the air is heavy, they graze close together but when it is cool they scatter more. Cattle do not graze beside cow pats, thus creating a patchwork of longer vegetation, but they will eat grass growing in fresh patches of urine.

**Structural diversity caused by movement and trampling.** Cattle on open range have quite large home ranges where they live as herds. It is likely that the preferred herd size is between 10 and 30 full-grown beasts with a home range of 400-800 hectares. A 30 cow herd, with followers, in Abernethy Forest in the 1970-80s ranged in summer within an area 2 by 4 kilometres. On our hill farm, one bull, 20-25 cows and their calves range within 400 hectares from April to December.

They visit the preferred feeding sites on a regular basis. Some sites may be grazed daily for several weeks at a time, while small flushes and glades may be visited for a few hours or a day once every two or three weeks. This patchiness of use creates a high diversity of ecotones.

To get from one feeding area to another, or to water or sleeping sites, cattle travel in single file and create distinctive tracks. Woods and rough grazing used by cattle have a network of paths. They are usually about 30 cms wide, about twice the width of forest deer tracks; usually meandering to avoid obstacles, sometimes leading through tall vegetation and often disappear once the animals reach preferred feeding areas when they disperse to graze. Tracks can be created even in rank vegetation within two months of sporadic use. Heather is killed by trampling, as well as urine and dung enrichment.

Cattle tracks are important pathways for a whole range of woodland and moorland birds and mammals. They are probably of most importance during the breeding season for the movements of broods of young birds. Greyhens use these tracks to take their broods from flush to flush to search for insect food. Long vegetation overhangs deer and sheep tracks, but the wider cattle tracks are more open in character and less likely to 'wet' smaller creatures using them after rain.

Where cattle cross wetter areas or visit lochs and river edges they churn up mud which provides important habitats for a variety of fauna. In some regular sites throughout their home range, cattle paw the ground as well as tear up bushes and old stumps, or even ant hills, with their heads. This exposes mineral soils, grit and insects to the benefit of other woodland species.

Their heavy feet push fallen tree seeds from the surface vegetation down into the soil, for example pine seeds on moss, thus aiding regeneration. Feeding in wetter areas can break up the rank surface layers. Poaching by foot action provides pioneer niche environments for plants and invertebrates. In the olden days, cattle grazing was increased in mature pinewoods reaching the end of the production cycle. Plant height was reduced through grazing, while trampling and dunging produced ideal conditions for the seeds from the remaining large

pinus to take root. The cattle were not removed as soon as the first young trees appeared, but were kept on until dense regeneration was achieved; then grazing was ceased. This was effective method of forestry.

Creation of short sward glades is beneficial to invertebrates which require sunny open ecotones in forest, for example the narrow-headed wood ant. Cattle can also reduce fire risk by removing combustible materials, such as dead grass, and by creating a patchwork of forest floor swards. It is likely that in the primeval forests, the mega-herbivores created open woodland in some areas which would have helped to prevent very extensive and hot fires. Cattle can also reduce dense bracken cover through trampling.

Cattle disturb insects and amphibians as they walk through vegetation; birds like swallows and pied wagtails often feed near grazing cattle. Cattle egrets have the same association abroad, and bats probably feed near cattle for the same reason at night. During snow cover, the movement and grazing of cattle exposes feeding sites for small birds.

Cattle often rest on river banks because they are drier, they then drink at watering sites and sometimes stand in the water. In winter, their large size breaks the ice and allows smaller creatures to drink. Their dunging and churning increases feeding opportunities for aquatic invertebrates to the benefit of fish, such as trout. In periods of drought, cattle will often reach out into vegetated lochs to graze sedges including their roots, which helps prevent the loss of open-water to excessive plant material. Sometimes this behaviour creates sedgy islands surrounded by open water, which provides safer nesting conditions for water birds.

It concerns me to see so many small lochs, within the more productive catchments of the Highlands, growing over with sedges and sphagnum. Some say this is natural plant succession but many lochans have survived as open water since the end of the Ice Age and it is only in recent decades, following the removal of cattle, that vegetation growth has clogged them up. Previously there was a history of grazing and trampling from the ancient forest fauna through to this century's domestic cattle.

