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SCOTTISH NATURAL HERITAGE

Integrated Upland Management for Wildlife, Field Sports, Agriculture & Public Enjoyment

Edited by
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Acknowledgements

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Preface

The management of habitats for individual species is an activity as old as when man first scratched the soil and inserted a seed in the groove that he had made. In its primitive way, that activity constituted a form of range management, in that it manipulated one ecosystem with the intention of favouring another.

Range management has been the subject of widespread, far-reaching and detailed research over many decades. In almost all cases, the manipulation of factors affecting the productivity of range-land has to be carried out against the background of existing uses by man, and sometimes in conjunction and association with species whose requirements may conflict and compete with the avowed interest. All of us have our pet examples. Land drainage and flood control may affect populations of wintering wildfowl and breeding waders adversely. The conversion of semi-natural upland heath to plantation woodland may disadvantage several moorland birds, notably golden plover, red grouse and merlin. The cessation of coppice woodland management can have adverse effects on butterflies, ground flora and breeding warblers – the list can be as long as you want to make it!

During recent years, much attention has been devoted to the management of game animals with a view to enhancing their numbers, and to provide the land owner with a sustainable yield and income. Pursuing these policies has sometimes created conflict; red deer numbers have increased and in some places encroach onto lowland farms and into forests where damage of economic importance may take place. Artificially high numbers of domestic sheep have been run on hill land in some areas with less emphasis on their productivity than on the revenue that the subsidies they attract can provide. In some cases, these factors have resulted in increasingly myopic approaches to the problems facing land managers.

In order to make a start on an attempt to resolve some of these crucial issues, The Heather Trust took the initiative and devised a conference programme in partnership with Scottish Natural Heritage. However, no show runs without the lubrication of adequate sums of money and a generous sponsor was quickly found through Anthony Hart in Bidwells' Property Consultants.

Concomitant with all this, John Phillips was fortunate to be awarded a Winston Churchill Travelling Fellowship in the autumn of 1998. He travelled widely in North America and Scandinavia and collected much information and many impressions of how other people manage land and quarry species. It was obvious that to expose some of these views and techniques to an audience in the United Kingdom might:

a) be of interest; and

b) be of significant economic, cultural and environmental value to the world-at-large.

Thus we drew together 16 speakers from far and near and asked them to give their views on the complex topic of Integrated Upland Management for Wildlife, Field Sports, Agriculture and Public Enjoyment – a phrase which formed the title of this Conference.

This collection of edited papers is the outcome and it is to be hoped that they will interest, inspire and even entertain a wider audience that the 180 or so who attended the conference at Battleby, near Perth during those two days in September 1999.

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Foreword

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I am delighted to welcome you all to this report on the important conference on upland management.

The conference was important because it came at a time when a number of things were happening which can have a profound effect on the future of our upland habitats. Firstly, some considerable concern has been expressed over the impact of the dramatic down-turn in sheep prices at a time when other agricultural sectors are also hard hit. What will the effect be on the uplands? Will it lead to the removal of sheep over large areas, or will well-managed uplands prove to be more viable for sheep farming than the lower-lying ground?

Secondly, grouse production continues to be very patchy and at best subject to population swings of feast and famine. What can be done in habitat management terms to ensure more balanced and sustainable grouse numbers to the benefit of field sports interests? What will be the long term impact of raptors on grouse and indeed other game birds on well-maintained and well-managed moors?

Thirdly, it is the Government's policy to provide for greater access to the countryside and already the principle of a right of responsible access for informal recreation and passage has been agreed. The necessary legislation is currently being developed to achieve this and the draft bill is likely to be ready for public consultation before the end of this year. Will this lead to an increase in people taking advantage of such a right in upland areas and how serious or otherwise will be the impact on grouse shooting and stalking? Or will the proposed codes and the educational package to promote such codes lead to an improving rather than worsening situation?

These are just three of the issues which face the manager of the uplands at this time. And of course since the conference we have had to witness the appalling impacts of Foot and Mouth disease – on agriculture, tourism and the country at large. We do have a responsibility to ensure that we get a sustainable return from our uplands because in many areas, particularly the remoter ones, the future of our rural communities depends on our collective success. I hope that the Scottish Parliament understands the close connection between successful management and utilisation of the uplands for agriculture and field sports and the success or failure of many areas of the rural economy.

One other responsibility which I believe we need to seriously address is how we ensure that the work of the organisations which contributed to this conference through paper, posters and debate are themselves integrated to tackle collectively the issues that face us. I am of course aware that there are issues which tend to divide us; differing priorities, differing management strategies and so on. However, I believe there is much that we can agree on and this should not only be our strength but also the vehicle with which to bring our collective expertise to bear on the upland issues of the day. We owe it to the activities that we promote, we owe it to the nation's commitment to bio-diversity, and we owe it to the human communities whose jobs may depend on the successful utilisation of our upland areas. I wish you every possible success in all these endeavours.

I would like to acknowledge on your behalf and that of The Heather Trust our gratitude to the sponsors of this conference. They are Bidwells Property Consultants and Scottish Natural Heritage.

PART 1. UPLAND MANAGEMENT PRACTICES

Principles of Range Management

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Summary

1. The principles of range management are illustrated by reference to range management in Scotland.

2. In the management of a range an important first step is the setting of the objective or objectives for the system. More often than not, there will be more than one objective and these objectives may not always be compatible, eg those of red grouse and red deer management.

3. Since most objectives will contain the concept of sustainability, important principles are the description of what the sustainable state of the range and its populations should be and what the current state of the range is. This latter principle requires the collection of information on soils, vegetation cover and the populations of mammals utilising the range.

4. Most managers of range in Scotland have a poor knowledge of the soil quality and vegetation cover and indeed mortality and reproductive rate of key species, which are important in determining their populations.

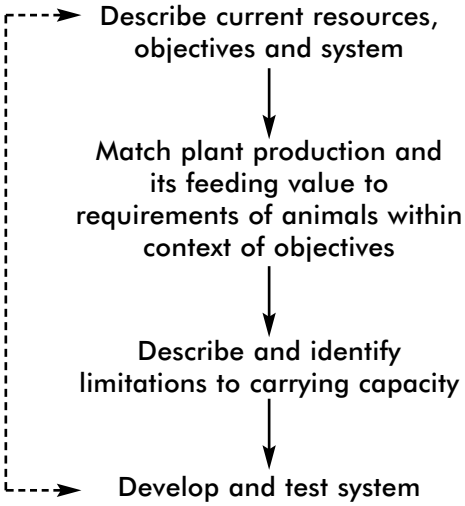
5. The description of the sustainable state of the range and its populations of mammals and birds requires a considerable understanding of the ecology of the range, not only in broad principle but in practical experience of the particular area of range. Scotland is fortunate in having a considerable body of scientific information on its animal and plant ecology.

6. General principles concerning the impact of large herbivores on vegetation and the factors influencing their population biology can be used to identify an appropriate carrying capacity to meet the objectives for the range. This is illustrated with reference to large ruminant populations in Scotland. Computer-based models have a role to play in aiding this process but it is also important to harness local knowledge.

Introduction

In the 1990's the most commonly used method of understanding the biological and socio-economic factors that influence the management of rangelands and for designing management protocols is one which adopts a systems approach (Pearson & Ison 1997). A systems approach describes the boundaries to the system, its objectives and current resources, how the components of the system interact, the extent to which a particular arrangement of resources meets the objectives set for the system and through a process of iteration arrives at a workable system. This methodology can be usefully applied to grazing systems. **Figure 1** describes a flow diagram that illustrates the stages described above in that context. In a grazing system the way that the components interact revolves around matching plant production and its feeding value to the requirements of animals for nutrients. The extent to which a particular set of resources meets the objectives set for the system can be described in terms of carrying capacity of the resources for a particular set of animal populations.

Figure 1 Schematic diagram of grazing systems approach.



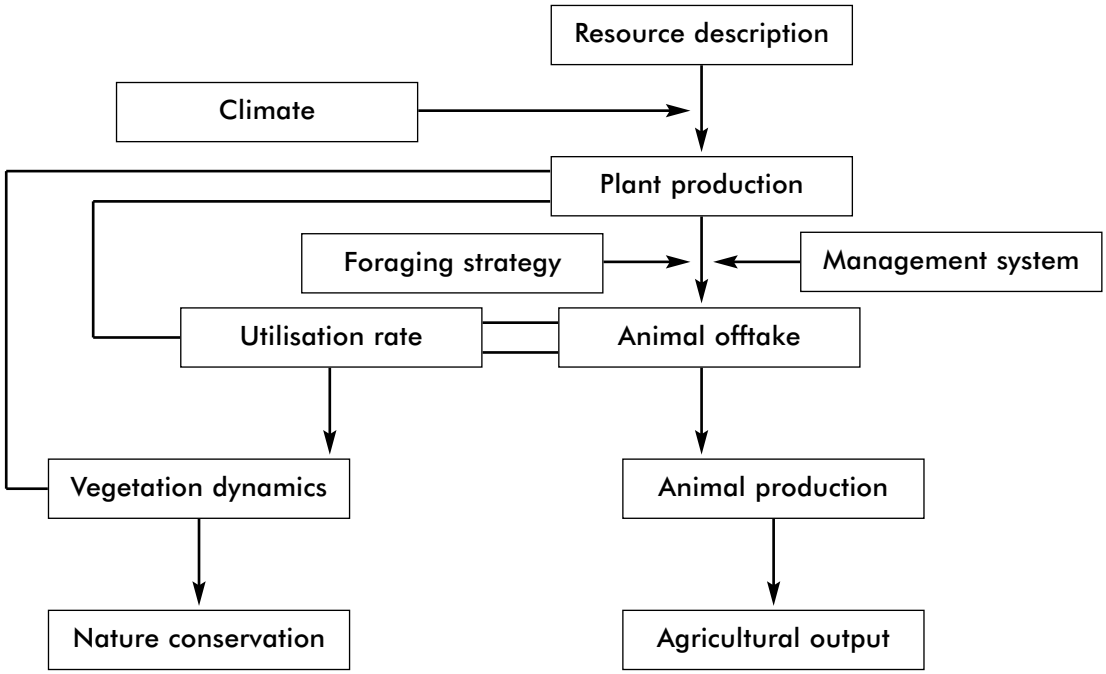
In this paper the key issues that require to be addressed are highlighted and illustrated by reference to range management in Scotland. It would require a manuscript the length of a book to do adequate justice to the subject and hence there is selectivity in the topics elaborated upon. These topics reflect the focus of this meeting and the main challenges for the future. Because of the multiple objectives and uses that the rangelands of Scotland are subjected to, their consideration is a key element of this paper and provides a strong challenge to the robustness of a systems approach in describing the principles of range management.

Objectives for Range Management

In Scotland there are a large number of objectives for the use of rangelands. These may be sporting, in terms of deer stalking and game bird shooting, agricultural in the production of meat from cattle and sheep, and in relation to nature conservation in the maintenance of moorland and native woodland habitats that are of European and UK significance. There will also be socio-economic objectives, in terms of sustaining rural human populations, meeting local community needs or in the provision of access. Whilst in the past sporting and agricultural objectives have been paramount and important in sustaining rural populations, nature conservation and access objectives are likely in the future to become important drivers of sustainable development through, for example, tourism. It is difficult to envisage most estates in Scotland not having to address all of the above objectives in designing their rangeland system. Some of the objectives may be more important than others in individual cases and their impact on the system will at least interact if not conflict. Moreover the relative importance of objectives will change over time. The long-term significance of a management to achieve one set of objectives may lead to difficulty in meeting a different mix of objectives in the future.

The need to be able to understand the implications of designing a system with multiple objectives and reacting to changes in the ranking in importance of these objectives argues for the use of computer-based models to predict the effects of different objectives as a component of the decision-making process. A schematic diagram of the components of a model of the biological part of the system is given in **Figure 2**. The outputs of this model can then be used to explore the socio-economic and nature conservation implications of the system. By a process of iteration by running such a model for a range of inputs, the desired mix of objectives can be obtained. Decision-support tools are being developed to make this process easier to undertake (Milne & Sibbald 1998).

Figure 2 Diagrammatic representation of a model of a grazing system.



Description of Resources

Central to understanding how rangelands behave is knowledge of the resources used in the current system. In Scotland there is considerable information available although it is not as well used as it could be. For soils there is a description of the soils of the rangelands of Scotland at a scale of 1:250,000, obtainable as maps from The Macaulay Land Use Research Institute. The vegetation cover of Scotland was described in 1988 at a scale of 1:25,000 from interpretation of aerial photography (Macaulay Land Use Research Institute 1993). This describes the areas of the main vegetation communities spatially and is essential information in providing information on the potential nutrient supply for large herbivores.

A key piece of information is the grazing impact on the vegetation as this influences the future productivity of the vegetation and changes in the proportion of the different vegetation communities (see **Figure 2**). At present there is a lack of information on grazing impact. An excellent method of describing grazing impact on the principal vegetation communities has been developed by Scottish Natural Heritage (MacDonald *et al* 1998). It describes three impact classes, light, moderate and high, for each vegetation community. However, the cost of undertaking a survey of each 0.25km^2 on a resource, the minimum appropriate area, is high. An approach, which combines field sampling, based on the method of MacDonald *et al* (1998), with a rule-based modelling approach using information on soils, vegetation cover and animal numbers, together with models of grazing systems, is being developed at the Macaulay Land Use Research Institute (A.J. Nolan, pers. comm.). This will allow the description of grazing impact on the principal vegetation communities at a five to ten times lower cost and with an accuracy of about 90% of that of a full field survey. Part of this approach will be the identification of the areas and vegetation communities that will require to be sampled as part of a subsequent monitoring programme.

Equally important as describing the impact of grazing animals is a description of the numbers of large herbivores, probably the principal drivers of ecosystem change in temperate rangelands. Accurate information is available on the numbers of domestic herbivores because of the need to collect information for the annual Scottish Office Rural Affairs Department's June Census and for subsidy payments. There has been, however, a dearth of information collected on the numbers of red deer, the other major large herbivore of Scotland's rangelands, at the level of the management unit. Information on the numbers of stags, hinds, milk hinds and calves is required annually in order not only to assess what the impact on the vegetation will be but also whether the sporting cull can be achieved, and what the hind cull should be. Information is also required on the reproductive rate of the hinds, the mortality of hinds, stags and calves and the approximate age distribution of the hinds and stags in order that the dynamics of the population can be adequately described and predicted. The Deer Management Group approach, which has been adopted in Scotland in the last ten years, gives the opportunity for accurate counts to be made annually as the Groups relate to relatively discrete populations of deer and a common counting methodology can be used. For population dynamics models to relate to a specific Group, knowledge of reproductive rate and mortality, together with the weight of culled animals and their age, are also required (Buckland *et al* 1996). There is a lack of consistency in the collection of the former information at present.

Principles of Grazing Systems

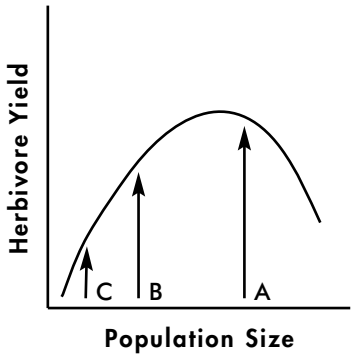
Figure 2 describes the major processes involved in grazing systems. Plant production from the different vegetation communities in Scotland has been described but the variations associated with soil type and altitude are less well understood (Armstrong *et al* 1997a). Foraging behaviour of sheep and to a lesser extent red deer and cattle, has been studied and reasonably accurate prediction of which plant communities will be selected, and what the nutrient offtake from these communities will be, can be made (Armstrong *et al* 1997b). Bent-Fescue (*Agrostis-Festuca*) grassland is the most preferred species at any time of the year provided that there is sufficient plant biomass available. Moor Mat Grass (*Nardus stricta*) and Cotton Sedge (*Eriphorum vaginatum*) are preferred in the spring and Flying bent (*Molinia caerulea*) in the summer. Heather (*Calluna vulgaris*) is only selected significantly when the biomass of the grasses limits the intakes of large herbivores. Differences between the feeding behaviour of sheep, cattle and red deer have been established such that the major differences between the species associated with size and muzzle width have been quantified (Milne *et al* 1998). Much of the uncertainty about utilisation rate relates to the spatial nature of foraging behaviour and this is still a weakness in our understanding. For example, the annual utilisation rate that will lead to a decline in the productivity of the pioneer and building phase of heather has been established (Grant *et al* 1982). However, the high utilisation rates around grass patches have only recently been described (Hester *et al* 1998) and their implications for vegetation dynamics are not properly understood. Indeed the long-term effects of different grazing pressures or changes in grazing pressure on the dynamics of plant community change are difficult to predict in a quantitative manner (Armstrong & Milne 1995). Knowledge of the nutrition of sheep and cattle is extensive, although less well developed for red deer, and hence the ability to predict the level of production of individual domestic animals is reasonable.

It can be argued that the scientifically based understanding of the upland ecosystems of Scotland is among the greatest in the world. It has enabled the development of computer-based simulation models (Gordon *et al* 1998; Milne & Sibbald 1998) to predict the impacts of large herbivores on the vegetation and the consequences for individual animal and population performance, ie components of carrying capacity.

Carrying Capacity

There is much confusion about the concept of carrying capacity often because of a lack of definition of what the objective in relation to the carrying capacity is. **Figure 3** shows a hypothetical example of the relationship between population size and the productivity of the herbivore population (described as herbivore yield in the Figure). Ecological carrying capacity describes the natural limit of a population set by resources in a particular environment (Caughley & Sinclair 1994). It applies to a point in time and hence the carrying capacity can change depending on how the population changes the resource. It describes a much higher population than economic carrying capacity. This is the population level that produces the maximum sustained yield for culling or cropping purposes. Because of the importance of the individual, either in terms of its antlers or weight in the case of the red deer, rather than the total population for economic carrying capacity, is set at a level that more nearly maximises the monetary value obtained from the individual. The third carrying capacity identified in **Figure 3** relates to a carrying capacity with a nature conservation objective, native woodland. It has an even lower carrying capacity because of the high impact that large herbivores can have on the growth of seedlings and saplings (Hester & Miller 1995) at other than low stocking densities. It could be argued by some that the carrying capacity of wolves in Scotland's upland habitats might be considered to be zero, whilst those favouring their re-introduction might take a different view! A major challenge for the future is the reconciling of carrying capacities which are appropriate for one objective but not for all objectives.

Figure 3 Relationship between population size and herbivore yield, illustrating different descriptions of carrying capacity.



A – Ecological Carrying Capacity

B – Economic Carrying Capacity

C – Native Woodland Carrying Capacity

Conclusion

In order to identify the carrying capacity of a particular species or range of species one requires a clear set of objectives, knowledge of current state of the resources, and an understanding of plant-herbivore interactions. Computer-based models, such as those described above, are one means of exploring what the carrying capacity to meet a biological or economic objective could be. However, models can never replace

the observations and understanding of resource managers and models should always be considered as a decision-support tool, along with other aids to management. A systems-based approach provides a valuable framework within which resource managers can effectively put into practice the principles of range management described in this paper.

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Range Management for Large Mammals

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Summary

1. Management of large mammals in Norway is based on the management of populations, and generally not on the management of habitats or ranges.
2. Hunting harvest toward the end of the 1990's of: moose (*Alces alces*), red deer (*Cervus elaphus*) and wild reindeer (*Rangifer tarandus*) increased between 30 and 60 times the pre WW II level, indicating a corresponding increase of populations. A total of 37,957 moose, 21,636 red deer and 9,761 wild reindeer equalling some 7000 tonnes of meat, were harvested in 1998. The estimated winter population of these three species numbers 200-300,000 animals toward the end of the 1990's.
3. The population increase is rooted primarily in a change in management practices, including management of individual populations in defined areas or regions, and a strictly regulated harvest with quotas specified to animal age and sex.
4. Approximately 2,5 million sheep graze in the alpine and forested areas every summer. The annual animal loss is 130,000 head. In 1997, the State paid 30 million NKr in compensation for 27,000 sheep lost to protected predators.
5. Predators such as wolves (*Canis lupus*), bears (*Ursus arctos*), wolverine (*Gulo gulo*), and lynx (*Lynx lynx*) were extensively hunted during most of the 20th century and existed in marginal populations until the 1990's.
6. Protection of the large predators, first in Sweden and later in Norway, has lead to an increase in their population and their level of conflict, primarily with the sheep owners.

Introduction

In Norway, the large terrestrial mammals surviving the Last Cold Stage (113,000-10,000 BP) and the Holocene (<10,000 BC) belong to the Cervid family and the large predator group. They include moose (*Alces alces*), red deer (*Cervus elaphus*), reindeer (*Rangifer tarandus*) roe deer (*Capreolus capreolus*) and the large predators including brown bear (*Ursus arctos*), wolf (*Canis lupus*), lynx (*Lynx lynx*) and wolverine (*Gulo gulo*). In addition, the Norwegian fauna was enriched by two recently the state- reintroduced species, the musk ox (*Ovibos moschatus*) and the fallow deer (*Cervus dama*). The mass extinction at the end of Pleistocene was unique in that the species lost were nearly all large terrestrial mammals, and the extinction occurred without replacement (Stuart 1991). It is possible that human hunters caused this extinction, and if so, this would be the first range management failure in a long line to follow.

In Norway, the living game is no one's property, while the hunting rights and the dead animal belongs to the landowner. The Ministry of environment is responsible for the big game populations. They in turn delegate much of the current management decisions to the Directorate for nature conservancy, and the individual county administrations (**Table 1**).

Land Ownership

Private owners (49%) dominate land-ownership, but with an important share (35%) held by the State (**Table 2**). The average privately-owned area size is approximately 50ha, but there is much variation (**Table 3**).

Deer Management

Early on, old laws had made it clear that the hunting rights belonged to the landowner. All registered landowners had the right to harvest moose and red deer. While the hunt for moose and red deer was restricted to registered property owners, the reindeer hunting was open to everybody. The oldest regulations contained no "management" measures, such as quotas or specific "seasons". First in 1730, moose, red deer and reindeer were given an annual protection period during the summer, and a quota of 2 reindeer or 2 moose. In 1863, the pitfall technique for harvesting of moose and red deer was prohibited, a regulation that included reindeer from 1899.

A very important regulation was implemented in 1930, restricting reindeer hunting to within certain areas. In 1951, a new hunting law introduced licence hunting for moose and red deer. Landowners had to pool property in order to meet the minimum area requirement granted an individual licence in the different districts. The 1951 regulations made it illegal to kill calves, a regulation that was changed during the latter part of the 1960's.

During these years, the concept of planned harvest was introduced. The hunting quota became age- and sex-specific. Presently, the principle of population-based management is the accepted management procedure. Various sub-populations are managed separately. Management and harvest are based upon population parameters like available area, population size or density, body weights, reproduction and natural mortality.

Today, the Cervid Regulations of 1989 (Hjorteviltforskriften) (eg Reimers *et al* 1999) regulate the big game management. Hunting of moose, red deer, wild reindeer and roe deer can only occur in municipalities decided upon by the County Governor. A basic concept in these regulations is the *minimum area requirement* – that is the minimum area required for every hunting licence issued. The municipality applies for deer hunting and minimum area and the proposal must be sent the County Governor within April 1 every year. The landowner must be familiar with the content of the application beforehand, such that that they (or others) may make statements if necessary. The minimum area is finally established by the Governor on basis of the respective deer's population size, the area's carrying capacity and other considerations such as forest and agriculture. Except for wild reindeer, the minimum area is defined in the individual municipalities, and in some cases, it can differ within a municipality.

The geographical area that is open for hunting of one or several deer species, and that is given hunting quotas, is named a *hunting area*. The hunting area must be a continuous area that satisfies certain qualifications. Within the hunting area, one calculates the *counting area* that is the basis for assigning the hunting quota. The counting area is determined by the municipality and sets the quota size, while the hunting area sets the area available for hunting.

An example clarifies this. Area A includes moose and red deer and the hunting area is 5000ha, of which 4000ha make up the counting area. The municipality's minimum area for moose is 300ha and for red deer 1500ha. This implies a hunting quota of 13 moose and 2 red deer. The municipality has the right to adjust the counting area up or down 50% if certain conditions like forest damage, traffic accidents and animal density indicate the need to do so.

Deer regulations differentiate the quota on the category calves, adult males, adult females or young (1½) year old males (**Table 4**). Quota sizes and quota differentiations are the only important deer regulations that enable the management authorities to control deer population development. Until the 1960's, when quota differentiation was put in effect, selective hunting resulted in distorted age and sex ratios in the population as found in most wild reindeer populations (Reimers, 1975).

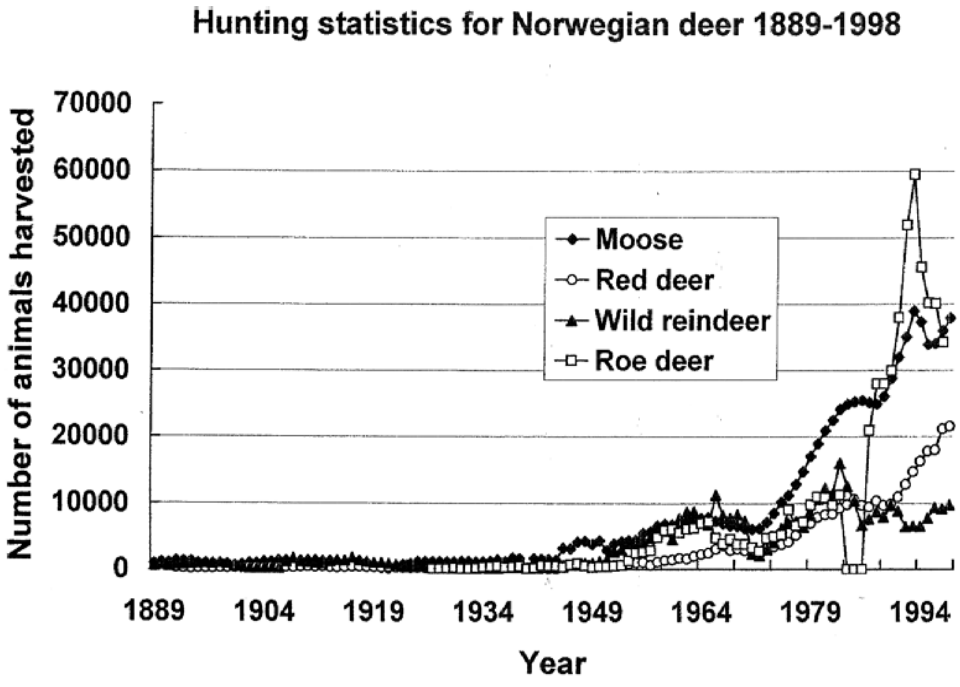
An extensive management monitoring program was implemented during the 1990's, including 17 areas with moose, red deer or wild reindeer (**Table 5**). At regular intervals, animal body size, recruitment and population size are recorded in selected areas.

Population Dynamics

The Cervids

Rangeland is not managed for the purpose of increasing or decreasing big game populations. The development of game populations is primarily the result of harvest regimes and accidental results of forestry or other industrial development. The Norwegian hunting statistics dates back to 1889 for moose and wild reindeer, 1892 for red deer and 1927 for roe deer when protection of the species was lifted. These statistics reflect the population development for the four species, although population size and hunting might be somewhat out of phase. A total of 37,957 moose, 21,636 red deer and 9,761 wild reindeer equalling some 7000 tonnes of meat were harvested in 1998. The increase in the Cervid populations indicated by the harvest statistics (**Figure 1**) and their distributions (Hunting statistics, 1998) is caused by strict hunting regulations that have changed with an increasing appreciation and monetary value of the game. Towards the end of the 1990's hunting harvest of moose, red deer and wild reindeer has increased between 30 and 60 times the pre WW II level. The population increase is primarily rooted in a change in management practices following the hunting law activated in 1951, which introduced licence hunting for moose, red deer and reindeer.

Figure 1 Harvest of moose, red deer, wild reindeer and roe deer in Norway 1887-1998 (Official Statistics of Norway, 1994).



Later regulations emphasised management of individual populations in defined areas or regions and a strict quota regulated harvest with specific sex and age quotas (**Figures 2** and **3**). The current harvest strategy includes culling high numbers of calves and yearlings (**Table 6**).

Figure 2 Moose felled by age and sex (%) 1976-1998 (Official Statistics of Norway).

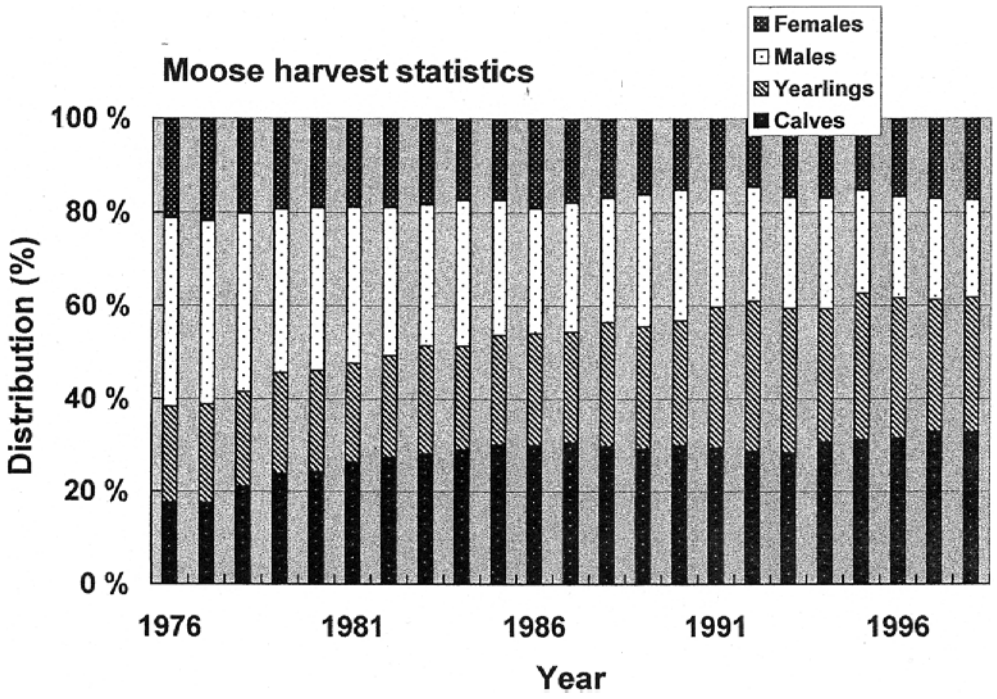
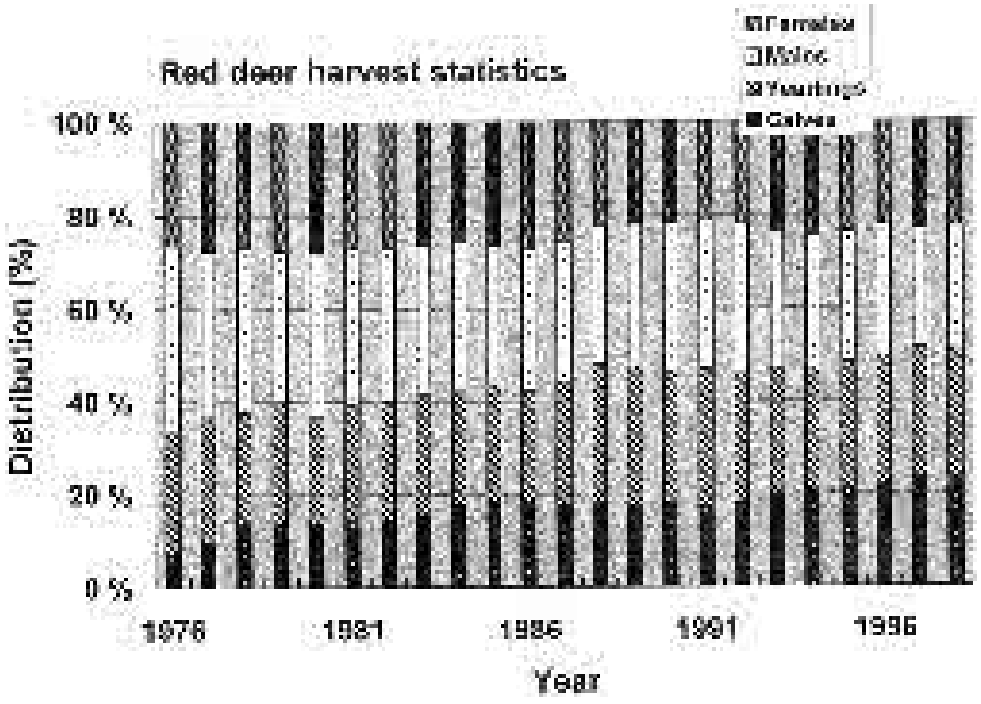
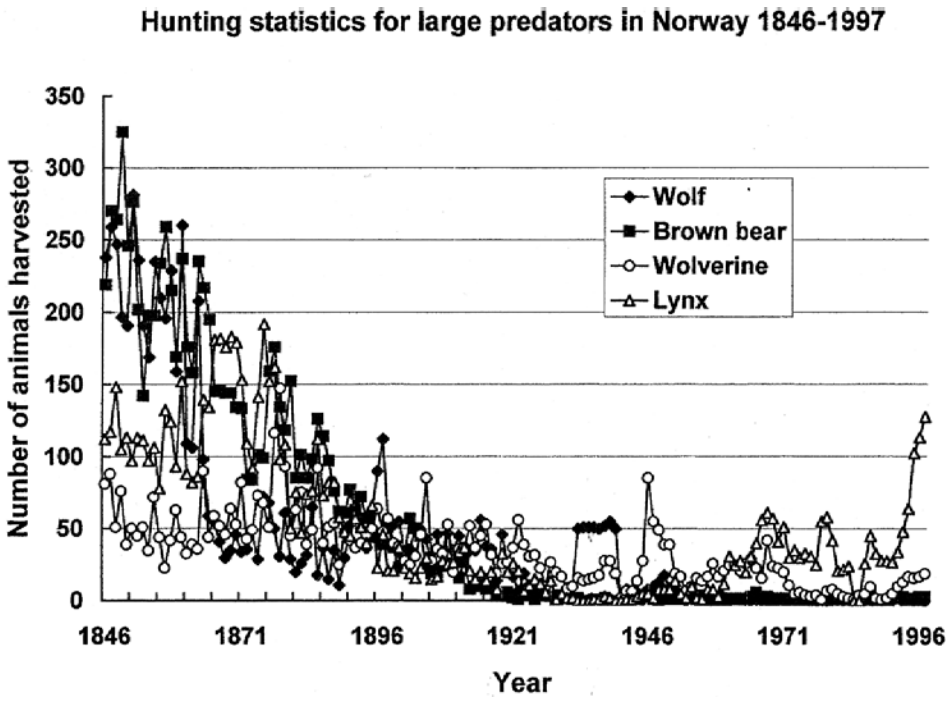


Figure 3 Red deer felled by age and sex (%) 1976-1998 (Official Statistics of Norway).



The near extinction of large predators during most of the 1800 and 1900 century (**Figure 4**) has allowed for a rapid increase of deer populations. The post-war change in forestry and agriculture increased forage for moose, red deer and roe deer. Wild reindeer were little influenced by these changes, but have profited from introduction of animals to previously unpopulated areas (Reimers 1972). Nevertheless, harvest control and management change did have by far the most important population effect.

Figure 4 Harvest of brown bear, wolf, wolverine and lynx in Norway 1846-1997 (Official Statistics of Norway, 1994).



Toward the end of the 20th century, the combined Norwegian cervids number between 350.000-500.000 over-wintering individuals (**Table 7**). This amount is presumably close to carrying capacity assigned on basis of range capacity, forest damage and traffic accidents.

The Large Mammalian Predators

In 1845, law to exterminate predators and protect other game was passed, initiating the decline of the 4 big predators. Before 1845, predator control was encouraged by the bounty system that began in 1730 for wolves and lasted until 1971. At the turn of the century and up to the 1980's, the populations of the 4 big predators were low, and in many districts only stragglers were occasionally encountered. Bears, wolves and wolverines were protected in 1972. However, conflicts with sheep and domestic reindeer interests made this protection less effective. In 1983, the Directorate for nature management was given authority by the State to allow killing of individual wolves, bears and wolverines that inflicted important damage upon husbandry or domestic reindeer. In 1993, lynx was included under the County Governor as management authority. In 1992, the total population of wolves was estimated at 5-10 animals. The recent population increase of big predators is the result of national concern (Stortingsmelding 1992, 1997) and the international concern for the large predators reflected in the signing of the Bern Convention by a number of nations, emphasising the responsibility for protection of all species native to the respective nations.

Presently, bears and wolverines have been assigned so-called nucleus or core areas, in which the various species have their key habitats and natural distribution. In these areas, the predator species enjoy an extended protection, which implies killing of individuals only under very special conditions. Outside these areas, the species are still protected, but individuals may be killed if they cause damage to husbandry or domestic reindeer. For wolves, nucleus areas are not yet organised and await a population growth to 8-10 family groups. While nuisance wolves may be killed in Norway, Sweden has given the wolves total protection; that implies that wolves can not be killed under any circumstance.

In 1999, the total population of the 4 mammalian predators was approximately 1000 individuals (**Table 8**).

Conflicts between big Predators and Cervids and Husbandry

Approximately 2.5 million sheep are released annually in Norwegian outlying fields (Stortingsmelding 1992, 1997). The annual animal loss is 130,000 head. In 1997, the state compensation amounted to 30 million NKr in 1997 for 27,000 sheep lost to protected predators (Unsgård & Vigerstøl 1998). The sheep owners' organisation considered the real loss to be 60,000 sheep. However, this was rejected by the Directorate for nature management on basis of the estimated present number of bears (200), wolves (<20), wolverines (300) and lynx (500). Wolverines and bears are responsible for the majority of losses, while wolves have been of minor importance (<2%) even in the border areas to Sweden in southern Norway during the years 1992-97 (**Table 9**). An annual loss of 5% of the sheep summer population is high, in fact, the highest in the world. This relates to the management practice developed in the country after the predators were hunted to near extinction.

The present low numbers of large predators have a limited effect on the Cervids in Norway. Roe deer is probably the most affected species, with lynx as the most important predator besides red fox (*Vulpes vulpes*). With growing populations of particularly brown bears and wolves, the predation pressure will increase, particularly on moose, but also on wild and semi-domestic reindeer. The present high net increase of moose will decrease, influencing the harvest and economy for the landowners and local communities. Apparently overlooked is wolf predation on dogs, particularly in regard to those used in hunting for moose and hares (*Lepus timidus*).

It will take time and good arguments to change the attitude towards predators in a society that over many centuries has adapted to the utilisation of natural resources free of predators. Without co-operation with our rural inhabitants, we run the risk of protecting the predator populations to extinction because of self-justice. The currently much-used genetic argument behind the protection of the "Norwegian wolves" is not a good one because the wolves presently roaming into our areas are leftovers from the population in our neighbouring countries to the east.

Fragmentation

Man utilises and changes the landscape with an efficiency and strength that is related to technology. Qualified wilderness areas, here defined as areas with a distance of at least 5km to the closest technical development in the form of roads, settlements, hydroelectric development (dams, roads and power lines), have been dramatically reduced during the 20th century (**Figure 5**). For most species, this development means loss of habitat. It also means improved access for the public to previously more or less inaccessible areas, and hence, improved opportunity for control of habitat and wildlife. Good news, provided that the management authorities posses relevant biological knowledge, but mostly bad news if such knowledge is lacking. For the large mammalian species, this development has resulted in habitat fragmentation and changed

area use through reduced use of traditional migration routes. Fragmentation of wild reindeer habitats primarily due to road and railroad crossings in the mountains, is the main reason for the existence of 22 mostly isolated wild reindeer areas (**Figure 6**). In some of the areas, the interior parts containing the winter grazing areas are separated from the western summer grazing areas. Correspondingly, in the forested areas, moose and roe deer habitats are fragmented by road- and railroad traffic that annually takes its toll (**Table 10**). Some measures to counteract fragmentation and traffic accidents are wildlife corridors (Andreassen *et al* 1995; Hobbs 1992) in terms of tunnels and wildlife passages either over or under roads and railroads.

Figure 5 Wilderness areas (in black) more than 5km from technical installations in Norway. Technical installations are roads, settlements, power dams or power lines. Data source: Statens kartverk, Miljøenheten, Direktoratet for naturforvaltning.

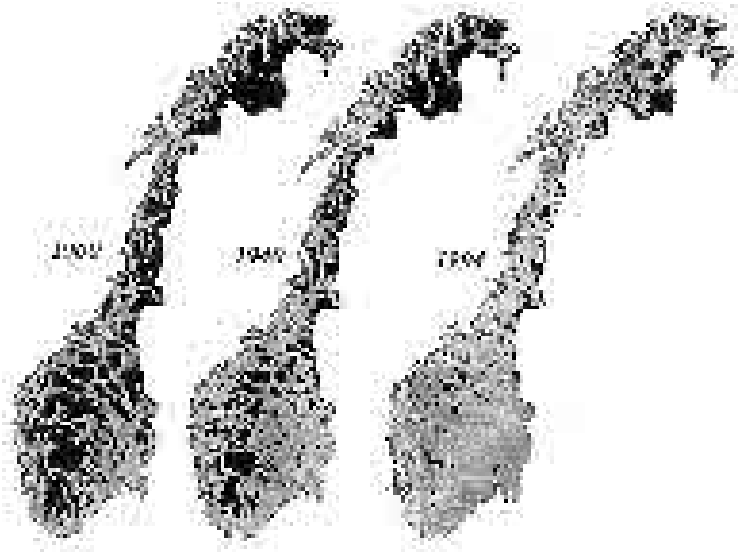
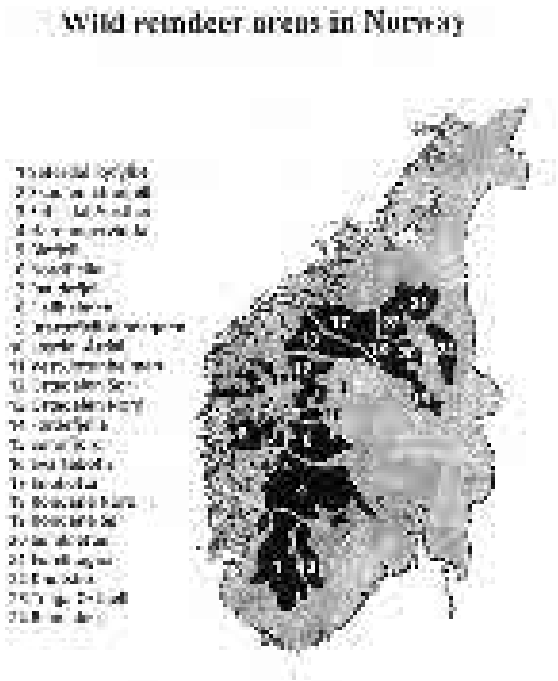


Figure 6 The twenty four wild reindeer areas in southern Norway.