Cattle grazed a lochan in my locality in this way three summer's ago and the following spring the wetter disturbed areas were actively used by teal, mallard, common sandpipers and lapwings, as well as by two rare waders, wood and green sandpipers. To this day, the lochan has maintained this open water edge. The prevention of loss of woodland lochans in this way is important. Muddy pools and ditches enriched by dunging and poaching are important for a range of specialised plants and invertebrates; in the New Forest such ephemeral eutrophic pools are the habitat of the rare fairy and tadpole shrimps.<sup>14</sup>

At night, cattle often use favoured 'sleeping places'. In winter and in high winds and rain, they know very sheltered places in thick forest, in summer they choose wooded knolls and on humid nights, with many flies and midges, they favour exposed ridges and hill tops. These places become heavily dunged and disturbed and the vegetation structure and plant community is changed. In hot weather the herd will stand and lie close together, sometimes for several days in a row and the area becomes heavily covered by urine and dung.

Effects on plant species and communities. I have noticed on the open range that our cattle help to keep down leggy vegetation and increase species diversity. The cattle will graze heather, sedges and rushes, ( Carex and Juncus), in winter, both during the day or night between feeds of hay. In summer, they prefer grassy areas and green flushes. Green flushes

and glades within the rough grazings, which had become over-grown with rank vegetation and rushes through lack of grazing, have been opened up and restored by cattle grazing. A variety of distinctive plants, such as fragrant and marsh orchids are not grazed. Nettles are eagerly grazed in autumn following the first frosts, while some individual cows are very fond of boletus fungi.

No systematic study has been carried out on our grazings of the selection of plant species by cattle. It is important to increase our knowledge in this field. A Swedish experiment in 1747 into the tastes of domestic animals to 583 different plants, showed that goats ate 86% of them, sheep 72% and cows only 64%. In recent studies, 374 species of plants have been recorded as food for wild European bison.<sup>3</sup>

In winter, they graze in wetter areas, where they consume rank vegetation, such as molinia and coarse grasses. As spring approaches they feed in even wetter places, pulling up mouthfuls of freshly emerging spikes of cotton grass, as well as old growth. This is known as the 'moss-crop' by crofters and hill-farmers, it provides a green bite for cattle and sheep, as well as red and roe deer, and capercaillie, black and red grouse.

Our cattle will eat willow shoots and twigs on occasions. In spring, certain individuals will push over saplings of birch and rowan, growing in dense stands, and browse the emerging buds and leaves. When cutting birch trees for firewood, the remaining branches of brash are attractive to the cattle, who snip off the soft tips and buds. Winter feed from coppiced deciduous trees was fed to cattle long ago. Cattle also graze areas of bog myrtle. In doing so, the old farmers believed, the cattle got relief from biting insects, such as midges, from the aromatic effects of the plant and that they gained beneficial elements from bog myrtle.

On the island of Rum, the remaining 40 cattle, as well as 1700 sheep, were removed in 1957 to protect the nature conservation interests. But the richness and diversity of flowering plants declined and were replaced by tussock forming grasses, such as Molinia and Nardus as well as heather on the drier sites. Highland cattle were reintroduced to the island in 1971 and some of these losses were reversed by the cattle grazing down the tussocky grasses.<sup>5</sup>

The non-selective behaviour of cattle in eating large quantities of poor quality herbage and extracting goodness through their efficient rumen and cudging ability is of importance to the ecosystem. It was also shown that the activities of the cattle increased the quantity of green biomass in the spring to the benefit of red deer, which produced more calves.