Conclusion

Range manipulation is generally not a management tool in Norway. Populations are managed through strict age- and sex-specific harvests. Populations of large predators are presently managed in relation to sheep and reindeer interests and I think it will be some years ahead before we make those species fully appreciated as members of the Norwegian fauna by the hunting public.

Acknowledgements

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Table 1 The wildlife management authorities in Norway and the year the institutions were established.

Authority	Responsibility
The Ministry of Environment (ME) (1973).	Top authority and the government executive organ. Forms the political guidelines and gives the legislative and budgetary framework for wildlife management.
The Directorate for Nature Management (DN) (1985).	Responsible for the national game management, outdoor recreation, nature conservancy. DN implements the ME's political and administrative decisions. It also co-ordinates, supervises and instructs the county wildlife administration.
The County governors and their Environmental Departments (MVA) (1982).	Responsible for the regional game management. Co-ordinates and supervises the municipality wildlife administration.
The municipality. Replaced the local State game boards in 1993, which had been operative since 1952.	Responsible for the local game management.
Wild reindeer State Boards.	Responsible for the management of the present 24 wild reindeer areas that frequently cover several municipalities and more than one county,

Table 2 The distribution of land ownership in Norway.

(Data from Storaas & Punsvik 1996).

Owner	Area (km^2)	%
Private	115,538	49
State[1]	83,133	35
Statsalmenninger[2]	26,622	11
Bygdealmenninger[3]	6,818	3
Municipality	3,386	1
Total	235,497	99

1 The land is owned and managed by the state through Statskog SF.

2 The land is owned by the state, but the right of use belongs to the local authorities through Fjellstyrene that consists of 5 persons elected by the municipality. Statskog SF carries out the management of moose, red deer and roe deer.

3 The ownership and the right of use are held by certain farms in the various districts. These farms have special rights relating to hunting and trapping.

Table 3 Percentage of landowners distributed in different area categories.

(Data from Storaas & Punsvik 1996).

Area size[1]	**2.5-49.9ha**	**50-100ha**	**➢ 100ha**
Forest owners (%) and their	76	13	11
share of forested areas (%)	23	16	62

[1] The national average is ca. 50ha.

Table 4 Management plans for the populations of Cervids requiring hunting quotas that are age and sex specific (Reimers *et al* 1997).

Moose	Calves[1]		Calves[1]
	Adult (1½ yr+) females	or	Adult (1½ yr+) males
	Adult (1½ yr+) males		Free choice
Red deer	Calves[1]		Calves[1]
	Adult (1½ yr+) males	or	Adult (1½ yr+) males
	Adult (1½ yr+) females		Free choice
	Males with 2 simple antler spikes		
Reindeer	Calves[1]		
	Females (1½ yr+) or Females (1½ yr+/young males (1½ yr))		
	Free choice		

[1] Calves may be killed on any kind of licence. Overkill or shooting the wrong category is violating the wildlife act and is prosecuted as a police case.

Table 5 Monitoring programs for Cervid populations. Number of areas on south-north and east-west gradients.

Species	**Number of areas**
Moose	7
Red deer	3
Wild reindeer	7

Table 6 Cohort distribution (%) in the 1997 harvest (Official Statistics of Norway).

Species	No. of animals harvested	Calves		Yearlings		Adults	
		Males	Females	Males	Females	Males	Females
Moose	36.059	17	16	17	12	22	17
Red deer	21.226	12	11	18	10	25	23
Reindeer	9.179	13	11	11	6	22	36

Table 7 Estimated population size of deer species in Norway.

Species	Winter Population
Moose	100,000-150,000
Red deer	75,000-100,000
Wild reindeer	30,000-35,000
Roe deer	150,000-200,000

Table 8 The estimated populations of brown bears, wolves, wolverines and lynx in 1999 (Miljøverndepartementet 1997).

Year	Brown bears	Wolves	Wolverines	Lynx	Total
1999	200	20	300	500	1,020

Table 9 Fatal injuries on sheep and domestic reindeer caused by big predators and eagles 1992-1998 (Official Statistics of Norway).

Year	Number of sheep compensated							Number of domestic reindeer compensated
	Total	Bear	Wolf	Wolverine	Lynx	Eagle	Unspecified	All predators
1992	11,167	2,144	462	1,972	1,797	509	4,283	2,739
1993	10,632	2,286	No Record	2,638	3,722	439	1,547	2,576
1994	15,186	1,967	279	4,085	5,462	414	2,979	4,240
1995	19,565	1,821	86	5,928	7,943	412	3,375	8,336
1996	23,416	3,138	No Record	7,588	9,862	570	2,258	11,847
1997	26,841	3,172	474	8,305	9,075	736	5,080	
1998	29,704	4,265	436	10,117	9,268	796	4,822	

Table 10 Cervids killed by cars and trains 1987-1998 (Official Statistics of Norway).

Year	Moose		Red deer		Wild reindeer		Roe deer		Total	
	Car	Train	Car	Train	Car	Train	Car	Train	Car	Train
1987/88	742	458	153	4	3	3	1,275	121	2,173	586
1988/89	711	305	196	4	4	0	1,578	54	2,489	363
1989/90	743	219	167	4	4	0	1,478	59	2,392	282
1990/91	884	326	194	7	3	1	2,002	63	3,083	397
1991/92	997	327	271	13	5	0	2,307	120	3,580	460
1992/93	1,418	630	366	10	3	2	3,168	159	4,955	801
1993/94	1,464	1,017	449	12	5	0	3,705	302	5,623	1,331
1994/95	1,111	646	368	6	0	0	2,823	234	4.302	886
1995/96	1,142	508	359	24	1	0	2,927	118	4,429	650
1996/97	1,394	616	502	13	4	0	3,396	117	5,296	746
1997/98	1,085	497	427	16	5	1	2,957	134	4,474	648

Range Management for Red Grouse

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Summary

1. Red grouse (*Lagopus lagopus scoticus (Lath.)*) have declined in many areas of the British Isles – particularly in Scotland and Wales, during the past 115 years.
2. This paper identifies the main reasons for the decline and suggests management changes which would help to reverse this trend.
3. Changes in current vegetation management practices have had beneficial effects on many species other than red grouse and have helped to satisfy wider national and conservation objectives.
4. Changes in the way red deer (*Cervus elaphus*) use the lower hills in summer have resulted in an increase in sheep ticks (*Ixodes ricinus*) and associated louping ill disease.
5. Proposals are made to limit the adverse effects of the conversion of moorland to forest and to maximise grouse yields and the conservation interest of UK moorland.

Introduction

Red grouse (*Lagopus lagopus scoticus*) is the most important bird quarry in the uplands of the United Kingdom, which extend to 6.48m hectares. Of this area, approximately one quarter is dominated by heather and approximately 30% of this is managed grouse moor. Deer forest – some of which is shot-over for grouse – extends to some 1.1m hectares or 23% of upland Britain (Graham Suggett 1999). The pursuit of grouse thus influences land use over large areas of Scotland and Northern England. In some districts, which are marginal for pastoral agriculture and unsuitable for forestry, grouse shooting provides the main, and often the only viable economic activity. Unsubsidised (unlike upland agriculture and forestry) it provides employment and profitable economic activity in places where there are very limited practical alternatives.

Grouse shooting has existed largely unchanged for 120 years. Since the development of the breech-loading shotgun reached its zenith in the last quarter of the 19th Century the perfecting of the breech loader resulted in the development of driven shooting – where birds are manoeuvred towards and over waiting guns who shoot from concealed posts (butts).

This activity reached its climax in the years leading up to the Great War – when large daily and seasonal bags were obtained. Up to 3,000 birds were shot in a single day on a number of moors during this epoch, notably at Broomhead and Abbeystead in England and Drynachan and Langholm in Scotland. On these four, and many other places, these huge bags were founded on the most detailed management of moorland vegetation by fire and grazing animals (Lovat 1911). Since then, bags generally have declined – in some cases to levels where grouse shooting has ceased to be a viable activity. The two questions which have to be asked are – "why has this taken place?", and "is there anything which can be done to reverse the trend?".

Grouse share this large upland area with domestic sheep, cattle and wild red deer. Under the right management system, mammal herbivores assist in the production of large grouse stocks. Large areas of this upland area – particularly in the western half of the country – have lost their heather and useful shrubs have been replaced by grasses of poor value for farm livestock, bracken (*Pterideum aquilinum*) and whins (*Ulex europeus*). The scale of this change can be illustrated by the fact that in 1885, in the county of Argyll, of the 221 estates listed in Hall (1885), 94 were described as shooting grouse in significant numbers and there would undoubtedly have been many more estates which supported them. In the same county today, none of these estates yield bags remotely comparable with 100 years ago, and on all but a handful of them [perhaps 5%] grouse have disappeared as a quarry species. In the county of Sutherland, Hall listed 69 estates, all of which included moorland. On 18 of them, likely bags were described and averaged 720 brace per estate. By 1999, 14 of these estates (78%) shot no grouse at all, three shot a few and on only one was grouse shooting considered to be a significant activity. In contrast, Hall listed 37 estates with grouse in Aberdeenshire. In the 19 cases where likely bags were stated, the average annual bag was 537 brace per estate, and in 1999, only 6 (32%) had ceased to be grouse moors. These losses are attributable to a combination of land reclamation for agriculture and afforestation. Contrary to popular belief, the grouse decline was not triggered by the Great War (1914-1918). In Sutherland, and probably elsewhere, it had begun before that (**Table 1**).

Table 1 Changes in numbers of red grouse and red deer shot on seven estates in Sutherland between 1885 and 1914.

	Grouse [brace]		Stags	
Estate	**1885**	**1914**	**1885**	**1914**
Bighouse	1500-2000	900	0	6
Rhifail	1000-1200	300	"occasional"	12-15
Syre	700-800	400-500	"few"	12-15
Ben Loyal & Ribigil	1100-1200	600-1000	12	12
Borgie	600	700	5-6	5-6
Hope	400	350	0	"occasional"
Kinloch	1000-1200	150	15	45

During the 29 years between 1885 and 1914, grouse shot declined by between 38 and 34% and stags shot increased by between 235 and 281% No data are available for sheep numbers over this period.

Sources – Hall 1885
– Knight Frank & Rutley 1914

The reasons for these changes are many – but are founded on habitat change. The wetter climate of the west and north can disadvantage heather, and injudicious burning practices associated with poor soils and overbrowsing by mammals in winter has accelerated this negative development, whereas grouse habitat on the drier eastern side of Scotland has proved to be more resilient. New farm systems have been developed nation-wide in the past 50 years and these have enabled increased numbers of productive sheep to utilise moorlands (which used to be their sole source of sustenance) by improving "in-bye" ground so that high-quality forage could be made available to them pre-tupping in November and before and during lambing in April. The effects of these increased numbers have been widespread and have, more often than not, assisted in the decline in the dominance and productivity of dwarf shrub heath and the animals which are dependant upon it. Over much of highland Scotland it is impossible to differentiate between the negative effects of declines in burning standards (Hester & Sydes 1992), increases in domestic sheep, the virtual end of cattle as upland grazers and changes in numbers of red deer – which have increased from 150,000 in 1960 to 300,000 in 1989 (Red Deer Commission 1989). It is sufficient to say that these historical changes are in the past – and our task today is to graft on to existing systems the best of the old days and design management practices which are compatible with the maintenance of productive dwarf shrub heath and the wildlife it supports in order to take us forward into the next century.

Changes in Land Use

The decline from the generally high bags of grouse obtained before the Great War to their present levels is most marked in the Northern counties and in the western half of Scotland. The reasons for this are related to:

a) Large areas of grass-dominated heathland which have been planted with exotic conifers (**Figure 1**), have been reclaimed from native vegetation to sown grasses, or have been converted to poor-quality highly acidic grasslands through over-exploitation by high numbers of wild and domestic animals – areas dominated by white bent (*Nardus stricta*) and purple moor grass (*Molinia caerulea*), with bracken on the deeper more fertile and well-drained soils and whins on thinner soils, on drier sites (Mather *et al* 1998);

b) An indirect loss arises from peripheral blight caused by fragmentation. It is very difficult and in some places it may be impossible to create good conditions for upland game in places where islands of potentially good habitat are surrounded by extensive areas of forestry (which often support large predator populations) or overbrowsed heath, together with grasslands which are incapable of sustaining breeding populations of grouse (**Figure 2** and **Table 2**). This damage to and destruction of extensive sweeps of quality managed habitat is of concern to many people beyond the sporting community as it has an effect on non-quarry species such as curlew (*Numenius arquata*), dunlin (*Calidris alpina*) and golden plover (*Pluvialis apricaria*) (Parr 1993) which are of general conservation interest. Such losses may be in breach of the UK's responsibilities towards birds listed under EU Council Directive (1979).

Table 2 Effects of fox predation on grouse bags, revenue and capital value – south Scotland – September 1999.

March Pair Count	Males and females present in equal numbers – ie no spare males
Bird shot on a driven day	
Adult males	29
Adult females	10
Juveniles	25
Bag for day	32 brace [64 birds]
Production	2.5 juveniles per female
If all the females had survived the breeding season, it is predicted that the bag would have been	
Adult males	29
Adult females	29
Juveniles	73
	65.5 brace [131 birds]
Income foregone on this one day due to predation by foxes is 65.5 – 32 = 33.5 brace @ £90/brace = £3,015.	
Capital value of the 33.5 missing brace = 33.5 x £2,500 = £83,750	

These losses have had the effect of reducing productive grouse habitat by a much greater amount than recent workers have recorded. Heather losses vary with district and amount to *ca* 43% in North Ayrshire/ Renfrewshire (Phillips & Watson 1995) and 48% at Langholm, Dumfriesshire (Redpath & Thirgood 1997) with even greater losses of 55% in Galloway (Mackay *et al* 1998). Grampian region in the drier eastern half of the country has lost 25% (Sydes 1988) and this is matched by losses in northern England of 22.5% (Felton & Marsden 1990). Wales has suffered a decline of even greater proportions and there are now hardly any extensive areas of heather moor which are not adversely affected by peripheral blight from forestry or degraded moorland.

Putting this situation right has to be addressed at both the macro- and micro-levels. Strategic decisions on land-use changes can be made at both district level – through regional structure plans which designate areas where there is a predisposition to plant trees, and others where the objective is to maintain areas as open country. At the local (estate) level – an owner may decide to keep more domestic livestock or encourage red deer without restriction – or go through the consultative processes necessary to obtain government grants for the creation of plantation – or native-forests.

By and large, these processes have resulted in piece-meal changes in land use – and have impacted in a negative way. If the remaining areas of quality moorland which support good populations of grouse and other wildlife and which are located in the central and eastern parts of Scotland are to be conserved and maintained, then a more vigorous process of zoning should be put in place – possibly backed by Statute whereby no consents for tree-planting – with its attendant inputs of public money – would be available to

owners. In other places, such as Argyll and Galloway, where the landscape and local economy is already dominated by the forest industry and heavily subsidised and often unprofitable upland agriculture yields very modest profits for farmers, there should be a pre-disposition to encourage land owners and occupiers to plant trees by making available generous grants which cover all the costs of establishment on suitable tree-growing areas (**Figure 3**). Financial pressures are making this happen already – with farms being abandoned because farmers cannot make any money from sheep farming on what have become economically marginal farms. In other areas, land use decisions should be made which reflect more accurately land capability and should be linked more closely with Habitat Action Plans and Regional Forest Strategies. In places – particularly on fertile and base-rich soils which can support productive wildlife habitats consideration should be given to the idea that re-stocking plantation sites where timber has been harvested should not be grant-aided and public money should be channelled towards a programme of re-habilitation of moorland and native vegetation. In effect, the forest industry should be zoned and perhaps even made subject to a quota – in the same way as is done with other primary products such as milk, lamb and beef.

If such a policy was followed, the high-quality moorland landscapes which remain would be safeguarded, the forestry industry would not lose any of its existing acreage and would, through time, concentrate its activities on the more productive timber-growing sites, and the average yield class of the national forest would rise. Opportunities would thus occur which would enable managers to re-create further extensive areas of interest for grouse production and wildlife conservation.

This is a radical suggestion, but the present free-for-all – which has been in place for most of this century – has served the nation poorly. It is important not to ignore the immense sums of public money which have been invested in the National Forest since the Forestry Commission was formed in 1919 and to recognise that it is bad business to fail to examine critically the profit and loss account of the National Forest as well as its impact on other forms of land use.

These suggestions may be criticised in many circles – and the arguments which are put forward by the forest industry in opposition to the existing processes will be based in part on the world shortage of timber and on the poor economic performance of the hill sheep industry over the past 2 years. Many people – both within and without the forest industry – are urging a revision of the nation's policy towards hill sheep farming – both on economic and conservation grounds. Such a position is fallacious. The depressed sheep industry is the result of three factors which are currently working together (Bevan 1999). These are:

1. The strong pound has made the export of lambs to Europe at pre-1997 prices impossible;

2. The retention of increased numbers of productive breeding ewes on low ground has resulted in the market becoming over-supplied with sheep-meat and is a direct product of the depressed state of lowland agriculture;

3. The collapse of the East European lamb skin trade has seriously affected the farm-gate price for lambs.

These situations will right themselves and there is no sound reason for hill farmers in the long-term not to recognise that they have an economic future. The hill sheep industry is inextricably bound up with the conservation and management of uplands for domestic livestock, game and other wildlife as well as the tourist and leisure industry.

If traditional hill farming was indeed to be abandoned over extensive areas, this would have a catastrophic effect on game numbers. If it was allowed to occur, it would pose enormous land use questions and the vacant land would have few plausible alternative uses but afforestation in one guise or another – with all the negative aspects of poor use of taxpayers money. There could be large negative conservation impacts and further ancillary negative effects on landscape quality and the tourist industry generally (currently worth £2,476m in Scotland (1998) (Scottish Tourist Board 1999).

Grazing and Browsing Damage by Hill Sheep

Hill sheep have had a bad press in recent years – and in some locations these criticisms are well-founded (Phillips *et al* 1981, Anderson *et al* 1997). There is no doubt that some sections of the industry have been responsible for a substantial amount of environmental damage – particularly overbrowsing dwarf shrub heath and attendant grant-aided reclamations resulting in substantial and unsustainable increases in sheep density, reliance on imported nutrients to maintain productivity and substantial (and expensive) inputs in prophylactic treatments to maintain that productivity. What is often overlooked by the critics of UK hill sheep farming is that traditional hefted flocks on quality range have always yielded sustainable livelihoods for many people – even in remote and hostile environments – and these critics fail to appreciate that the solution to the current hill sheep problem is not to attack the industry, but to get that industry to go back to its roots and encourage farmers to adopt sustainable traditional management systems. This may involve a substantial shake-out within the industry, but if this can be achieved it will be for the long-term good of that industry and game and wildlife conservation generally.

If we fail to come to terms with this issue, we will further disadvantage the moorland economy. Game management and hill sheep – properly managed – are not mutually exclusive – and this is easy to demonstrate if reference is made to farms and estates where traditional hefted flocks are run on well-managed mosaics of native vegetation (Clark *et al* 1995a; 1995b. J.A. Robertson, I. Lamont, *pers comm*). People who clear sheep completely from an area because of a perceived negative impact by them on the hill environment normally do themselves no favours. Stock reductions on over-used moorland often have the opposite effect to what managers intended. De-stocking is a cornerstone of the ESA and Stewardship Schemes nationwide – and the effects of this are many and have mostly proved negative in terms of maintaining range for game and wildlife. Taking sheep off hill ground has the effect of reducing <u>total</u> utilisation of hill vegetation but as sheep are selective feeders, most stock reductions result in the best sites continuing to be over-used while the worst ones are abandoned altogether. The result is that unpalatable moorland grasses dominate, levels of dead vegetation (mat) increase and can often impede the regeneration of dwarf shrub heath (Todd *et al* 2000) and the result is a predisposition for the build-up of sheep ticks which thrive on under-grazed moorland with much mat (q.v.).

It is abundantly clear that putting sheep off with the intention of improving game performance has to be done carefully and with a grasp of the processes involved or it will be counter-productive. The problem lies in the fact that <u>all</u> hill land can carry far more animals in summer than in winter. Traditionally set-stocked sheep stocks over-use the dwarf shrub heath in the winter and under use the grasses in the summer. Grant *et al* 1996a, 1996b & 1996c showed the importance of adequate defoliation of *Molinia caerulea* and *Nardus stricta* by farm animals in summer in order to reduce their dominance and maintain swards of fine-leaved grasses. If unpalatable and dead material has to be removed, fire is commonly used to rejuvenate the grazing. Wrongly used, this can have a very damaging effect on heather and its dominance and can result in its replacement by plants of little economic or conservation value.

Sheep, Red Deer and Moorland

Because range management for game birds is inextricably tied up with range management for wild and domestic mammals, it is of supreme importance for game managers to comprehend the grazing requirements of hill sheep and red deer.

Traditional sheep farming practices required vegetation to be kept short (Wallace 1917). Shepherds have never sought to have heather longer than 20-30cm (8-12") on sheep-range and have always maintained the vegetation by burning in such a way that the sward available for browsing was short and dense. Burning heather which was morphologically young had the effect of maintaining productive swards which supported and sustained even heavy browsing pressure without long-term loss of heather cover. Shepherds favoured a fire pattern which maintained good browse as a first priority and which made the mobility of the flock and hence shepherding of hefted flocks easier. This tended to result in a fire pattern which was too coarse to support large numbers of grouse and sowed the seeds of discord between farmers and game managers.

Although red deer also have home ranges, their mobility means that these ranges are often very large, so big fires do not seriously limit their performance, although such a policy may be damaging to other wildlife.

Grouse and Moorland

Grouse breeding density and breeding success is related to the quality of the underlying rocks and the management of the vegetation (Picozzi 1968). Grouse require an intimate mixture of heather lengths to exist at high densities and grouse keepers try to burn many small fires to achieve this (Jenkins *et al* 1963, Miller *et al* 1970). Because suitable weather and the availability of manpower may both be in short supply, two things are likely to happen if a commitment to this policy is followed (SNH 1993).

On the one hand, if a small-fire pattern is maintained, the actual area burned may be small in percentage terms and the heather rotation will be extended. This results in heather becoming too long and rank for optimal sheep and grouse performance and when the degenerate heather is burned, it regenerates poorly. On the other, if fire sizes rise – thus maintaining heather dominance and productivity, the coarse mosaic reduces the grouse carrying capacity of a given piece of moorland (Straker-Smith & Phillips 1994). Lovat was in no doubt that it was essential to keep heather young and productive, and his idea of optimal management was a good deal closer to what hill farmers and shepherds required than is currently recognised and is generally the case today – where under-burning is widespread. Burning too few small fires for grouse in the presence of deer and sheep often leads to a reduction in the percentage of heather because the animals concentrate their browsing on these small areas of regrowth and may pressure the shrubs into extinction. They are then replaced by poor-quality grasses, sedges (*Carex* spp.) and mosses. Repeated over decades, the percentage of heather declines progressively and the smaller the percentage of heather on any given piece of moorland, the greater the pressure it will be under from the resident sheep flock or deer herd. It is by this route that so much heather has been lost over the past century.

Aids to Range Management for Grouse

Mechanical

Because manpower is often in short supply, an increasing number of moor managers have adopted innovative techniques to improve the effectiveness of available labour. They employ tractor-driven brush-

cutters to create fire-breaks immediately prior to lighting the fires, and water-sprayers mounted on 4 wheel drive tractors and all-terrain vehicles (ATVs) to control them subsequently. Owners who adopt these techniques find that management standards improve dramatically, and the capital investment is soon repaid in increased revenue from selling grouse shooting. There is scarcely a moor in the United Kingdom that would not benefit from increased investment in this way.

Fiscal Burdens on Grouse Moors

A grouse shooting enterprise can be highly profitable in years of high numbers, but if this is followed by a series of lean years, over a decade the enterprise will be likely to be in deficit. The Scottish Executive is proposing to re-introduce sporting rates which were removed in 1995. This would have a very negative effect on grouse enterprises throughout Scotland. Although the exchequer yield from rates produced £4m from grouse and deer enterprises in its last year, the important aspect about rates is that they are levied on bags retrospectively. Proprietors find themselves paying rates on bags (and revenue) obtained several years before. On account of the cyclic nature of grouse populations, these demands have to be paid in the years following high grouse numbers when revenue may be low or non-existent. It should be recognised that the re-imposition of sporting rates will have a negative effect on moorland conservation generally and grouse numbers in particular, and will result in a decline in job opportunities in the more remote and often economically sensitive areas.

Since the removal of rates in 1995, progressively managed estates have become more confident in the future of game shooting – particularly grouse – and many have invested in machinery and labour to assist with heather management. This has had a highly beneficial effect, and if rates are to be re-introduced this investment in new initiatives will slow up, if not cease and managerial confidence will decline – much to the detriment of rural economies and moorland conservation.

Public Access on Moorland

At a time when legislative proposals are being made to improve public access to open areas nation-wide, many landowners and farmers express misgivings at the prospects of large numbers of people walking on moorland. Their concerns are related to disturbance of farm animals and wildlife, increases in vandalism of shooting butts and lunch huts, increased wear and tear on hill paths possibly resulting in increases in erosion – and possible damage to grouse breeding success if young broods are disturbed – particularly in bad weather. In the Peak District National Park, Pearce-Higgins and Yalden (1997) found that 55.7% of dogs were off the lead and 14% were running wild, despite upgraded bylaws forbidding dogs being off leads, coupled with a major publicity campaign aimed at educating people about the negative conservation and agricultural effects of out-of-control dogs.

All country people are united in their opposition to loose dogs. However, the effect of recreation on game birds is less clear cut. Picozzi (1971) and Watson (1979) showed that grouse bred at the same density and reared young with the same level of success on places used by many people compared with places where public access was low. Watson (1979) showed that ptarmigan responded similarly. However, when public access was high it was found that golden plover were adversely affected by disturbance by people (Yalden & Yalden 1990, Brown 1993). Watson *et al* 1988 recorded very big declines of common sandpiper (*Actitis hypoleucos*) and other waders at Loch Morlich, Speyside and Dutch studies (Hotchin *et al* 1992) showed large declines of many species in places with heavy recreational use.

If public access to moorland was to increase greatly, then the conservation implications for non-quarry species are likely to be much more serious than for grouse. There is danger that uncontrolled and universal access by large numbers of people could damage biodiversity and result in the degradation, if not the actual destruction of the wildlife which many people wish to appreciate when they visit the countryside (Harvey 1998).

The Implications of Current Land Reform Proposals

The larger the block of land under management for grouse, the larger will be the available crop of birds per unit of area. Anything which encourages occupiers to pursue their individual objectives without reference to their neighbours imparts negatively on game and wildlife generally. The examples throughout Europe are many; wild game is scarce in France, Portugal, Greece and Ireland chiefly because the land-holdings are small and the management is fragmented.

The existing structure of land ownership in Scotland and Northern England is of immense importance to the long-term benefit of grouse and wildlife generally and it would be folly of a high order for the fiscal system to be changed in such a way that large estates became unviable. Rural economies would suffer and the very people that politicians seek to help would be the first to suffer from the adverse effects of those policies.

Rehabilitation of Heather Moorland

Further options now available to managers include techniques to convert swards of acid grassland created by past misuse back into productive swards where heather dominates (R. May, G. Eyre *pers comm*). In parts of south Scotland and the North of England, hundreds of hectares have been treated with graminicide, cutting machinery, fencing to control farm animals and the application of heather seed – in combination. Within 3-5 years, the conversion from grassland to dwarf shrub heath can be complete if the correct sequence of events is followed. As these techniques become further refined, so we will have the mechanics for rehabilitation in place and will see the re-creation of good game range and productive sheep walks in places where neither has been present for many decades.

Sheep Ticks and Louping Ill

Sheep ticks were recognised as a serious agricultural pest more than 100 years ago, but it is only in the past 35 years that they have become of widespread importance to game managers.

Ticks can transmit the virus disease louping ill to grouse against which have little resistance to it (Reid *et al* 1978; Hudson *et al* 1995). Low-lying moorland which is under-burned and under-grazed – and so is evolving ecologically towards woodland – favours tick build-up, although trees may be scarce or absent. If mammal hosts, particularly hares (*Lepus timidus*), roe (*Capreolus capreolus*) and red deer, are present in significant numbers in summer – when ticks are active – the circle is complete and tick numbers will rise. The management solution to this problem is to burn the heather on these moors (which are mostly between 250-500m asl) on a short rotation, graze the grasses hard in summer with domestic sheep which are subjected to regular anti-tick prophylactic treatment and reduce the wild hosts to the lowest practical level. The importance of adequate levels of summer grazing by domestic stock cannot be over-stressed, as it is by this route that the mat build-up on the heavily used grassy sites is prevented. In our present state of knowledge, nobody need have ticks on their grouse ground if they have the management of vegetation, sheep and wild mammals in their own hands.

Triggers to recent rises in tick numbers include the decline in hill farming activity, the regulation of sale, use and disposal of sheep dips, the extension of "easy care" sheep ranching systems, and often the abandonment of remote farms. If red deer are present, particularly stags, they may spend many summer days on heathery slopes below 500m above valley grassland onto which they descend to feed at night. When this happens, a tick build-up is inevitable and the performance of grouse and other moorland birds will decline.

Cropping Policies and Cyclic Changes

Cropping policies are not strictly a part of range management, but range management impacts greatly on cropping policies.

Good burning and grazing practices increase the capacity of range of support high game numbers for man to crop. Control of common predators, crows (*Corvus corone*), foxes (*Vulpes vulpes*) and certain mustelids, further increases this standing crop of game.

If man does not compensate for natural predation because of inadequate cropping policies, grouse numbers will ultimately decline. This will be caused either by a reduction in breeding success (density dependence) followed by emigration (Moss *et al* 1996), or mortality *in situ* caused by the strongyle worm (*Trichostrongylus tenuis*) resulting in an outbreak of grouse disease (Hudson 1986) which can reduce very high breeding densities to virtually nothing in the space of a few weeks.

This scourge has been recognised for well over a century (Lovat 1911) and much research effort has been devoted to the topic in the past 20 years – with substantial emphasis on anti-helminth treatments. Referred scientific studies on the effectiveness of the technique are scant. The results of these prophylactic treatments are mainly anecdotal, and there are as many examples of treatment having yielded no benefit whatever as there are where survival of birds appears to have been improved.

Because the disease is transmitted from grouse to grouse by larvae which crawl up heather shoots where they encyst and may be eaten subsequently, anything which physically separates worm eggs from proximity to feeding heather reduces the parasite's success. Managers and keepers have known for many years that grouse choose to roost on the barest ground available to them – be it a sheep-path, finely grazed turf or a recently burned area. As most of the worm eggs are voided in the caecal droppings which the bird excretes as soon as it becomes active at dawn, the presence of many recently burned fire sites (which carry no food plants) result in the physical separation of eggs (and the resultant larvae) from food and so potential host birds. While well-burned moors may suffer from disease outbreaks, it is unusual for the decline in numbers to rival that experienced on less well-burned sites, where reductions in breeding populations of the order 90-100% can be recorded in a major outbreak, such as occurred on some moors in Scotland in 1999.

Shooting policies also serve to control worm build-ups. This is often admitted by sportsmen who will explain a "disease" year by saying that "too many birds were left on the ground last year."

The control of disease therefore lies in population limitation. There are a number of examples of moors which produce consistent bags over many years. On these places shooting is hard in years of high production and is less in years when fewer young are produced but shooting at some level takes place every year. Managers of such moors are sufficiently professional to know well in advance what kind of season is in prospect, so that the correct crop is assessed and the shooting programme is geared up to achieve that crop.

Grouse Groups

One technique which could help to dampen down the large cyclic changes in populations of grouse would be for neighbouring estates on a district basis to pool their knowledge annually and arrive at a consensus with regard to shooting pressure and predicted bag.

While this may be difficult to achieve in practice, the same was said twenty years ago when Deer Management Groups were first mooted and the Association of Deer Management Groups is now a key player in the matter of red deer management and control.

The widespread disappointments of the shooting season in 1999, when many moors cancelled all their shooting after good seasons in 1997 and 1998, had the seeds of the disaster sown in 1997 (and in some cases even in 1996) when good grouse production caught managers unaware, so that they did not shoot enough birds that year. Many managers were concerned to leave a good stock, in some cases this was done "to feed the raptors" and ensure adequate stock for the subsequent season in the face of that challenge. Undercropping in 1997 resulted in high breeding densities in 1998 – with many cases where stocks were much higher than the moors could safely carry and still produce many young. Density dependence caused fewer young/hen to be reared that year compared with 1997. Many moors killed very large – even record – bags in 1998 but bag analysis at that time showed very poor ratios of young per hen – thus presaging a decline in 1999 when spring stocks were often made up of a majority of 1997-bred birds which carried high worm burdens and a minority of "maiden" 1998-bred birds. A moist, mild autumn in 1998 provided exceptionally favourable conditions for worm transmission among an undercropped population of old and young birds alike, and the resulting crash was as inevitable as it was probably avoidable, particularly as it was predicted (Anon 1997, 1998). What has been a feature of the 1999 outbreak is the number of moors which were carrying modest stocks which suffered. Not only the high-density moors crashed; moors carrying a moderate density of infected birds still experienced widespread chick and sub-adult mortality which was attributed to high worm numbers.

Many managers fail to appreciate that any piece of moorland has a finite carrying capacity, whether for hill sheep or grouse. No hill farmer with 1,000 ewes on 3,000 acres (1,400ha) keeps his cast ewes for an extra year or two and allows his stock to build up to 1,500 animals and expects the flock performance to stay the same as it was at a lower density. From experience, he knows the hill carries 1,000 ewes and if he maintains the stock at that level he can expect a consistent lambing – varying between relatively narrow limits according to season. Why should grouse be any different? Managers overlook this fact at their peril.

Conclusion

The Way Ahead

Despite the many problems which face owners, managers and game keepers, game management and grouse shooting has a great future in Scotland and the north of England because:

1. It is indisputable that game management and hill farming are complementary, provided both parties appreciate each others needs and accept that high levels of management have to be applied if both are to realise their potential;

2. Ultimately, subsidised hill farming and forestry are economically unsustainable – facts which are partially addressed by the current Agenda 2000 initiatives designed to implement the CAP reforms – 1999. Hill managers who understand game management and put into practice the well-proven techniques to create good conditions for game and other upland wildlife will reap a rich and consistent harvest from this (unsubsidised) activity provided they address management problems with knowledge and vigour;

3. Upland game management and game harvesting is a "green" activity which can and should be sold as such to the general public. In order to do so successfully, managers have to put their houses in order and carry out high-quality traditional management within the law;

4. Dogmatic and outdated political credos fail to take account of realities of life in economically fragile and highly vulnerable communities. Game shooting has a vital part to play – provided the shooting fraternity adopt a less confrontational stance on issues such as raptors and public access. If they fail to do so, opposition to legitimate game management and grouse shooting will increase;

5. Current proposals on land reform and the re-introduction of sporting rates will both be likely to have a damaging effect on range management and hence the conservation of UK wildlife generally and grouse shooting in particular;

6. The need to rekindle a spirit of confidence and implement competent management on places where both have disappeared is an important requirement for the next century and resources should be devoted to the creation of demonstration moors which represent biogeographic zones – so following in the footsteps of the initiatives of The Heather Trust.

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Figure 1 Grass-dominated heathland planted with exotic conifers.

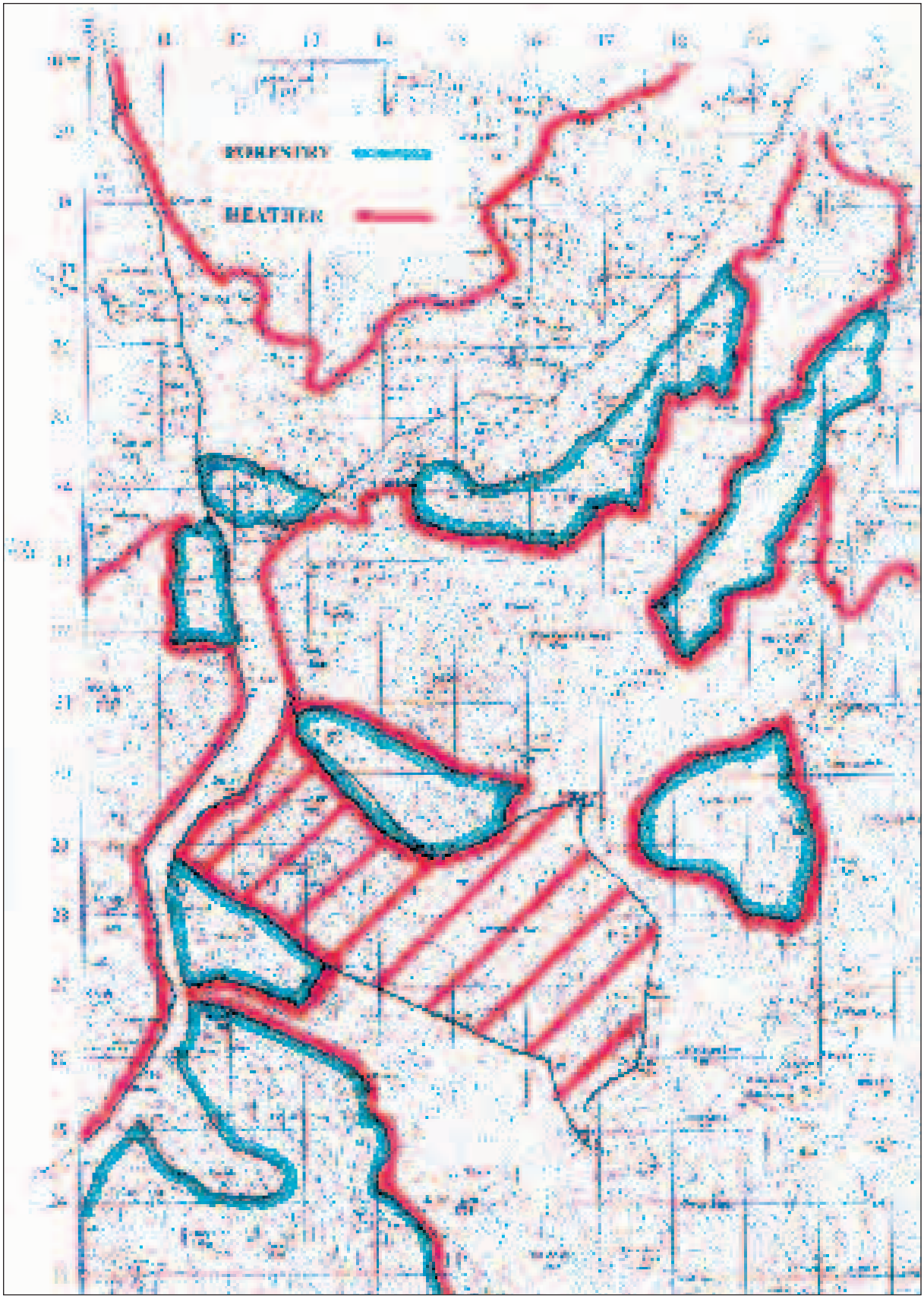


Figure 2 Extensive forest areas supporting large predator populations.