A more recent analysis of the data from Rum has confirmed the trend towards greater species richness within grazed plant communities following the reintroduction of cattle. It has resulted in the growth of a richer flora, with plants such as sweet vernal grass, red fescue, thyme and kidney vetch. At the same time, the species differences between the plant communities was slightly reduced, favouring species characteristic of mesotrophic conditions against those of oligotrophic conditions.<sup>2</sup>

There are frequent references to cattle destroying heather through over-grazing, trampling, dunging and urinating but these examples are often localised. It is difficult to find references of successful grazing of heather by low-density cattle use from an ecological point of view. When lightly but regularly grazed, heather can be kept in a 'young' state, six inches or so high, with a strong dense growth of new shoots and woody material is kept to a minimum. It

has been suggested that the grazing of up to 60% of the current season's shoots is the optimum for moorland livestock management.<sup>9</sup>

Grazed in this way it is possible that plant biomass production is increased several-fold in a growing season. Good quality heather provides forage of reasonable quality with a fair content of protein, fat and carbohydrate, as well as a fairly good source of minerals including calcium. Nutrient values are highest in young shoots and declines as the plant matures over the years. Heather maintained in this way by livestock is also more nutritious to wild herbivores than ungrazed rank heather.

It has been shown that grazing by ponies and cattle caused New Forest valley bogs to be much richer in plants and invertebrates than ungrazed bogs in the same region.<sup>14</sup> The rearing of traditional Maremmana beef cattle in Italy has benefited nature conservation, with their grazing and browsing resulting in a mosaic of scrub, woodland and woodland pasture, creating a landscape of high biodiversity.

**The importance of cattle dung and urine.** <sup>13</sup> Cow dung is very special and is of supreme importance to nature and the fertility of the land. The cow eats vegetation and breaks it down into digestible material, just over half of which is excreted in dung. A cow produces about 10 cow pats a day or about 23 kg of dung per cow of 450kg liveweight and this is distributed throughout its home range. Each pat is about 30cms in diameter, 5-8 cms in height and 1.2 litres in volume. In winter, the pats are drier and more fibrous, and tend to be 8-15 cms in height and take much longer to disintegrate.

The organic matter and minerals in the dung is utilised by a remarkably rich and varied fauna. Once the cow pat hits the ground it is attractive to about 60 species of fly, the majority of which lay eggs in the pat. Once a skin is formed, large numbers of adult beetles arrive to lay their eggs, followed by other species of small fly, nematodes and mites. The final wave of colonists come from underground, soil living organisms such as earthworms and springtails. In winter, more activity comes from earthworms in milder spells, rather than flies and beetles.

The burgeoning population of fly and beetle larvae is a very attractive food source for a range of birds and mammals. Each pat may contain up to 1000 developing insects, principally fly larvae, and in consequence one cow may increase the insect population in its home range by up to three million or more dung loving insects. It has been estimated that at any one time one eightieth of each pat by weight is made up of invertebrates and that in one year the dung of one cow supplies enough food to support an insect population equivalent to 20-25% of her own body weight.

The chough is one of the rare and well studied species which feed on dung invertebrates on open grazing lands. Many other birds species such as starling, jackdaws, waders and almost certainly gamebirds scratch over dung of the right age, in a similar manner to domestic hens in the farmyard. Badgers, foxes, shrews and hedgehogs also feed at cow pats, while bats hawk over them at night. Smaller birds, as well as predatory insects, hunt adult flies attracted to the dung.

Researchers have drawn attention to the side-effects of using the systemic veterinary drug, Ivermectin, for controlling parasites in livestock. Traces of the chemical are excreted continuously and this causes the dung to be toxic to invertebrates. Some species are

eliminated at levels as low as 0.5ppm. Invertebrates are important for recycling cow dung and in environmentally important areas, this drug should not be used on livestock. <sup>12</sup>

In the Netherlands, it was calculated that on heathlands with one cow per 3 hectares the chances of one place, with the exception of sleeping and standing sites, receiving a cow pat is once every 40 years and a pool of urine once every 15 years. Urination and trampling are as effective as grazing in reducing heather, because of its intolerance to high concentrations of nitrogen and potassium in urine. <sup>10</sup>

Regular dunging leads to soil enrichment and an increase in below-ground fauna, including earthworms. This cycle continues with increasing soil fertility and aeration due to worm activity. Worms are an important food for many birds as well as mammals, such as moles and badgers. Cattle also help spread trees and plants by excreting undigested seeds as they wander and graze.