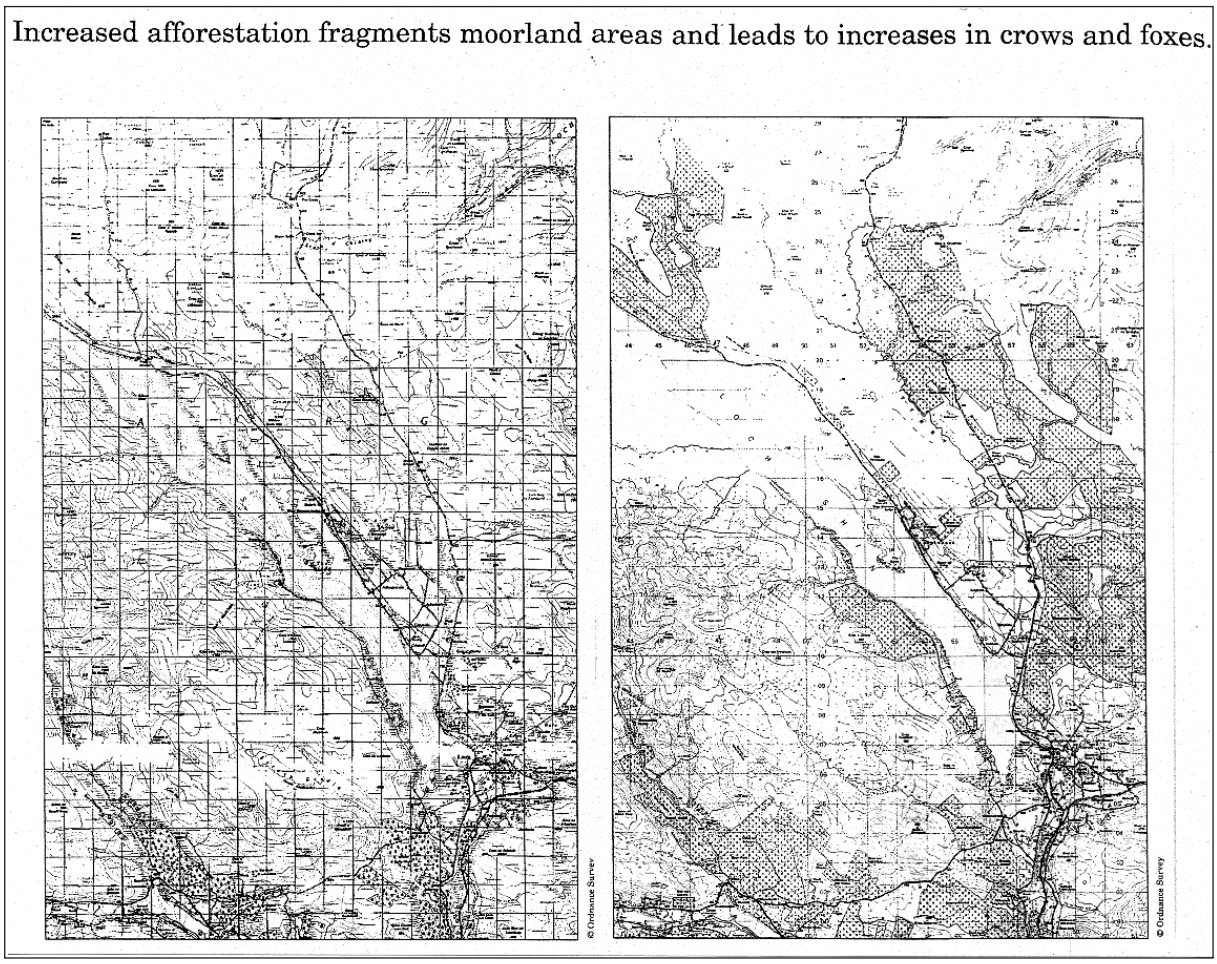
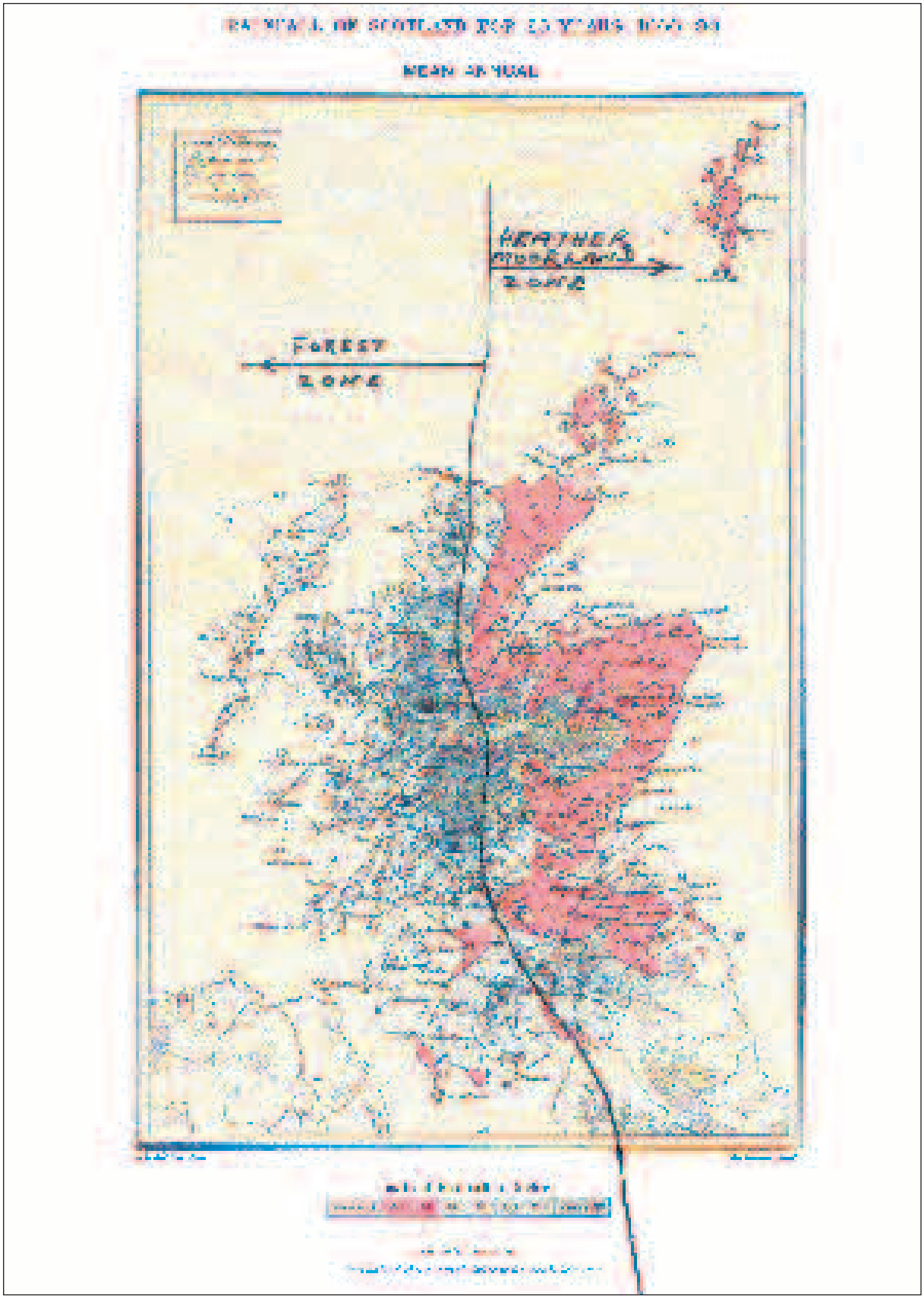


Figure 3 Suitable tree growing areas.



Range Management for North American Grouse

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Summary

1. Ten species of grouse are native to North America; four of them generally are considered rangeland species. These rangeland species have experienced population declines over the last two or three decades.
2. Range improvement techniques are parts of modern range management and gradually are being adopted in North America. Range conditions are better now than in the early 1900s. Management programs are designed to improve livestock production on rangelands.
3. Range management and improvement techniques include grazing, controlled burns, chemical applications, mechanical alterations, and seeding.
4. Application of certain range-improvement and management techniques commonly produce habitat conditions that are suboptimal for grouse species and generally are detrimental to native grouse populations. Establishing economic values for grouse might stimulate range management programs beneficial to grouse populations.

Introduction

Ten species of grouse (subfamily *Tetraoninae*) are native to North America (American Ornithologists' Union 1998), and four of these occur in what generally is considered rangeland habitat (includes shrublands, steppes, and grasslands). These four species (the sage grouse, *Centrocercus urophasianus*; sharp-tailed grouse, *Tympanuchus phasianellus*; greater prairie-chicken, *T. cupido*; and lesser prairie-chicken, *T. pallidicinctus*) originally inhabited vast areas of rangeland in North America, primarily in the midwest and west.

The westward expansion of civilization and droughts caused deterioration of over 75% of the North American rangelands by the 1930s (U.S. Forest Service 1936). However, research combined with regulated livestock grazing has rehabilitated much of those rangeland resources (Heady & Child 1994). Most range improvements have been focused on increasing the ability of rangelands to support livestock. Unfortunately, less effort has been devoted to developing techniques required to restore the suitability of deteriorated rangelands for native grouse populations. Therefore, wildlife biologists commonly use livestock-oriented techniques in their limited efforts to enhance rangeland habitat for grouse.

This paper will:

1. summarize the current population status of each of the four North American rangeland grouse species;
2. review the effects range management practices have on rangeland grouse habitats; and
3. assess the impacts range improvement programs have on rangeland grouse populations.

Grouse Population Status

Sage Grouse

Sagebrush (primarily *Artemisia tridentata*) is the principal food of sage grouse (especially during winter); therefore this grouse is found in the northwestern United States where sagebrush is abundant on rangeland (Aldrich 1963). Sage grouse have been extirpated from the periphery of their original range, and populations in their current range have been reduced greatly in numbers (Braun *et al* 1994). These declines in sage grouse populations have been associated with expanding rowcrop agriculture, overgrazing by livestock, and modifying sagebrush stands to benefit livestock (Dalke *et al* 1963).

The negative impacts on sage grouse of overgrazing and altering sagebrush habitats include impaired productivity (Crawford & Lutz 1985), increased nest losses to predators (Crawford *et al* 1992), and reduced food sources for hens (Barnett & Crawford 1994) and chicks (Drut *et al* 1994). Positive impacts of altering sagebrush habitats include improved nutrient quality of sagebrush (Remington & Braun 1985), reduced predation and enhanced nesting success (Gregg *et al* 1994), and improved nesting habitat from changes in amounts of grass (DeLong *et al* 1995) and forbs (Dunn & Braun 1985, 1986) in the sagebrush community. Several range management techniques are available to improve sagebrush stands for sage grouse.

Sharp-Tailed Grouse

Sharp-tailed grouse are found from the Great Lakes region of the United States westward and northwestward through Canada and Alaska. Several subspecies and races are recognized (Edminster 1954, Aldrich 1963, Johnsgard 1983), and their habitats include brush grasslands and hills, oak savannas, edges of riparian woodlands and sagebrush rangelands, and muskegs and bogs. Sharp-tailed grouse still occupy extensive areas but have experienced population reductions rangewide and restrictions at the western and southern peripheries of their historic range (Braun *et al* 1994). Most population reductions and decreased ranges of the sharp-tailed grouse have resulted from agricultural expansion, intensive grazing by livestock, and fragmentation of suitable habitat by human activities.

Excessive livestock grazing and herbicide spraying of rangeland removes nesting and brood cover (Kessler & Bosch 1982) and may reduce nest success (Giesen & Connelly 1993). Burning of rangelands can contribute to nest losses (Yocom 1952) but also prevents the invasion of sharp-tailed grouse habitats by undesirable tree species (Giesen & Connelly 1993). Mechanical alteration of sharp-tailed habitat can be extremely beneficial (McArdle 1977) or very detrimental (Giesen & Connelly 1993), depending on frequency and timing.

Greater Prairie-Chicken

Three subspecies of this grouse are recognized (Aldrich 1963, Johnsgard 1983). The heath hen (*Tympanuchus cupido cupido*), formerly found along the east coast of the United States, became extinct in 1932. The Attwater's prairie-chicken (*T. c. attwateri*) is endangered (U. S. Fish and Wildlife Service 1983) and restricted to isolated areas along the Texas coast. The wild population of Attwater's prairie-chicken now numbers less than 100 birds (Morrow 1999), and I am not optimistic that efforts being made to maintain the population through releases of captivity-reared birds will be successful. The greater prairie-chicken (*T. c. pinnatus*) had, and still has, a wider distribution than either the heath hen or the Attwater's prairie-chicken. Historically, the greater prairie-chicken ranged across the tallgrass prairies of North America from

eastern Texas northwestward to Alberta and northeastward to Michican and southern Ontario (Aldrich 1963). It has been extirpated or very much reduced in numbers over much of its range, and was numerous enough in only three states (Kansas, Nebraska, and South Dakota) to be hunted legally during 1998.

Conversion of the tallgrass prairie habitat to intensive agriculture is the primary cause of declines in the greater prairie-chicken population across its original range (Schroeder & Robb 1993). This conversion over much of the midwestern portion of North America greatly reduced or degraded the nesting habitat of greater prairie-chickens and negatively impacted their populations (Christisen 1969, 1985). Predator populations also reduce nesting success of greater prairie-chickens (Lawrence 1982). Other factors reported to negatively affect the numbers of greater prairie-chickens include hunting isolated populations (Hamerstrom & Hamerstrom 1973); reduced insect availability for broods because of pesticide use (Flickinger & Swineford 1983); and interspecific competition with ring-necked pheasants (*Phasianus colchicus*) (Vance & Westemeier 1979, Westemeier 1986, Westemeier *et al* 1998b).

Management of greater prairie-chickens has focused on hunting restrictions (Schroeder & Robb 1993); predator control (Lawrence 1982); removal of ring-necked pheasants (Zewadski 1977, Westemeier 1988); alterations of grazing practices (Chamrad & Dodd 1972, Horak 1985, Eng *et al* 1988); translocations of birds (Toepfer *et al* 1990, Hoffman *et al* 1992, Westemeier *et al* 1998a); creation of food sources (Horak 1985); prescribed burning of grasslands (Chamrad & Dodd 1972, Westemeier 1972, Horak 1985); and establishment of preserves (Christisen 1969, 1985, Schroeder & Robb 1993).

Lesser Prairie-Chicken

Of the four species of North American grouse inhabiting rangelands, the lesser prairie-chicken has the most restricted distribution (Aldrich 1963, Johnsgard 1983). It is found in rangelands dominated primarily by sand sagebrush (*Artemisia filifolia*) or shinnery oak (*Quercus havardii*) and bluestem grasses (*Andropogon* spp.) in eastern New Mexico, southeastern Colorado, western Oklahoma, the Texas panhandle, and southwestern Kansas. Even though this area of the Southern Great Plains is populated sparsely by humans, their activities have had a severe impact on lesser prairie-chicken populations. Intensive livestock grazing and conversion of native rangelands to cropland coupled with recurrent droughts have reduced lesser prairie-chicken habitat by 92% and populations by approximately 97% rangewide since the 1800s (Crawford 1980). Lesser prairie-chicken populations are now fragmented and isolated over much of their original range (Giesen 1998), and the species was petitioned in 1995 for listing under provisions of the Endangered Species Act (Mote *et al* 1999). The U.S. Fish and Wildlife Service determined that listing the species as threatened was warranted, but precluded (Clark 1999). Among the five states in which lesser prairie-chicken populations existed, only Texas and Kansas permitted hunting them in 1998.

Attempts to increase lesser prairie-chicken numbers have included additional restrictions on hunting, providing artificial sources of water and food, and translocating birds. None of these efforts has increased populations significantly (Giesen 1998). Most habitat improvement efforts have focused on brush control (Donaldson 1969, Doer & Guthery 1980, Olawsky & Smith 1991) and increasing density and cover of native grasses and forbs for nesting, brood-rearing, and loafing cover by protecting small areas from livestock grazing (Hamerstrom & Hamerstron 1961, Hoffman 1963); however, beneficial results from these efforts have not been documented yet. The Lesser Prairie-Chicken Interstate Working Group, composed of representatives of the U.S. Fish and Wildlife Service and the five states having lesser prairie-chickens, is attempting to implement a conservation plan for this species (Mote *et al* 1999).

Range Management Practices

Management of rangelands generally is accomplished using one of five approaches: grazing, controlled burns, chemical applications, mechanical alterations, and seeding. These five approaches seldom are incorporated independently, eg chemical treatments are combined with modified grazing programs, mechanical alterations often are followed by reseeding grasses, and so on. Range management is a complex discipline combining science with common sense. A successful range manager must interact continuously with a constantly changing rangeland ecosystem, while responding to current and future economic constraints and opportunities. Government policies, regulations, programs, and public opinion often will dictate short-term decisions that may be counter to known, long-term, scientifically correct decisions, but such is the situation in which range managers in North America must operate whether working on private or public lands.

Range managers strive to manipulate rangeland vegetation in such a way that it maximizes the sustained yield of grazing animals. Because domestic animals generally are the grazers with the highest economic value in North America, range managers concentrate on maximizing the production of cattle, sheep, goats, and other commercial livestock. Wildlife populations on most managed rangelands are incidental byproducts of livestock management, and in the case of some big game animals [eg deer (*Odocoileus virginianus* and *O. hemionus*), elk (*Cervus elaphus*), pronghorn (*Antilocapra americana*), etc.], can negatively impact production of the livestock for which management programs are designed. Seldom are range management efforts devoted solely to benefit wildlife species.

Grazing

People not well versed in the art/science of range management often look at grazing in a simplistic fashion, ie they consider only the number of domestic animals stocked on a specific parcel of rangeland over a given period of time. The use of grazing as a range management technique is far more complex than simply the stocking rate of grazing animals. The number of animals on a piece of rangeland for each year or grazing season is defined as the "stocking rate" and is expressed as standard livestock units or animal units. The impact of a specific stocking rate on rangeland vegetation varies with factors such as the amount and type of herbage present, productivity of the plants, season of use, and type of grazer. The relationships between the range resource and the stocking rate are complex and not appreciated fully by most biologists interested solely in a specific wildlife species.

Extensive research has been conducted by range scientists in North America to determine the "proper utilization" of most rangeland forage species. Proper utilization is the maximum point of defoliation that continues to maintain desirable range productivity (Heady & Child 1994). Proper utilization of most rangeland vegetation results in average stubble grass heights ranging from 3 to 10cm (for *Buchloe dactyloide* and *Agropyron smithii*, respectively). Heavy stocking rates would reduce the average stubble height, and light stocking rates would result in taller stubble heights. Generally, these stubble heights are shorter than optimal for grouse habitat.

Vegetation heights of good nesting habitat range from 37 to 55cm for lesser prairie-chickens (T. Walker, Kansas State University, unpubl. data) and 20 to 29cm for greater prairie-chickens (Horak 1985) in Kansas; 25 to 70cm for those two species in Oklahoma (Jones 1963); 18 to 51cm for sage grouse in Colorado, Wyoming, Montana, and Idaho (Dunn & Braun 1986); and >25cm for sharp-tailed grouse in Idaho

(Giesen & Connelly 1993). Similar heights of vegetation cover are needed for good brood range, day and night roosting, and winter cover.

These vegetation heights needed by grouse all exceed the heights commonly associated with proper utilization of rangelands by livestock. Therefore, management programs designed to benefit grouse of the open range must include stocking rates well below the level generally considered "proper". For the livestock producer, these lower stocking rates equate to economic losses and are difficult for wildlife managers to implement.

Declines in grouse populations as a result of overgrazing have been reported widely (eg Klott & Lindzey 1990, Marks & Marks 1988, Giesen & Connelly 1993, U.S. Fish & Wildlife Service 1992, Schneegas 1967). Localized reductions in grazing pressure benefitted localized populations of greater prairie-chickens in Missouri (Drobney & Sparrowe 1977), but no large-scale experiments have been conducted to monitor the responses of grouse populations to reduced grazing pressure by livestock.

Controlled Burning

Use of fire as a silvicultural tool in the pine (*Pinus* spp.) plantations of the southeastern United States has been common since the 1920s; however, a cautious attitude towards the use of fire as a management practice prevailed in much of North America until recent years (Heady & Child 1994). Use of prescribed burning to manipulate rangeland vegetation gained favor in the 1980s because of increased knowledge of fire and its low cost compared to other range management techniques. Controlled burns are used primarily to:

1. alter vegetational composition of rangelands;
2. increase the quality and quantity of livestock forage; and
3. decrease litter to reduce hazards from wildfires.

Relative to wildlife on rangelands, prescribed burning is used primarily to alter vegetation composition and structure. Controlled burns are used to constrain or eradicate sagebrush in the western and northwestern states; to reduce invasion by woody species of tallgrass prairie on the Great Plains; and to open up stands of mixed shrub/grass communities in the northern Midwestern states. Fire used efficiently can reduce stands of sagebrush, easily kills some woody species invading tallgrass prairie, and reduces woody cover in mixed grass/shrub complexes. Because fire is a low cost and highly effective range management tool, it has become quite popular for the management of wildlife habitat in North America.

Small-scale controlled burns in extensive stands of dense sagebrush have increased nest success of sage grouse when the heights of grasses that replace sagebrush were allowed to exceed 18cm (Gregg *et al* 1994, DeLong *et al* 1995) and the forb canopy cover increased (Dunn & Braun 1986). However, sage grouse require sagebrush habitat during every stage of their life (Patterson 1952), and widespread conversion of sagebrush rangeland to grassland for livestock grazing has led to the loss, degradation, and fragmentation of that habitat across much of the original sage grouse range (Braun *et al* 1977).

Sage grouse require a minimum of 15% sagebrush canopy cover with a height of 36 to 70cm (Wallestad & Pyrah 1974). Most sagebrush species do not root-sprout and are killed easily by fire. Burned sagebrush stands require at least 15 to 20 years to reach preburn densities and heights (Bunting *et al* 1987), and

severe fires can double the re-establishment period. Costs of burning decreases with increasing size (up to 500ha); therefore, burning large tracts of land has become a common range management strategy. The combination of a program of large planned burns coupled with wildfires has resulted in a significant reduction in the expanses of sagebrush stands needed for healthy sage grouse populations in North America.

Conversely, burning of sharp-tailed grouse habitat generally is a useful management tool for opening dense stands of sagebrush and creating an interspersion of grass and shrub cover for these birds (Giesen & Connelly 1993). Several studies have documented beneficial impacts of burning sharp-tailed grouse habitats (eg Rogers 1969, Oedekoven 1985), especially where conifers invade bunchgrass-prairie habitats. In these instances, fire is being used to stop or set back the progression of ecological succession. The beneficial impacts of fire on sharp-tailed grouse habitats are influenced by vegetation type, timing, frequency, intensity, and size of burn.