**The value of cattle to birds.** Over two-thirds of forest and woodland edge species in Scotland benefit from the presence of low-intensity cattle in a variety of ways, including increased and more easily accessible food, vegetation changes and structural diversity. For example, owls benefit from higher rodent numbers and greater opportunities to catch them in small patches of open ground. Thrushes, redstarts and robins require some open ground for feeding. In fact, the occasional breeding sites of the rare redwing in Scotland often have cattle pastures nearby. A variety of small and large species benefit from dung invertebrates and associated increases in insects and worms. Cattle are important for woodland grouse and one species is highlighted below.

**Capercaillie.** This bird is a large distinctive species of the old Scots pine forests. It became extinct in Scotland in the eighteenth century and was re-introduced from Sweden early in the 19th century. Numbers were plentiful in the middle of this century but in the last two decades there has been a serious decline and there are now about 2000 of them left. Much research has been undertaken on capercaillies and reasons for its decline have included old forest destruction, cold wet springs, over-grazing by red deer and sheep, loss of blaeberrries, fence strikes, predation and disturbance. Positive management has concentrated on increasing the size and condition of native pine woods.

Young capercaillies feed on insects, with caterpillars on blaeberry leaves being particularly important. These broods are cared for by the hen, in much the same manner as a domestic hen around the farmyard. She leads them to the best feeding places, draws attention to choice morsels, warns them of danger and broods them in bad weather and at night. Studies on the Continent showed that capercaillie chicks may move between 50 and 600 metres in a day.

It is noticeable in native forests, where high red deer numbers have been reduced to encourage tree regeneration, that the heather grows quite dramatically. It creates a thick, often uniform, field layer which is very difficult for the movement of young capercaillies. Vegetation height increases beyond their reach, they may even hang themselves jumping up for insects, and patchy ecotones vegetate over. Long, dense vegetation causes the young to get much wetter and colder during periods of wet weather. In the absence of large herbivores the forest floor is less suitable for this species.

Increasing red deer numbers again is not the answer as they are specialist woody plant browsers, and they do not lower the overall vegetation height until high densities and over



grazing occurs. In my view, the original wild ox would have benefited woodland grouse in many ways. Low intensity cattle grazing in forests would now benefit capercaillies, especially young families, by creating path networks for easy access to feeding sites, structural and vegetation diversity as well as invertebrate increases associated with cattle dung.

A photographer in a hide at a capercaillie nest told me that the hen led the young brood off along an animal track as soon as they were ready to move, while a gamekeeper, who kept cattle, told me that capercaillie hens scratch up cow pats full of fly and beetle maggots in the forest.

**Incidental effects.** The moulting hair of cows in spring provide nesting material for a variety of birds. In 'wild cattle' situations, the biomass at death of each cow is an important food supply for scavengers, burrowing beetles and flies. In a special reserve in the Netherlands, it was found that wild boar scavenged a dead cow in about two weeks. The presence of 'wild cattle' in strict wildlife reserve areas is a totemic of the original aurochs.

**Can cattle rearing be a problem?.** The problems identified by conservationists, such as damage to birds' nests, poaching, over-grazing and lack of regenerating plants, are nearly always the result of cattle densities based on modern agriculture or poor husbandry. Most often the reported cases of damage are the result of winter feeding in small woodlands adjacent to in-bye fields, often the result of the farmer having lost his rough or hill grazings.

It is important to recognise that often it is the visual effect rather than the ecological which draws comment. Even in truly natural ecosystems, concentrations of large animals can cause massive soil disturbance but this is natural. It is mankind, not nature, which judges tidiness.

Foresters can be concerned about cattle in commercial woods because of the potential damage to tree roots by the hooves of cows. These root scars might possibly allow the entry of the pathogenic fungus, *fomesannosus*, or conifer butt rot. The significance of this risk is difficult to assess. High densities of cattle in young woodland can sometimes cause broken and twisted stems, but it appears that these problems are associated with high numbers in small areas.