In the Midwest, periodic fire is necessary to maintain the little remaining tallgrass prairie. Without fire, these grasslands are invaded by woody species (Owensby 1994). Prescribed burns in the spring every 3 to 5 years following 2 or 3 years of successive burning are sufficient to control the invasion by woody species. These burns also increase the nutrient quality of rangeland vegetation for livestock, thereby elevating livestock gain rates by 10 to 15%. This increased livestock production has encouraged annual burning of tallgrass prairie, and the more frequent burning has detrimental impacts on nest success of grassland birds (Robel *et al* 1998). Annual spring burns are thought to be involved in declines of greater prairie-chicken populations in Kansas (R. Rodgers, Kansas Department of Wildlife and Parks, *pers. comm.*).

Chemical Applications

Since 2,4-D and 2,4,5-T were released for general use shortly after the end of World War II, many different chemical compounds have been formulated to kill herbaceous vegetation (herbicides) and applied worldwide. Herbicides are sprayed across rangelands in North America primarily to reduce woody species, poisonous plants, cropland weeds, and herbaceous plants competing with grasses. In 1977, the U.S. Environmental Protection Agency suspended uses of 2,4,5-T on rangeland, and this spurred the development of safer herbicides that could be incorporated into management programs for pastures and rangeland. Of the many herbicides currently available, only a few are used extensively on rangelands in North America, namely; 2,4-D, picloram, clopyralid, tebuthiuron, glyphosate (Round-up), dicamba, and triclopyr.

Herbicides are applied to rangelands in liquid and granular forms and from ground surface and aerial sources. Proper application of herbicides to produce the desired control of vegetation requires a great deal of knowledge, care, and planning. Used properly, herbicides can be very effective tools for the management of rangeland, ie they are selective, safe, inexpensive, and generally short-lived.

Herbicides have been used to control sagebrush on rangelands of the western and northwestern states of North America. When properly applied, 2,4-D or tebuthiuron, alone or combined with other herbicides, produce a 70 to 100% kill of sagebrush (Carr & Glover 1970, Johnson *et al* 1996). Although killing sagebrush to increase grass production for domestic animals has proven economically successful for the livestock industry, such practices sometimes prove detrimental to sage grouse populations. Dense stands of sagebrush are required by sage grouse during winter (Homer *et al* 1993), but not in the reproductive season (Johnson & Braun 1999). Where herbicide treatments cover less than 15% of the area (in patches or strips), or where chemical control is designed to kill less than 20% of the sagebrush plants, the modified habitat can

result in increased sage grouse nest success and brood usage. However, large-scale programs designed to convert sagebrush rangeland to grasslands have been generally detrimental to sage grouse populations in North America. The Western States Sage Grouse Committee developed a set of guidelines to reduce the adverse impacts of sagebrush control on sage grouse populations (Braun *et al* 1977), but the guidelines are not always followed.

Use of chemicals to open up dense stands of shrub/grass complexes for sharp-tailed grouse have not proven too successful. The herbicides are effective in reducing canopy cover of woody vegetation but also kill broad-leafed herbaceous vegetation needed by the birds and invading grasses retard the recovery of the forbs (Snyder 1997). Additionally, herbicide spraying of sharp-tailed habitat causes a loss of nesting, brood, and winter cover because of detrimental impacts on deciduous shrubs (McArdle 1977, Oedekoven 1985, Klott 1987). In general, use of herbicides is not recommended for management of sharp-tailed grouse habitat (Giesen & Connelly 1993).

Because other management methods (eg grazing, burning, etc.) are better suited than herbicides for modifying vegetation composition and structure in tallgrass prairie habitats, chemical controls have not been used extensively to manipulate greater prairie-chicken habitats. The habitat for the lesser prairie-chicken is "brushy" vegetation (Copelin 1963). In the shinnery oak habitat of New Mexico, a reduction of the oak basal cover to less than 50% resulted in increased nest success if grass height was maintained at >30cm (Riley *et al* 1992). In this habitat, lesser prairie-chicken broods tend to avoid dense stands of shinnery oak. Although the oak stands can be controlled with herbicides, it is a very costly process. Moderate grazing of the grassland habitat appears to be a better management approach than trying to chemically control the woody vegetation.

Sand sagebrush prairie is the primary habitat of the lesser prairie-chicken in southwestern Kansas. Periodic chemical treatment of this habitat increases livestock forage production. State and federal agencies recommend treating sandsage habitat in strips or small blocks to create a mosaic of vegetation communities beneficial to lesser prairie-chickens. The adverse impacts on wildlife of large-scale herbicide treatments of sandsage habitat are well documented (Rodgers & Sexson 1990, Jackson & DeArment 1963).

Mechanical Alterations

Large-scale mechanical control of woody plants on rangeland is history in North America. It began after World War II and essentially ceased by 1980. The Journal of Range Management is the official journal of the Society for Range Management. Between 1980 and 1991, this journal did not include even one paper dealing with mechanical control, although it contained papers referring to results of earlier treatments. The high costs of machinery and its operation and the short time until the treatment needs to be repeated have all but eliminated mechanical control as a management technique on extensive rangeland (Heady & Child 1994).

Tractors and bulldozers with front-mounted blades or root-plow blades behind were used to clear heavy brush and trees from rangelands. Some of the machines were huge and complex (Abernathy & Herbel 1973) and very costly and environmentally damaging. Two tractors or bulldozers dragging a heavy chain between them were used widely in the 1950s and 1960s, and the method was quite effective at controlling some woody vegetation on rangelands. Brushland disks and gangs of disks of various sorts still are used to remove woody vegetation from rangeland but only to convert limited areas to agricultural cropland. Today, "the cost of applying mechanical plant controls to large rangeland areas is beyond any hope for a profitable return" (Heady & Child 1994:319) and therefore the approach is no longer used on a large-scale in North America.

Seeding Rangeland

Rehabilitation of rangelands by seeding has been used for over a century. The literature is more extensive for this technique than any other range management practice. Seeding and reseeding trials have provided a wealth of information for the range manager (Laycock 1982). Originally, seeding was done primarily to increase the carrying capacity of rangeland for domestic livestock. However, the goals now also include prevention of soil erosion, re-establishment of native grass stands, rehabilitation of areas ravaged by wildfires, and control of invading weed species.

Seldom is seeding initiated in isolation. It generally follows or is an integral part of other range management practices like altered grazing schedules, prescribed burns, chemical treatments, and/or mechanical alterations. Sites selected for seeding are commonly the better sites (eg adequate moisture, fertile soil, etc.), because they are more likely to be successful. Abandoned cropland has great potential for conversion to rangeland via seeding.

The grasses selected for seeding rangeland depend on soil type, moisture available, slope, and competing vegetation on the site and the type of grazer and season of use anticipated. Each species of grass has its specific requirements, so no single species is suitable for use across all the rangelands of North America. For example, crested wheatgrass (*Agropyron cristatum*) works well in the Northern Great Plains; several of the gramas (*Bouteloua* spp.), western wheatgrass and sand dropseed (*Sporobolus cryptandrus*) are used widely in the Southern Great Plains; several species of *Agropyron*, *Festuca*, and *Poa* are favorites for the Northwestern Sagebrush rangelands; and the list goes on – different species for different regions. Seeding with mixtures of grass species has become more common in recent years and generally is more successful than seeding single species (Heady & Child 1994).

With few exceptions, seeding efforts are designed to increase forage production for domestic livestock. The resulting vegetation stands have often been grass monocultures with limited benefits for rangeland wildlife. Neither sharp-tailed grouse nor greater prairie-chickens were attracted to rangeland areas in Colorado renovated by interseeding warm season grasses (Snyder 1997) possibly because of a lack of food sources for the birds. Giesen and Connelly (1993) stressed the need of vegetation diversity (shrubs, grasses, and forbs) in suitable habitat for sharp-tailed grouse, and the grass monocultures created by seeding do not satisfy this requirement. Numerous other researchers have reported the need for diverse vegetation in habitat for grouse on rangelands (see Klott & Lindzey 1990, Robel *et al* 1970, Klebenow 1969, Oedekoven 1985, Marks & Marks 1987, Mote *et al* 1999). Seeding efforts to renovate rangelands seldom produce such vegetation complexes. With rare exceptions, rehabilitation of most rangeland by seeding has afforded few benefits for rangeland grouse.

Overall Impacts of Range Improvements on North American Grouse Populations

Western rangelands occupy approximately 240 million hectares in North America. This is a vast area, equal to 31 times the land mass of Scotland. The open rangelands are diverse, varying from desert shrublands to tallgrass prairie. Their productivity is proportional to the amount of moisture received; the High Plains tallgrass prairies of the Midwest (>75cm annual rainfall) are more productive than the southwestern desert shrub areas (<20cm annual rainfall). Over half of the western rangeland is federally owned, primarily under the control of the U.S. Department of Agriculture and the Department of the Interior.

In the late 1800s and early 1900s, poor management and overgrazing led to widespread deterioration of the western rangelands. The U.S. Forest Service (1936) estimated that overgrazing had destroyed over half of the range forage resource by the early 1930s and deterioration was continuing on three-fourths of all rangeland (Heady & Child 1994). Congress passed the Taylor Grazing Act in 1934 to stop the abuse of public grazing lands. Range conditions on public lands have improved greatly since the 1930s; 36% were considered to be in good to excellent condition by 1984, and perhaps as much as 60% in stable condition by 1990.

The improvement of vegetation conditions on public and private rangelands has been due to regulations, economics, and advances in the science of range management. The overriding thrust of scientific range management is to maximize the sustained income from the range resource while minimizing environmental damage. Economics are the driving force on both public and private holdings. As mentioned earlier, domestic livestock is the principal economic product of rangelands and is the primary focus of most range improvement programs.

On average, American rangelands provide an annual rental income of $6 to $8 per hectare from livestock grazing. Of course, incomes are greater for the more productive tallgrass prairie rangelands than the less productive desert shrublands. This margin of return is not great when considering the capital investments required by the average livestock producer. Even though the rate of return on investment is low, profits in the past have been sufficient to maintain a healthy and diversified livestock industry in North America.

Prudent management of rangelands for production of domestic animals is not accomplished without a financial outlay. The proper utilization rate of rangeland vegetation results in an average stubble height that is below the 20 to 50cm height optimal for nesting by most rangeland grouse species. To have a stubble height of >20cm for grouse would require a significant reduction (perhaps up to 50%) in the stocking rate. The magnitude of the reduction would depend on the species of grass and the location and vegetation composition of the rangeland. That reduced stocking rate probably would not produce a large enough stream of income to sustain most ranching operations.

Other range improvements involve a significant outlay of hard cash by the rancher, eg $2 to $10/ha for prescribed burns to $120/ha for some mechanical treatments followed by seeding and herbicide applications (Snyder 1997). Only if livestock production is increased by 10 to 30% are these costs recoverable, even when they are prorated over a 5- to 30-year period. Thus, range improvement programs, including moderate stocking levels, are economically feasible only when proper utilization rates are followed. As I have pointed out earlier, these rates result in vegetation heights and structures that are suboptimal for most grouse species. Basic economic reality is the reason that rangelands are not being managed for grouse populations in North America.

Economics are dictating that modern range management techniques be incorporated into the operational programs on both public and private rangelands in North America. Although the applications of advanced range management methodology are beneficial to the ranching industry, they generally are detrimental to grouse species reliant on diverse rangeland habitats. Successful educational programs of the Cooperative Extension Service have encouraged adoption of proven range improvement approaches by individual ranchers. As more and more of the 240 million hectares of rangeland come under the "range improvement" and "proper utilization" approaches, less and less of it will be suitable for native grouse species. Essentially, the expansion of management practices to improve rangeland for livestock production is one of the primary reasons for the decreases across North America of grouse populations that rely on rangelands.

This trend can be reversed by either:

1. imposing restrictive regulations on the livestock industry;
2. altering the economic playing field; or
3. adopting grazing systems and stocking rates that are economically feasible for the livestock producer and beneficial to grouse that rely on rangelands.

The livestock industry already is stressed economically, and development of regulations requiring reduced stocking rates and management practices beneficial to rangeland grouse would only exacerbate that situation. The second approach is one that already is in operation elsewhere in the world, ie placing an economic value on game species. If a brace of greater prairie-chickens in Kansas had the $75 value of walked-up grouse in Scotland, economics would move the rancher in eastern Kansas to improve range conditions for prairie-chicken populations and/or develop a management program that addresses the needs of livestock and prairie-chickens equally. Likewise, if an adult sage grouse in Idaho attracted $500 or $200 trophy fees like cock capercaillie (*Tetras urogallus*) or black grouse (*T. tetrix*), respectively, do in Russia, the approach to managing Idaho sagebrush rangelands would be altered. Placing realistic economic values on rangeland grouse species in North America is counter to traditional thinking but certainly would result in the implementation of range management practices that would be beneficial to those species. Without such economic incentives, I believe the grouse species that rely on rangelands in North America will continue to decline in the future.

Conclusion

I'm sorry to report that the title of this paper "MANAGING RANGELAND FOR NORTH AMERICAN GROUSE" is erroneous. Very, very little rangeland in North America is being managed for grouse. The majority of the rangeland is being managed for the production of livestock, often to the detriment of rangeland grouse populations.

The problem has not been caused by insensitive range managers. Rather, the responsibility rests with negligent wildlife agencies in North America. Circumstantial evidence indicates that overgrazing, alteration of vegetation composition, increased burning frequency, and fragmentation of rangelands adversely affect grouse populations relying on those rangelands. However, we do not fully understand the processes (Braun *et al* 1994). American wildlife agencies need to become engaged aggressively in long-term landscape-level experimental research that determines the specific habitat needs of each of the four rangeland grouse species and the range management techniques that produce those conditions. Once these requirements and techniques have been identified, they can either be melded into existing range management programs, or used to create new approaches, to develop range conditions that are compatible with livestock production goals and the maintenance of viable grouse populations. Until this is accomplished, the future for rangeland grouse populations in North America is not bright.

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Field Sports and Wildlife Conservation

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Summary

1. This paper covers the whole range of habitats where field sport, and field sports' participants, help to conserve the UK's natural environment. It is designed for the breadth of interest that is gathered at this conference.

Introduction

The Policy Framework

Let us start with some underlying policy principles. The European Union has been working hard to develop a strategy for conservation that is capable of delivering the right results on an appropriate scale. The NATURA 2000[1] programme is the framework within which we all have to work. The programme recognises that "It is necessary to involve stakeholders (local users including hunters) in the planning and decision making process; to respect local peoples' knowledge of 'their sites' and to recognise that without local acceptance and understanding a nature conservation scheme may fail in the longer term[2]."

Stakeholders provide practical assistance, which often comes without charge to the taxpayer. The NATURA 2000 Bath Conference recognised that "The participation of stakeholders, including hunters, is helping to ensure success and commitment of extra management resources." There are many examples that show this to be true.

Stakeholders contribute to sustainability of the wildlife resource. "Managed sustainably, exploitation can bring conservation benefits, not just to the populations of quarry species but to other species which benefit from the creation and maintenance of wildlife habitats".

The principle of partnership between authorities and local stakeholders is increasingly accepted and is well reflected in the African-Eurasian Migratory Waterbird Agreement 1995[3]. This agreement enters into force this year and is based on the understanding that all the parties are "aware of the economic, social, cultural and recreational benefits from the taking of certain species of migratory waterfowl …" and "convinced that any (such) taking must be conducted on a sustainable basis".

1 Natura 2000 represents the totality of sites classified or requirirng classification as Special Protection Areas (SPAs) under Directive 79/409/EEC on the conservation of wild birds, as well as the sites incorporated under Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna.

2 Natura 2000 and People – A Partnership Conference, Bath UK, June 1998.

3 Convention on the Conversation of Migratory Animals (Bonn Convention or CMS) Agreement on the Conservation of African-Eurasian Migratory Waterbirds 1995.

An action plan is attached to the agreement and it encourages hunters "… to form clubs and organisations to co-ordinate their activities and to help ensure sustainability".[4]

In the UK and in order to provide a platform for the delivery of these principles, the British Association for Shooting and Conservation (BASC) has signed up to joint statements of common interest, co-operation and intent with all the statutory conservation agencies. The joint statement with Scottish Natural Heritage (SNH) is called "Sport Shooting and the Natural Heritage". It stresses that country sports have long played a part in the management of the natural heritage of Scotland and today sport shooting is an activity which makes an important social and economic contribution to rural areas. In this context SNH recognises that shooting, practised within the law, makes a positive contribution to viable, well managed, and shared countryside.[5]

English Nature (EN) and BASC signed a statement of common interests and co-operation in February 1994 that re-affirmed each organisation's appreciation of the other's interests and set out specific arrangements for liaison and co-operation. The statement replaced a statement signed in 1988 and reflected the constructive mutual understanding and working relationship that has now existed for many years.

English Nature acknowledged the place of field sports, practised within the law, in a shared countryside and recognises the additional value of an attractive natural environment to those who practise those sports. EN recognised that sporting shooting interests make positive contributions to creating and maintaining habitats for wildlife[6].

Similar statements have been signed between BASC and the Countryside Council for Wales[7], (CCW) and the Environment and Heritage Service in Northern Ireland[8]. They are all backed by action plans.

The Habitats

So let us look at the contribution these stakeholders make to the fabric of the countryside as a whole.

In 1994, BASC surveyed the interests of the 5,000 gamekeepers in the UK. We sent a survey questionnaire to all the BASC gamekeeper members and of the 1,612 returned 1,532 could be used in analysis[9].

1,012 respondents recorded 5,846,714 acres of land. The average acreage per keeper was 5,772 acres/keeper and the range extended from 36 to 170,000 acres. The results, in **Table 1**, reveal the scale of the habitats they influence.

4 African-Eurasian Water Bird Agreement 1995 Action Plan – Management of Human Activities: Hunting.

5 Sport Shooting and the Natural Heritage. A Statement of Intent between the British Association for Shooting and Conservation and Scottish Natural Heritage. Signed on 21st November 1994.

6 A Statement of Common Interests and Co-operation. English Nature and the British Association for Shooting and Conservation. Signed 21st February 1994.

7 A Joint Statement of Common Interest and Co-operation between the Countryside Council for Wales and the British Association for Shooting and Conservation. Signed 24th July 1995.

8 Environment and Heritage Service and the British Association for Shooting and Conservation: A Statement of Common Interests and Co-operation. Signed 24th February 1998.

9 Gamekeepers, Gamekeeping and the Future. 1995. BASC Report.

Table 1 The habitats managed by gamekeepers in the UK.

Habitat Type	Acreage	Hectares
Heather moor	1,534,645	621,314
Arable	1,180,828	478,068
Woodland	1,117,416	452,395
Upland grass moor	434,656	175,974
Improved lowland pasture	305,449	123,664
Unimproved Lowland Pasture	104,992	42,507
Wetlands [excluding rivers]	45,835	18,557
Scrub	33,169	13,429
Lowland Heath	26,169	10,595
Coastal marsh	18,599	7,530
Inland marsh	11,742	4,754
TOTAL	4,813,500	1,948,787

The survey asked whether the land was subject to any conservation designation and revealed that almost half of the respondents were responsible for management in designated areas.

Table 2 Does any of your land have any conservation designation?

	Number
Land without designated sites	478
Land with designations	453
Don't know	42
TOTAL	973

The designations covered the full range of conservation interest.

Table 3 The designations of land managed by gamekeepers in the UK.

Designation	Number
Site of Special Scientific Interest	319
Area of Outstanding Natural Beauty	117
Environmentally Sensitive Area	96
Local Nature Reserve	63
National Park	54
Voluntary Conservation Body Reserve	39
National Nature Reserve	31
Country Park	24
Ancient Monument	11
TOTAL	754

Habitat creation work was frequently not assisted by grant schemes. A large amount of conservation work was done without charge to the taxpayer.

Table 4 Was any of the habitat creation work assisted by grant schemes?

	Number
Habitat creation assisted by grant schemes	273
Habitat creation schemes not assisted	270
TOTAL	543

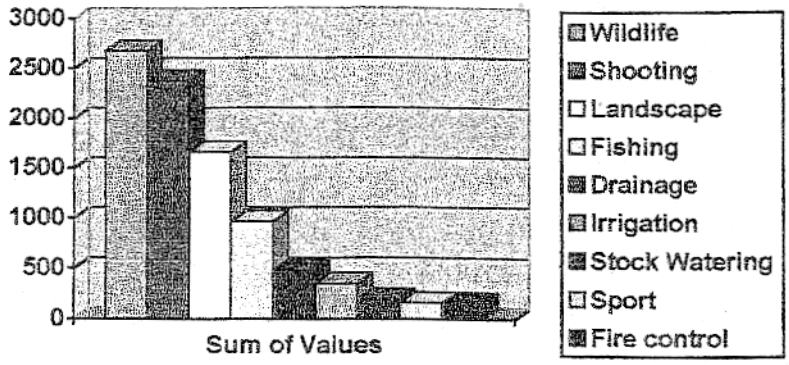
Wetlands

Wetlands extend from coastal saltines and mudflats, through rivers and streams, seasonally flooding washes, ponds, lakes and ditches, and finally to lowland and upland bogs. It is beyond the scope of this paper to review the huge range of management inputs associated with management for shooting.