## Cattle rearing in Scotland

**The past.** The kyloe was the cow of the Highlands and Western Islands of Scotland. They were small dark or black cattle, the forerunner of present day Highland Cattle. A description of them written by Bishop Leslie in 1578 says "In the mountains of Argyll, in Ross likewise, and several sundry other places, are fed ky, not tame, as in other parts, but like wild harts (deer), wandering out of order, and which through certain wildness of nature, flee the company or sight of men: as may be seen in winter, how deep so ever be the snow, how long so ever the frost lie, how sharp or cold how ever it be they never their head sett under the roof of any house".<sup>4</sup>

These hardy cattle from the Highlands became an important part of the economy in the eighteenth century. 90,000 head were sold at Falkirk in 1777 and by 1850 this had risen to 150,000 per annum. Bishop Forbes recalls meeting a drove of black cattle in The Pass of Drumochter on 31st August 1762. There were about eight separate droves, totalling 1200 cattle, on their way to the Crieff Fair.

Culley writing about kyloes in 1807, said they were ‘ a hardy, industrious and excellent breed of cattle, calculated in every respect to thrive in a cold, exposed, mountainous country’. The cow provided milk and it was the young beast of 3 to 4 years that was sent for sale. On the contrary in the lowlands at this time, most beef came from old cows and draught oxen, usually 12 years or older.

The rearing and feeding of cattle primarily for the production of beef, rather than as a by-product of the slaughter of older dairy cows or draught oxen, began in the British Isles in the eighteenth century. This was to satisfy the demand for beef in the rapidly growing towns and cities.

Beltane (1st May) and Samhain (1st November) were festival days linked to the taking of the cattle to the summer pastures and their return. All the cattle were moved to the summer grazings in the hills and mountains with the people living in sheilings. This pastoral movement or transhumance was very important; it gave the low ground a rest from grazing and allowed cultivation to take place.

The numbers of cattle in the hills were incredible by today’s standards and their effect on the hill land was dramatic. The pastures on the hill grazings were improved by the beneficial summer grazing of cattle and the soils were enriched by their dung. The humans benefited from meat, milk, butter and cheese while wildlife flourished from the enhanced biological activity.

Many have remarked on the quality of the summer pastures in the Scottish hills, the great numbers of hardy cattle and the bonny shielings, as well as the dramatic change, since the time sheep replaced cattle and people in the glens. Now the hills are mostly degraded from the long term extractive practices of sheep grazing and excessive burning, and from very high numbers of red deer. It is very hard to believe that such numbers of cattle could once have lived and thrived in the same hills. There is still some disagreement on the ‘wet desert’ theory.<sup>6</sup> It is, in my view, easier to understand when viewed in the bigger picture.

**The present day.** Within the post-war modernisation of farming, cattle breeding and rearing have also changed quite dramatically in the Highlands and Islands. The days of a house cow for milk and the mixed farm or croft have given way to increased commercial cattle herds or more often to a concentration on sheep, as well as to the amalgamation of farms and crofts.

Three decades ago, there was a move away from traditional breeds to the use of larger continental cattle, especially Charolais, Limousin and Simmental. The substitution of traditional cattle by modern breeds invariably led to more intensive systems, because the ‘improved’ cattle cannot graze less nutritious vegetation so effectively and thus require supplementary feed to maintain growth rates and to avoid excessive weight loss. This required increased on-farm production and the buying of feeding stuffs. The new breeds were less resistant to disease and parasites and required to be sheltered in winter.

At the same time, there has been a continuing drift from cattle into sheep, and many observers have commented about the worrying loss of traditional hill cattle. Correspondingly, there was often an increase in the numbers of cattle on those farms and crofts staying in cattle, which masked the increasing rate of decline of crofts and farms with cattle. Too many cattle are now grazed on in-bye land without access to extensive summer grazings, although often the 'big' breeds are not capable of thriving on hill pastures. The use of systemic chemicals, such as organo-phosphates, to treat cattle parasites in recent decades is higher than in the past.

Cattle rearing is now further threatened by a decline in meat eating and the loss of public confidence in beef due to BSE and E-coli diseases. There is a welcome resurgence in interest in traditional breeds and some market confidence that high quality meat production has a favourable future. Recognition that cattle are important contributors to the environmental health of the land is growing and financial schemes are starting to support cattle for these reasons.

In some parts of Spain, farmers in extensive mountain grazings are returning to traditional cattle after losing faith in the 'improved' breeds. At present, incentives in Scotland, such as those in the ESA and extensification schemes, are insufficient to redress the loss of hill cattle and the stocking levels are not satisfactory nor sufficiently tiered to ensure real environmental gains. The present system tends to protect the status quo or tries to prevent damage, but sometimes even results in loss of biodiversity. There is a tendency to fence out cattle from sensitive sites rather than use skilful herding.

## Cattle for nature conservation enhancement

Within the ambit of low density cattle rearing on extensive range, there are a variety of options ranging from commercial herds contributing some ecological gains, through to specialised nature conservation herds. In my view, the great majority of these herds are or will be owned by farmers and crofters with the principal aim of producing quality suckler calves for beef production and breeding stock, with financial support for contributing to wildlife, landscape and cultural values.

Traditional breeds and their crosses are ideal for these purposes, The heavier 'improved' breeds, including the large continentals, are not suited to foraging rough grazings and woodland with limited supervision.

A small percentage of the total herds will have a greater role in ecosystem management, and the financial reward for this specialist work will need to be higher. Finally, there will be an increasing requirement for special herds of strictly conservation cattle where the principal value is their role in the ecosystem. Some of these will probably be ancient breeds or aurochs-like animals, similar to the Heck cattle of mainland Europe, living in a nearly wild state.

It is clear that the potential management options range through a wide spectrum. At the commercial end, there would be farm or croft based herds, including continental crosses, which graze in adjoining woods or are moved to summer grazings. The next stages in the production end of the system could be commercial herds made up of traditional breeds with

access to woodland, common and rough grazings, with a choice of grazing density, and traditional herds maintained at low density on large grazings, including regeneration woodlands, throughout the year.

The higher levels of conservation management would involve traditional or special cattle living throughout the year in important wildlife areas, including reserves, with minimal or no winter feeding, some of these herds could be composed of castrated males to reduce management. Finally, some places could merit the use of 'wild' cattle running in extensive ecosystems with minimal or no intrusive management.

Optimum herd size as well as the size and quality of home range will vary, and there is a need to try various options to develop best practice. Transhumance or stock movement to associated summer grazing would seem to offer the best options for the majority of herds. New arrangements will need to be forged for farmers and crofters to summer their cattle in woodlands, forests, hills, nature reserves and scientific sites. Unfortunately, many farmers and crofters have lost access to their ancient summer grazings. Although some common grazings have been over-grazed by sheep, many are under-grazed and too few are now used by cattle; this needs urgent attention to improve the use and quality of common grazings.

Any of the traditional Scottish beef breeds and their crosses will be appropriate. For the more demanding sites, those with a family history of living and thriving on open range or in woodlands, as well as being sure-footed and wide-ranging will be preferable. Herds and sites may involve summer, seasonal, short-term, mixed or year-round grazing; some may involve transhumance, lowering stocking rates in winter or supplementary feeding on open range. Winter feeding is required as usual on farm or croft.

Agricultural researchers have developed stocking rates based on the nutritional value of rough vegetation but these rates are usually higher than required even for moderate ecological gain. Present agricultural stocking rates cannot exceed 2LU per forage ha (1996, down from 3.5LU in 1993) with environmental extensification payments for stocking rates below 1.4 LU/ha, with higher payments below 1 LU/ha. A livestock unit (LU) is one cow or 6 sheep.

Research has show that all but low levels of cattle grazing (less than 0.2 per ha) tend to reduce heather cover<sup>16</sup>. In the New Forest, present day densities of one cow per 9 ha as well as one pony per 5 ha (bearing in mind Tubbs's view that one pony is equivalent to 2.5 cows) is causing over-grazing of the ecosystem.<sup>14</sup> Before 1965, there was some shrub and tree regeneration when stock levels were lower, with one cow per 10 ha and one pony per 8.5 ha.

Yalden <sup>17</sup> used present day data from Bialowieza on European bison numbers and densities to extrapolate possible numbers and densities of aurochs in Mesolithic Britain; his rough figures were 100,000, giving about one per 25 ha, 0.04 LU/ha. Dutch nature conservation managers have used cattle densities of one cow per 5 to 30 ha in nature reserves. Highland cattle have been grazed on the woodlands and heaths of the Imbosch, about 2100 ha since 1982 and they do not receive supplementary feeding. Density is about one animal per 30 ha and surprisingly the sex ratio is just about equal.<sup>10</sup>

On our hill farm, I consider that a stocking rate of one cow per 20 ha, or 0.05LU/ha, is the optimum for enhancing the nature conservation interests. Fewer than this appears to have little effect while higher numbers could cause overuse in key areas. Natural herd size would

appear to have been in the range 10-30 animals, and there will be a need to try to aim at herd sizes in this range. Herds larger than this tend to damage the ground.