One of the unsung types of wetland is the humble farm pond in the lowlands. Abused and in-filled, frequently without a second thought: but a valuable habitat for a host of wildlife species, nonetheless.

By using a system of points whereby the most important reason for creating habitats is given 9 points and the second 8 points and so on, and then multiplying by the total number of people giving each answer, the overall importance of creating a habitat type, in this case ponds, can be assessed.

Figure 1 The Reasons Given for Creating Ponds Managed by Gamekeepers.

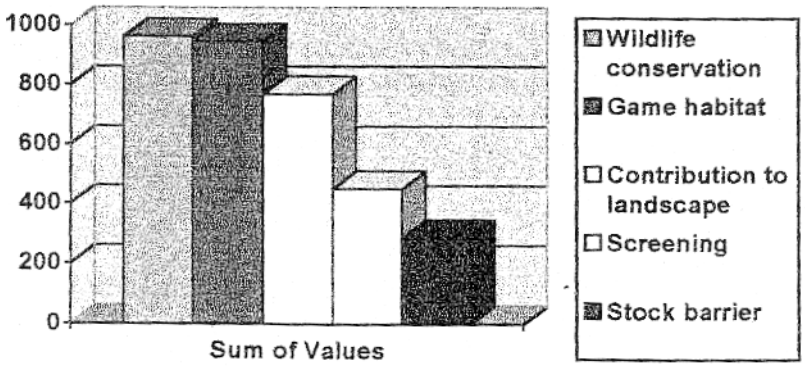


Farm Hedges

Game managers put great store by good hedges as they provide cover for nesting, the maintenance of natural food supplies and shelter. If of an appropriate species such as hawthorn, and they are left untrimmed, the berry crop can attract winter songbird migrants.

The reasons for creating hedges are similar to those given for ponds.

Figure 2 The Reasons Given for Creating Hedges Managed for Game.



Woodland

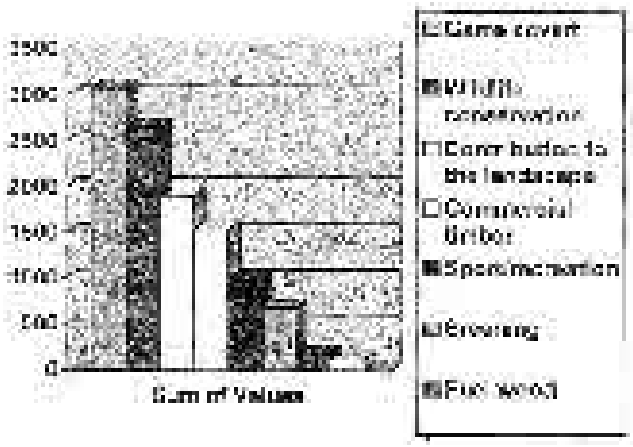
80% of woodland under 10 acres in England is managed in part for its game interest. New tree plantings occur on 68% of agricultural holdings where pheasants are released, compared with 19% of holdings which do not release pheasants.

Both professional and recreational stalkers contribute enormously to the active maintenance of Scotland's woodlands – both native and commercial. Red, roe, sika and fallow deer cause an estimated £4million of damage to commercial forestry each year. Without the annual culling of approximately 100,000 deer this damage would be considerably greater, as would the damage to the natural heritage.

Table 5 Acreage of Managed Woodland.

Woodland type	Acreage	Hectares
Coniferous woodland	645,281	261,247
Mixed woodland	271,691	109,996
Broadleaf woodland	200,444	81,151
Scrub woodland	33,169	13,429
TOTAL	1,150,585	465,823

Figure 3 Reasons Given for Creating Woodlands.



Other Benefits

Outside the rural areas conservation benefits of shooting often go unseen and unsung. Shooting is a major incentive for action and also in the search for knowledge. My own introduction to the natural sciences took on a new reality when I was a research student under the late Professor Niko Tinbergen at Oxford, who had such a close and productive relationship with the late Hugh Falkus. Many gamekeepers share this search for insight into the workings of the natural world, and many partnerships between scientists and local game managers continue to flourish. The late Dr Jeffery Harrison, who the wildfowl and ornithological worlds owe so much, brought me into BASC.

Those who responded to the survey had an equally wide range of involvement in wildlife study and survey projects.

Table 6 Mammal Studies and Surveys.

	Number
Badger Watch	24
Bat boxes and bat surveys	17
Otter research	6
Brown Hare research (at Bristol Univ)	1
Red Squirrel research	1
TOTAL	49

Table 7 Bird Conservation Projects.

	Number
Bird counting	20
Merlin ringing and counting	17
Barn Owl boxes	10
Raptor surveys	9
Golden Eagle surveys	6
Hawk and Owl Survey	6
Red Kite release	4
Harrier Survey	4
Osprey research	2
Buzzard research	2
Sea Eagle study [RSPB]	1
Stone Curlew [RSPB]	1
Corncrake Census [GCT]	1
TOTAL	83

Table 8 Vegetation and Insect Conservation.

	Number
Butterfly survey	12
Moth survey	2
Bee survey	1
Alpine plant regeneration [SNH]	1
Birch wood regeneration	1
Caledonian Pine regeneration	1
Orchid habitat management	1
Water plant survey [English Nature]	1
TOTAL	20

The Fight Against Rural Crime

Game managers suffer problems from poaching and incidents can involve theft and vandalism to farm and estate property, as well as the threat of assault to themselves or members of their families. 63% of game managers experience such problems at some level.

These days BASC has much contact with the police wildlife liaison and rural beat officers and, through BASC, the game manager is an important partner in the Partnership for Action Against Wildlife Crime (PAW) under the auspices of the Department for Transport and the Regions (DETR). PAW brings together a wide range of statutory and voluntary agencies in a carefully thought through campaign. At the local level Poacher Watch schemes have a substantial effect in reducing crime levels. One recent scheme in Dorset for example, rapidly achieved a 14% reduction in recorded crime in the area covered. Modern approaches and techniques have moved on considerably from yesteryear!

Nature of Problem	Number of Incidents	Successful Prosecutions
Hares	345	205
Pheasants	337	105
Deer poaching	253	34
Rabbits	212	87
Trout	79	49
Partridges	43	4
Salmon	39	51
Duck	26	3
Sea Trout	25	26
Grouse	17	3
Geese	7	18
TOTAL	1383	585

Who Pays?

Field sports contribute to central and local government revenues in several ways, principally through:

- Value Added Tax on goods and services purchased by the providers, participants and others;
- Income and company taxes on the revenues generated by field sports;
- National Health Insurance contributions levied on employees;
- Licence and certificate fees levied periodically on participants and providers.

The total contribution to central and local government is estimated at £650 million and 60% is derived from angling.

From the shooting side, an important initiative is to be found in the Wildlife Habitat Trust Stamp Programme. A commemorative postage stamp for £5.00 is sold to shooters and all the revenues are devoted to the purchase and conservation of nationally and internationally important wildlife sites in the UK and overseas. This has resulted in the spending of some £500,000 in recent years and the multiplier effects, releasing local fund raising, have been considerable. Projects have been supported in Lithuania and other Baltic countries as well as Turkey.

Conclusions

Over 1 million people participate in shooting sports in the UK. This is more than the sum of those taking part in rugby, athletics, sailing, motor sports and skiing[10]. 26,300 full time jobs are directly dependent on shooting[11]. There are 5,000 full-time gamekeepers in the UK. The direct expenditure on shooting and stalking in 1996 amounted to £402 million.

There has been an effective working partnership between the statutory conservation agencies and BASC on behalf of shooting and it continues to flourish.

The local resources empowered by these partnerships are in tune with and contributing in practical ways to international, national and local conservation priorities. Shooters are actively involved in conservation programmes for key species such as the red squirrel, stone curlew and red kite, identified in the UK Biodiversity Action Plan.

Sustainable use and good conservation rely on partnership and adaptive management that brings commitment, local ownership of initiatives, and additional man power and financial resources.

[10] Calculated from the 1996 Household Survey.

[11] Figures based on the 1997 Cobham Report published by the Standing Conference on Countryside Sports that indicates expenditure and employment covering country and clay shooting only. It does not include target shooting.

Fire and Forest Management

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Summary

1. Forests of the Southern United States of America are primarily privately owned and provide approximately 50% of the nation's wood product. The State of Georgia is 66% forested with 9.8 million hectares of forest land.

2. Prescribed fire must provide an economic benefit to the average forest landowner who stewards less than 40 hectares of forest if it is to be utilised widely enough to be effective.

3. Most common benefits from prescribed burning include fuel reduction, site preparation for reforestation, competing species management, and wildlife habitat enhancement. Prescribed fire was regulated in 1988 by the Georgia General Assembly due to smoke from prescribed fires causing vehicle accidents on state and county roadways in the vicinity of outdoor burning activities.

4. A practitioner must now receive a permit to burn from the Georgia Forestry Commission. Air Quality problems are brought about by a growing population with a corresponding increase in emissions from off-road combustion engines, stationary sources of emissions including electric power plants and other manufacturing facilities. With this increase from other sources, regulatory agencies are reluctant to encourage prescribed burning.

5. Federal and State air quality regulations aimed at dealing with particulates, smog and ozone are affecting prescribed fire programs. Support of prescribed burning comes from the need for fuel reduction to reduce severity of wildfires and when prescribed burning is part of wildlife programs.

6. Interagency cooperation, favourable advertisement, practitioner liability protection, and prescribed fire support groups appear to be viable means by which prescribed burning may be continued. Professional application of prescribed fire to meet specific objectives, communication among practitioners and with the general public, and cooperation among agencies and individuals are the maintenance items needed to insure continuance of this practice in the United States of America.

Introduction

In the Southeastern United States of America (**Figure 1**) there are 81 million hectares of forestland. Private non-industrial owners hold the majority of this acreage followed by forest industry. Federal and state holdings are a minor part of the ownership (**Figure 2**). Approximately 50% of all wood products used in the United States are produced in the Southeastern states (Forests of the South 1996).

Figure 1 Southeastern United States of America.

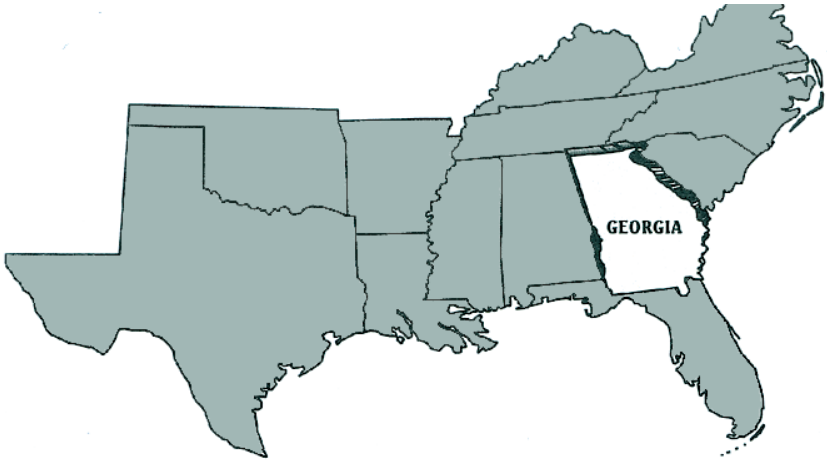
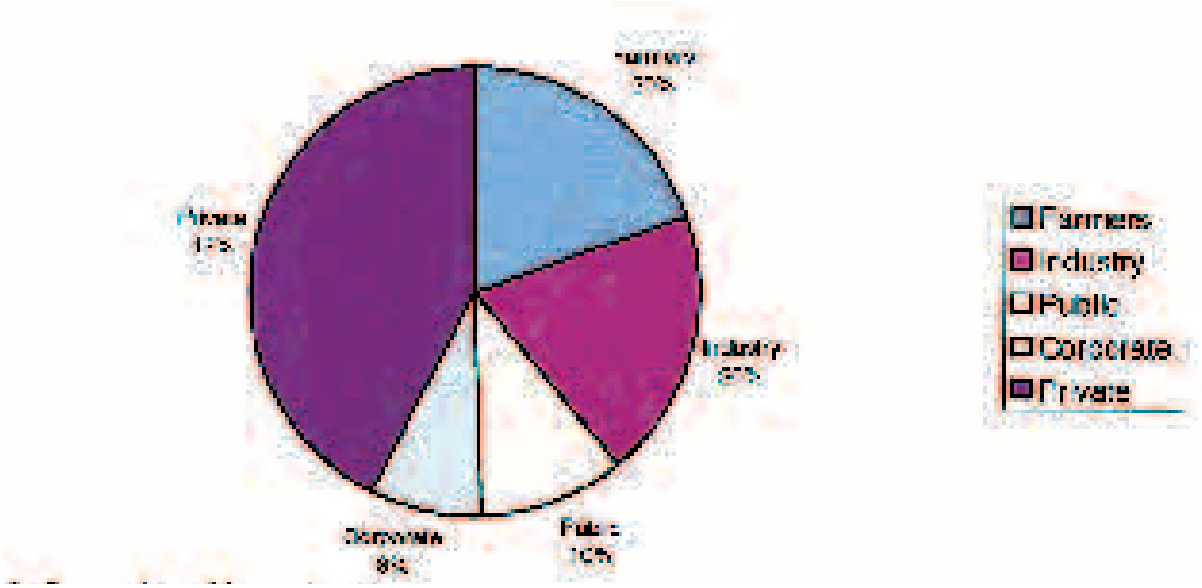


Figure 2 Ownership of forest land by hectares and percent of total in the southeastern U.S.



There is more forested land in Georgia than any southern state. 66% of Georgia's 15 million hectares, (9.7 million hectares) are designated as commercial timberland. Private non-industrial landowners own 68% of these forest, commercial forest industry owns 25% and government owns 7% (**Figure 3** – Georgia Forestry Association 1995)

Georgia's forests contribute more than 19 billion dollars annually to the state's economy. This includes sales of wood pulp, paper, and wood products worldwide. (Georgia Forestry Association 1995). The average forest owner, who stewards less than 40 hectares, values environmental qualities and recreation but seeks financial security through use and marketability of more tangible forest assets. However if it were not for the financial value of the forests of the Southern USA, the land would be converted to other uses.

The Georgia Forestry Commission's 35 million dollar annual budget is mostly spent on fire suppression.

The average number of fires and hectares burned in Georgia over the last 10 years was 7,898 and 12,699 respectively (**Figure 4**). This year has been a more severe fire season than normal. Through June of this year 7,313 fires burned 314,773 hectares.

Figure 3 Forest Ownership in Georgia.

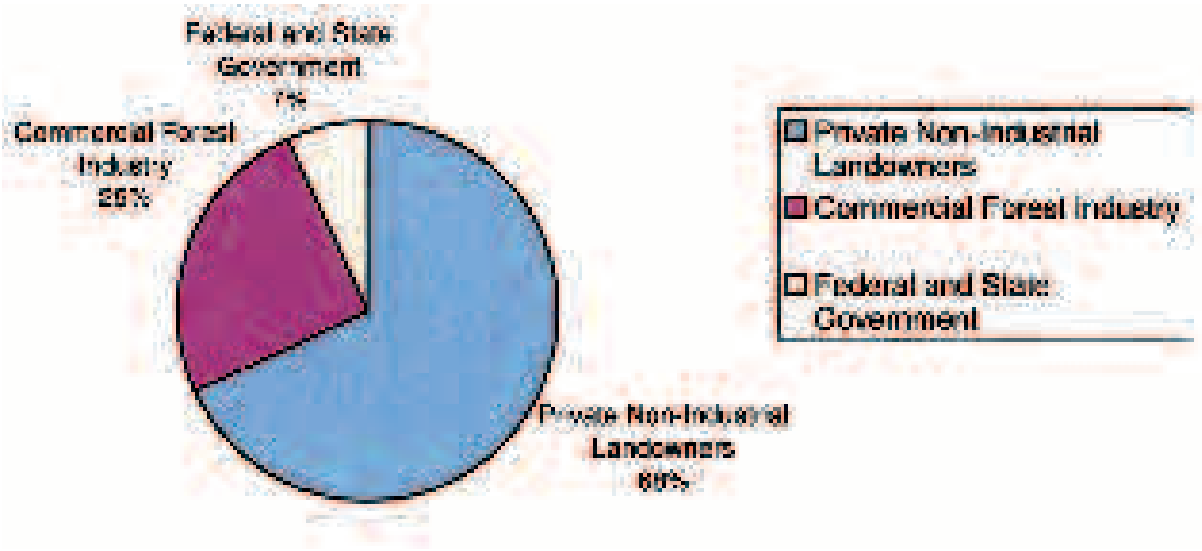
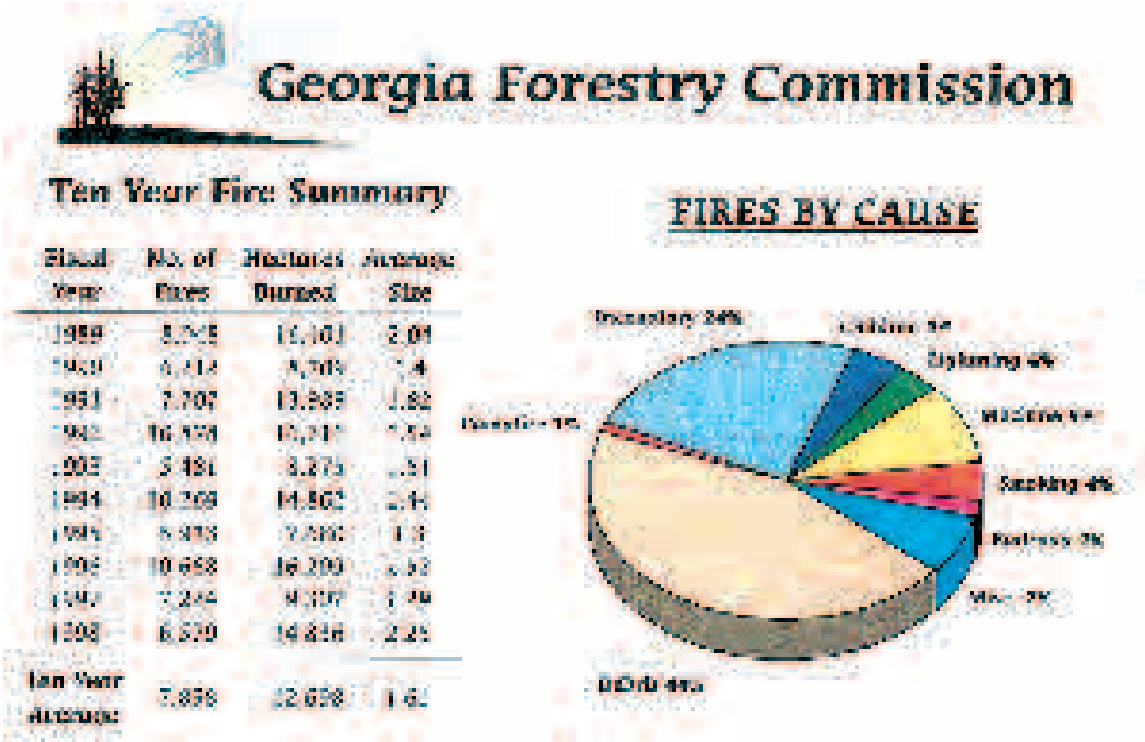


Figure 4 Hectares burned, average size, number of fires and cause – 1989-1998.



According to estimates by Miles (1984), Moody (1984), Green (1984), and Ashley (1984) almost 2.5 million hectares are treated by prescribed fire in the South each year. In Georgia, about 365,000 hectares are treated with prescribed fire each year. Guidelines for prescribed burning have been published most recently by Wade and Lunsford (1989).

Wildfire – Prescribed Fire

Fire has been used by man in the South for hundreds of years. Payne (1982), Wade *et al* (1980), and others describe in some detail the use of fire by the American Indian, early European settlers, and finally its adoption and use by professional foresters. Briefly summarised, the historical use of fire includes:

American Indians

Fire was used to drive game, gain advantage in warfare, provide a better living environment by reducing the forest understory, as a tool in felling trees, as an aid in hollowing dugout canoes, to improve wildlife habitat and perhaps to clear land for agriculture.

European Settlers

They adopted the use of fire from the Indians for many of the same purposes, and also used fire to clear land for crops. Until the early 1900's, turpentine operators, hunters, local residents, and cattlemen all burned the forests. As a result, most of the forested South was touched by fire, sometimes on an annual basis.

Professional Foresters

Foresters recognised that burning, as commonly practised in the early 1900's, was not consistent with emerging forest management methods. Consequently, the objective usually was to eliminate all fire from the forest. The debate on fire use vs. fire exclusion continues to be an issue. However, the evidence has slowly accumulated over the years, beginning with the work of Stoddard (1931), that fire was part of the natural ecosystem; and if properly used it could enhance wildlife habitat, reduce fuels (and hence the chance of a catastrophe fire), control disease, enhance reforestation, and in some cases, is essential for biological diversity.