## Benefits and disadvantages of conservation cattle rearing

Along with contributing to ecological processes and enhancing the quality of the natural environment, running cattle on an extensive system is also of benefit to the farmer or crofter.

Cattle grazed on extensive pastures are more healthy than high numbers of cattle which have limited range on improved farmland. The low stocking densities mean that they feed on cleaner ground, with less risk of disease and cross-infection. Outwintered cattle in hill country acquire a strong sense of hefting and disease immunity. It is a low input/low output system which suits both the people and the place.

In our own case, we have found that the cattle are healthier now that they are outwintered. Living in summer and autumn on extensive hill pastures keeps them in excellent health. They live longer. Now that we use an Aberdeen-Angus bull on traditional cows, we have easier calving and better mothers. From our point of view, these advantages make up for the lower value (at present) of the traditional lighter calf compared to a heavier 'continental' cross. In these days of economic crisis lower feed and veterinary bills are welcome.

Cattle kept on in-bye improved pastures can suffer from mineral deficiencies because lime and artificial fertiliser tend to 'lock up' some trace elements, for example selenium. On open, clean ground, important minerals are more easily obtained, for instance, young heather is a good source of cobalt.

Low density stocking on rough and woodland grazings provides greater variety of plant species as food, almost certainly including valuable additional nutrients and trace elements. Shelter and variety are an important welfare consideration and cows with young calves are less exposed to pneumonia.

Cattle in low density open range are also cleaner and stress free, less likely to have dung on their hides, which is important for food hygiene, while the wholesome nature of contented cattle in a rich environment is likely to be of increasing importance to the consumer and, thus, a marketing advantage.

Currently there is a move back to high quality beef production using traditional breeds. For the hill producer this must be the way ahead in a competitive market. At present, the financial returns are not adequate but improvement requires better targeting aimed at the specialist beef market. It is worth remembering the old days. Even as far back as 1578, Bishop Leslie said of the kyloes "Their flesh of a marvellous sweetness, of a wonderful tenderness and excellent taste". Two hundred years ago, 'the meat of a kyloe in good condition was much esteemed for its sweetness'

A small number of specialist butchers are now selling meat from traditional beef cattle grazed on open land where the rich variety of different grasses and herbs produce a high quality product. Taste tests have shown that meat from beef cattle grown on extensive grazings are preferred by the consumer. How much of the quality of taste is based on the slow-maturing

nature of these cattle in unforced situations and how much on the special characters of food plants is not known. In addition, consumers are beginning to appreciate, and hopefully pay a premium for, the feeling of well-being associated with growing beef in such healthy and natural lands. I am told the U.K. is only 80% self sufficient in quality beef.

There are some difficulties in these methods. Some farmers find it hard to forego the increased prices of recent decades from larger 'continental' crosses. Daily monitoring of the herd takes more time if one has to search for the cattle on extensive, partly wooded pastures. For those who use artificial insemination, it is much more difficult to check for 'bulling' cows. New born calves can be hidden by their mothers and this increases the work of ear-tagging calves. There is also the worry of cattle falling in holes or getting stuck in bogs, although hefted cattle tend to know the danger areas.

It is well known by farmers and crofters that cattle are more labour intensive than sheep. They need daily or twice daily feeding in winter whereas sheep can look after themselves for several days if the owner has to be away.

Free-ranging herds have some risks for humans. People require to keep some distance from them, much as on most farms. Dogs should not be taken near cows with young calves, especially some of the protective breeds like Highlanders. With the 'wild' replicate herds of the future feeding by hand should not be allowed and individuals with aggressive temperaments should not be bred or kept. There will be a need for public information.

## The way ahead: research, demonstration and management

The most important step is to achieve a consensus that cattle and forest conservation are mutually beneficial and then to agree that something must be done about it.

It is necessary to halt the alarming loss of hill cattle from an environmental and social point of view. It will be a costly business to replace them and even more difficult to restore the hefting abilities and other cultural knowledge of resident cattle. The government must review the support systems and adjust them to encourage increased keeping of traditional cattle and high levels of environmental gain. There are three areas of required activity.

a. Ecological knowledge. Research and experiment are required on the effects and nature conservation benefits of low intensity cattle rearing on woodlands and regenerating moorland.

It will be necessary to test different methods of cattle grazing in native woods and regenerating hill ground in order to identify the true range of ecological benefits. A search for present models and potential demonstration and research sites is an urgent first step. Many farmers only have access to small woods and I believe it is very difficult to gain most of the benefits in small woods. I do not believe it is possible to reduce the grazing to two to three cows in ten acres, and get the same effect as that in the larger ranges. I have a feeling that cows like to live in natural herd sizes, 10-30, within 'natural home ranges'. Then they have the greatest beneficial influence on biodiversity.

There is an urgent need for the appropriate research and conservation bodies to select a range of trial sites to test the different options for cattle management and to carry out field work on enhancing their ecological effects.

b. Farming options. The way forward will be based on the use of traditional suckler cows, with a strong presumption to spring calving and the calves being sold off at the back-end. Additionally, there is clearly scope for the use of summer grazings by low ground farms. Outwintering will be the norm, but density and availability of winter range will require to be sufficient to prevent excessive localised poaching. Individual herd size should keep around 15-25 cows, but larger farms could run several herds.

There is a need to review the choice of breeds, herd and range sizes, the types of management and the necessary arrangements between farmers, crofters, foresters and nature conservation managers. At the conservation end of the spectrum, there is merit in examining the role of 'wild' cattle. Knowledge and experience in the Netherlands and Germany is worth investigation as are the health and welfare rules.

c. Support systems. It is important to recognise that 'cattle' are an indigenous species in the UK and Europe so cattle support payments for ecological reasons are legitimate and justified, within world trade talks, and in line with biodiversity conservation. Cattle are not native to North and South America, Australia and New Zealand, so farmers in those countries should not receive positive environmental payments as the encouragement of exotic species would not accord with biodiversity conservation. This could give an edge for European farmers.

Financial incentives for traditional low-intensity cattle farming and the required range and tiers of enhanced payments for environmental work need to be examined by government. There is a need to look at the possibility of paying support on all cattle, not just breeding cows. Some conservation grazing could involve less intensive calving rates; at present non-pregnant cows are penalised. It would reduce the production of calves which, under present circumstances, may be beneficial. In some schemes, the use of castrated male cattle may be appropriate and sufficient for conservation habitat management.

Stocking rates for environmental enhancement require further research and examination; to get the best results there needs to be several more tiers. The present stocking rates of 2LU per forage ha base rate with under 1.4 LU/ha and under 1 LU/ha for additional extensification payments are too high for real ecological gains. New more substantive payments for lower levels, such as 0.5 LU/ha, 0.1LU/ha and 0.05LU/ha, to achieve specific environmental benefits is urgently required. They would require a sliding rate of payment based on the area under active management.

Many of these issues are important considerations which require government action. The agriculture and environment departments of the Scottish Office, together with Scottish Natural Heritage and the Forestry Commission are the appropriate authorities to undertake such a review.

The most crucial consideration is time. There is an urgent need to reverse the decline in the numbers of farmers and crofters rearing traditional cattle now. In our township, only four herds remain, one of those will be gone by summer time and another may be gone by the end of the year. How many other townships are in the same plight?.

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The Scottish Highlands refers to the northwestern area of Scotland and includes some of the northern islands. The exact boundaries of the Scottish Highlands differ based on different definitions. The important things to note if you are renting a vehicle is to make sure you are fully insured, check out our guide to driving in the UK, (especially if you are used to driving on the right side of the road), and be prepared for narrow, rural, and mountainous roads in the Highlands. On several roads in the Highlands and islands, you (or the other car) will have to stop and pull over to allow cars to pass as roads become one lane in some places. Make sure you understand how to drive on single track roads before you go.