Wildlife

One of the major uses of fire is in wildlife management. For example bobwhite quail (*Colinus virginianus*) benefits from prescribed fire because fire stimulates germination of plants that provide food, and by creating better nesting conditions. The Endangered Species Act of 1973 (P. L. 93-205) provides for conservation of threatened and endangered wildlife, plants, and fish. Komarek (1982) lists nine animal species that depend on fire to some degree for their survival. Specifically, the recovery plan for the red cockaded woodpecker, (*Picoider borealis*) (U.S. Fish and Wildlife Service 1985) depends on prescribed fire to maintain the desired habitat. Many plant species such as the pitcher plant (*Sarrancenia* sp) that are either threatened or endangered are adapted to a fire environment. Consequently, limitations on the use of prescribed fire will have an adverse, and potentially fatal, effect on many threatened species.

The Wildland Urban Interface

An increasing percentage of Americans have built permanent or vacation homes adjacent to wildland without regard for the flammability of the surrounding fuel complex. When these forest fuels are ignited, the

resulting fires often threaten these structures and the lives of the residents. One method being used to minimise this problem is to burn these wildland fuels under benign weather conditions and thereby temporarily reduce the potential wildfire threat to life and property.

One example of this problem occurred near the Palm Coast Development in Flagler County, Florida, on May 17, 1985. High winds, low relative humidity, and an abundance of fuel resulted in a high intensity fire that erupted from 61 hectares on May 16th to burn 5,261 hectares and destroy 99 homes on the 17th (Abt *et al* 1987) (**Figure 2**). Heavy build-up of forest fuels was a major contributor to the fire's intensity, which in turn was the major factor associated with the destruction of houses (Abt *et al* 1987). As a consequence of the Palm Coast experience, the Florida Division of Forestry has coordinated a prescribed burning program in the area to minimize fuel buildup and hence the intensity of potential wildfire.

Wildfire Protection

If prescribed fire were not used, there would eventually be an increase in the size, intensity, and costs of suppressing wildfire. Davis and Cooper (1963) found this occurred after about five years. Consequently, the GFC encourages forest landowners to burn on a three to five year cycle. Generally speaking, a prescribed burn for any reason results in benefits for most other objectives. It has been noted that direct economic benefits result from periodic prescribed burning, since a well managed forest stand attracts more timber buyers resulting in more competition and higher prices paid to the owner (Moss 1999).

Regulatory Issues

Trial and tribulation marks the past and present state of prescribed burning in Georgia. Smoke- related vehicle accidents, fatal to several motorists, attracted the attention of Georgia legislators in 1987. Georgia's State Forester negotiated a compromise with the general assembly which resulted in continued use of prescribed fire only through a regulatory process requiring each fire to receive a permit prior to being initiated (The Georgia Forest Fire Protection Act 1987).

Air Quality issues currently provide the impetus for further regulation of prescribed burning. An announcement by the USDA-Forest Service of a nation-wide goal to increase prescribed burning on National Forests by as much as 1.2 million hectares, combined with continued public pressure against the United States Environmental Protection Agency to provide clean air, has resulted in federal guidelines for prescribed fire as conducted on private forests (Environment Protection Agency 1998). Additionally, local air quality problems resulting mostly from industrial emissions and vehicular pollution have resulted in curtailment of prescribed burning during the ozone season of the summer months in an area surrounding metropolitan Atlanta, Georgia.

New regulatory efforts must be balanced against the need recognised by the USDA Forest Service and others that properly conducted prescribed fire is in the public interest. Most states in the Southern United States have enacted limited legislation to protect the prescribed burn practitioner. Georgia's Prescribed Burning Act of 1992 proclaims prescribed burning as a valuable forest management tool and gives landowners the right to prescribe burn forestlands. The act declares that prescribed burning "be considered in the public interest and shall not create a public or private nuisance ". Furthermore, the law states "No property owner or owner's agent conducting an authorised prescribed burn under this part shall be liable for damages or injury caused by fire or resulting smoke unless it is proven that there was negligence

in starting, controlling, or completing the burn". The Georgia Prescribed Burning Act also allows the Georgia Forestry Commission to administer a Prescribe Fire Manager Certification program whereby graduates of the course are certified as being qualified prescribed burners (Georgia Code Title 12, Chapter 6, Article 1, Part 6. Senate Bill #543).

Most forest management and wildlife affiliations in Georgia currently support the philosophy of prescribed fire. A new group, Georgia Prescribed Fire Council, formed in 1997, encourages the exchange of information, techniques, and experiences among practitioners of prescribed fire and promotes public understanding of the importance and benefits of the safe use of prescribed fire (Georgia Prescribed Fire Council 1997). The council is well supported by a collage of interests with various motives for promotion of fire management.

The benefits of fuel reduction and wildlife habitat enhancement place prescribed burning in favour with legislators and with the general public but the air quality issue looms as an impetuous blight on the future of good forest management through prescribed burning.

Interagency Cooperation

Interagency cooperation, favourable advertisement, practitioner liability protection, and prescribed fire support groups appear to be viable means by which prescribed burning may be continued. State, Federal, and private entities work together in Georgia to accomplish favourable results. The GFC employs foresters and forest rangers to provide assistance to landowners in conducting prescribed burns. Federal and GFC employees combine forces in a cooperative effort to complete goals on lands belonging to each. The Georgia Department of Transportation and the Georgia Department of Public Safety (highway patrol) has formed agreements with the Georgia Forestry Commission to mitigate highway visibility problems resulting from prescribed burning.

One agency formed on the foundation of interagency cooperation is the Greater Okefenokee Association of Landowners (GOAL). This group brings together private landowners, forest industry, Georgia Forestry Commission, Florida Division of Forestry, USDA-Forest Service, and the Department of Interior United States Fish and Wildlife Service (Okefenokee Wildlife Refuge), together for the common good of all concerned. Due to a patchwork of ownership, and complex ecology, the Okefenokee Swamp provides a complicated arena for fire management decisions. This interagency cooperation provides a way to minimize complication and ensure fire management suitable to all.

Public Support

The support for increased prescribed burning comes from benefits of fuel reduction and wildlife habitat management. Extreme severity of wildfires in the State of Florida, USA, in 1985, 1998, and 1999 has brought to the forefront the need to reduce dangerous accumulations of forest fuels within the wildland/urban interface. Legislators across the Southern United States now ask; what can be done to encourage more fuel reduction burning? Prescribed burning is mandated for landowners that participate in a federal subsidy program (Conservation Reserve Program) to cost share planting of longleaf pine (*Pinus palustris*). Georgia landowners have signed up with the federal government to install 30,800 hectares of artificial regeneration of longleaf pine in this program.

Georgia's general public supports wildlife programs with enthusiasm. For example, a recent vehicle licence tag sponsored by the Georgia Department of Natural Resources Wildlife Resources Division, sports the resemblance of a bob white quail (*Colinus virginianus*) and a longleaf pine (*Pinus palustris*) with the words "Give Wildlife a Chance" embossed along with the licence number. This wildlife motif sold 50,000 licence plates and generated 9 million dollars for the wildlife agency. Advertisement of the benefits to wildlife from prescribed burning is gaining public acceptance of the practice but not yet reducing individual complaints about the ensuing smoke.

Favourable advertisement seems to be the nemesis of forestry in Georgia. Good news rarely rates as high as does bad news with editors of public information providers. We ride on the coat tails of fire disasters with advertisement of prescribed fire as a cure but we lose sight in the long term only to be reminded by the next disastrous fire.

Conclusion

Prescribed fire continues to survive in the United States of America, in the southern region of the United States, and in the State of Georgia. Nearly everything we know that provides value and benefit to mankind also requires maintenance. The professional application of prescribed fire to meet specific objectives, communication with each other and with the public, and cooperation among agencies and individuals are the maintenance items needed to insure continuance of this practice in the United States of America.

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Developments in Red Deer Management

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Introduction

Red deer numbers have risen fairly steadily in Scotland over the last 40 years. The first national population estimate was made by Frank Fraser Darling and he used a different methodology from subsequent estimates. It was based on a very limited number of counts, but the figure of 150,000 red deer in Scotland in 1960 was arrived at, and it is a generally accepted figure today. Deer counting coverage increased widely through the 60s and 70s and population estimates continued to rise. In 1989, the Red Deer Commission estimated a population of 300,000 red deer in Scotland. Now we no longer calculate national population estimates. Deer Commission for Scotland [DCS] consider that the results produced are of dubious accuracy and are probably of no practical worth. So we use our limited resources to produce local population estimates for local deer managers. That said, there is no doubt at all that there are far more deer in Scotland in 1999 than there were in 1989 and it has been speculated that the population that exists on the open hill today is the highest that there has been at any time over the last 500 years.

Current Situation in Deer Management

The pattern of population change has in itself changed widely across decades and across different parts of Scotland. In the 1960s, 70s, and perhaps the early 80s, we had rapid expansion of the deer range, colonising particularly grouse moor areas on the southern and eastern fringes of the Central Highlands. Deer colonised grouse moors and at that time they were not perceived as a threat in any shape or form. Control was not exercised against them, and numbers built up to some of the highest densities ever recorded in Scotland. In the Cairngorms, between 1967 and 1983 there was a 25% increase in stags, a 49% increase in hinds and an even larger percentage increase in East Grampian. In the 80s and 90s populations began to stabilise. In the Cairngorms by 1995 we still had a 14% increase in the stag population, but decreases in hind populations. Contrast that with the situation in the Central Highlands and along the western seaboard. Two Deer Management Groups [DMG] which we counted recently show the trends which are mirrored up and down the west coast. Between 1975 and 1989 in Wester Ross, we had a 11% decrease in stags, while hind numbers were increasing, but at lower rates relative to the east coast populations. Similar things are happening on Rannoch. But in the 1990s there were radical changes to the rates of population growth on the west coast. In Wester Ross over the last 10 years we have seen a 39% increase in stags and a 27% increase in hinds and a truly dramatic change on Rannoch, where we have a 121% increase in stags and a 74% increase in hinds. Clearly these are big rates of population growth. The common factor throughout the 1990s is that stag populations have risen throughout Scotland and they are still rising faster than hinds in many areas. That has implications for estates, in that in many places sporting estates have never had it better in terms of the numbers of stags on their ground, and the quality and number of mature stags from which they can select their cull and from which they can sell to clients.

The fact that stag numbers have risen so markedly is in direct contradiction to the message that the Red Deer Commission frequently used in the 1980s to persuade people to reduce deer. It was felt that continuing increases in hind density would lead to increased rates of stag natural mortality and increased emigration of stags to fringe areas on the edges of deer forests where they would suffer preferentially high mortality,

being shot on crofts and farms *etc*. That conclusion was reached following the work of Tim Clutton-Brock in the long-term study at the north end of Rum where in an unculled population, exactly that scenario occurred. However, the opposite has occurred on parts of mainland Scotland. This fact has a lot of implications for DCS in that it is particularly difficult to persuade people to change a system where the main practitioners see things as relatively rosy in the garden.

So why are deer numbers continuing to increase? There are a number of confounding factors. There has been a considerable expansion of plantation forestry throughout Scotland, planted in the 60s and 70s. The fences that were used to bring about establishment have fallen into disrepair and deer have colonised these woodlands to such an extent that there are hardly any open hill deer now which do not have some access to woodland at some point through the year when they want it. That has knock-on effects on the population dynamics of the national red deer herd in that stags (which preferentially winter in forestry) have lower natural mortality rates and hinds have increased reproductive rates due to the beneficial effects of shelter and, in some cases, increased food.

We have a decline in the hill sheep population on many estates. Given current market conditions that is a decline which is likely to continue. Nobody knows the exact biological competitive interaction between sheep and deer but there is plenty of anecdotal evidence that as sheep numbers decrease, red deer numbers increase. Combined with that, we have experienced very low rates of natural mortality throughout the 1990s. There have only really been two years when natural mortality has occurred on a wide scale. In 1993 the Deer Commission organised a nation-wide natural mortality survey and estimated about 20,000 red deer died throughout the land. In the spring of 1999 there was high mortality in parts of the west coast – with between 5% and 10% of adult animals dying, with an even higher percentage death in the calves. But overall, there has been very little natural mortality throughout the whole 90s.

Combined with that, we have had very good calving years. Throughout the 1990s there have only been two years when calving percentages have dropped below the high 30s as measured by post-winter counts, so deer populations are performing relatively well. Interestingly, calving percentages in the 1990s are identical to levels recorded in the 1960s, so there is no clear-cut density dependent effect working on a broad scale throughout Scotland.

The fundamental reason why deer populations continue to increase is that not enough are being shot. And that statement in itself raises a whole host of questions. Are people unwilling to shoot sufficient deer numbers or are people physically unable to shoot sufficient deer numbers because of the physical size of the job? There is plenty of evidence to suggest that the real reason is that people have been unwilling to shoot sufficient animals. The total national cull throughout Scotland has ranged quite widely in the 1990s from between 50,000 to 65,000, with the exception of 1993, when about 73,000 red deer were shot. Now, what was special about 1993? Despite the fact it was probably the wildest, mildest, wettest, windiest winter in the entire decade and the weather conditions were unpleasant for culling hinds, deer managers were sufficiently convinced by arguments made by DCS and by the whole industry internally, to go out and take a huge cull that year. Those arguments were linked to natural mortality and the state of the deer herd. The following year, with far better weather, the cull dropped back to about 60,000. There is clear evidence that people have been unwilling to shoot sufficient numbers and we are certainly not at any form of physical capacity. Individual estates may be, but nationally we are not. The fact that people are unwilling to shoot sufficient deer is a very important topic for DCS.

Data on population increase is collected from our open range counting programme to which DCS devotes a considerable amount of its resources and it is often asked – *why do we devote so much effort to that?* There are four main reasons:

1. We need to provide advice on future culling levels;
2. We need to be able to comment authoritatively on the likely impacts on deer of land use change, in particular woodland grant scheme consultations;
3. Increasingly, we need to be able to verify the accuracy of local Deer Management Group counts which are an increasing feature of deer management;
4. Training in counting techniques. We always try to involve local estate staff in our counting programme. We feel the best way to train people is actually to carry out the count with them and we go to considerable efforts to involve local people. There is already considerable expertise within estates on counting their own ground but the programme often falls down because of a lack of co-ordination between estates, or a lack of total coverage within any one area.

Since 1993 we have counted all of Scotland, bar one block. There are obvious limitations of manpower, finance and the weather, and without a substantial and probably unrealistic increase in the level of resources, we are unlikely to count the whole country much quicker than this. However, one count of the whole of Scotland every seven years – although a fair achievement in itself – is providing insufficient management data for sound decision-making. So the implications for DCS are that we clearly have to encourage local Deer Management Group counts, we have to continue training people, and we have to improve the co-ordination within those counts.

Stag numbers and deer numbers on the whole are at unprecedented high levels and although that fact attracts an exceptionally bad press, especially in the last 10 years, it is not universally regarded as a wholly bad thing. Many deer managers think it is a very good thing. It has been estimated recently that on an annual basis, the sport of stalking generates an estimated £15m to the Scottish economy and may support 1,000 full-time job equivalents. These estimates may be disputed. DCS does not consider there are sufficient data collected on the socio-economics of deer management; it is something we wish to rectify. But there is no doubt that deer are a valuable resource and should be considered as such. They are particularly valuable in the remote areas where the management of deer may be one of the few economically possible land uses.

However, it is obvious that deer cause conflict. They conflict with agriculture, with forestry and increasingly with public safety, and it is important to note that the main arguments which are driving reductions in deer numbers have varied markedly over the decades. In the 60s and 70s, the desire to reduce agriculture and forestry damage was probably the main argument. In the 80s, it was felt that reductions in deer would benefit the deer themselves. In the future it will be the public safely aspect of a high deer density in the Highlands which will reach increasing prominence. Deer on the roads cause accidents, as do deer in the urban fringe. These are particularly difficult and complicated topics to deal with, but in the last decade, the main driving force for deer reductions has been the conflict with conservation interests. Deer conflict with conservation in a number of ways. In many areas, they prevent the regeneration and spread of our native woodland resource. They can prevent the maintenance of heather moorland, causing heather to decline and be replaced by less valuable grass species. The issue of deer fencing is increasing in prominence. The impact of deer fencing on woodland grouse populations is particularly relevant today, given the perilous

state of the capercaillie population and also the effect that fences can have on black grouse and many other birds. There are a whole raft of perhaps woollier, less clearly defined issues, dealing with the impact of deer grazing on biodiversity throughout Scotland. It seems likely that as density increases, as it is at the moment, conflict is likely to increase and I suppose the main role of DCS, or the main aim of DCS, is to achieve an acceptable balance between the benefits that deer bring and the conflicts they cause.

So, having set the scene and given that scenario, how are DCS seeking to combat increasing density? As a first and fundamental step, the Scottish red deer population has been divided into 50 discrete populations. The boundaries between these are physical features, such as lochs, main roads and railways – and while they certainly do not prevent all movement, they do give us discrete populations to all intents and purposes. Because the movement across the boundaries is limited, landowners within these discrete population areas form Deer Management Groups. In the best cases these meet perhaps twice a year to discuss the management of the shared resource they enjoy. They talk about populations, they talk about culls and obviously a whole raft of other issues of common interest. Deer Management Groups vary widely in Scotland in terms of their performance, in terms of their enthusiasm, and in the standard of debate that occurs at meetings. But DCS obviously have to encourage the more far-seeing groups to move ahead and educate those that are perhaps somewhere behind.

In 1998 we took the initiative of setting target populations and target culls for each Deer Management Group. These are based entirely on the sporting requirements of the estates involved within each group. Target populations are calculated in the following way. Firstly we look at the total sporting requirements of the estates in the group. We can find that out either by looking at historical culls or by asking estates directly how many deer they wish to shoot. We then look for all other sources of stag mortality for which reasonable data exist. We may look at culling on the fringes of Deer Management Groups by agricultural occupiers and forestry owners. Where they exist we may look at natural mortality records. We may look at road deaths and poaching if there is any form of reasonable data to enter into the equation. All that is added together to produce a total annual stag cull or stag mortality. That figure is then multiplied by 6. That effectively means that the average age at death of any stag within the Deer Management Group is 6 years old, and that is relatively low for sporting estates where the average may be 8, 9 or 10 years. But by the time you take into account fringe culling and natural mortality, it is probably a reasonable figure to use. Those data give you a total number of stags required and to calculate a target hind population we multiply that figure by 1.3. That instantly builds in a number of safety factors for the estates involved. It builds in an excess to the population which allows people to have confidence that they can cope with things like a particularly severe winter or bad cases of poaching, or whatever. We are only too well aware that this is an exceptionally simplistic approach but the figures produced are almost always far lower than what actually exists on the open hill. The figures produced should sustain existing sporting requirements, together with the employment which those culls support and Deer Management Groups have been surprisingly enthusiastic about accepting these target populations. We calculate target culls along the whole process by looking at the actual population, the target population, the increment of the actual population and subtracting one from the other. We temper that with a heavy dose of realism in terms of how many hinds we feel it is acceptable, or what the Deer Management Groups are physically able, to cull. That approach was tried for the first time in the 98/99 season and the results were very encouraging. Nearly every Deer Management Group achieved 90% of the target cull that was set. Many groups greatly exceeded their targets and the end product was the largest red deer cull in history. Obviously that is very much a first step; that sort of culling has to be sustained for several years if populations are to decrease. We felt, as is traditional in this area,

that a large cull would instinctively be followed by a reduced cull and we felt that persuading estates to adopt target culls this year would be far harder. But to date, (and it is early days), the new round of target culling has been received very enthusiastically and very positively. So we are optimistic about the whole approach. Now obviously these target populations are not populations – they are just numbers and they are not linked to one another to impact in any way. We want to be able to link deer numbers to the impact those numbers have on the vegetation on which they graze and a first attempt at that is the hill deer decision support model which John Milne talked about briefly this morning.

This model is an extremely complicated and sophisticated bit of equipment. It is a first attempt at linking deer numbers with their impact on six vegetation communities. There are numerous outputs, some of which are of practical use to deer managers, some of which are interesting at a scientific level. The model consists of two parts – firstly a population dynamics side which allows or might allow deer managers to predict long-term consequences of different culling strategies. Secondly, there is a habitat model which predicts changes in the extent of vegetation communities as a consequence of different deer densities and different grazing regimes. There is the possibility of including sheep numbers and rabbit numbers in the grazing regime. The population dynamics model and the habitat model can then be run in combination so that both deer numbers and habitat change can interact with each other. In order to use the Hill Deer computer model in a sensible way and to make sensible predictions we need a lot of data; for the population dynamics side we need perhaps ideally five years of counts – five counting years – and perhaps for the last decade, and cull information on ages of both stags and hinds. There are few estates currently holding that level of information and probably no Deer Management Groups, but the techniques and facilities for collecting that sort of information do exist and DCS has to promote the value of its collection and demonstrate that value. We have to encourage people to go out and do it, because there is an element of work involved in collecting this information. So the population dynamics side can be dealt with, but where we are seriously lacking data is on the habitat side. Currently, we are using the LCS 88 dataset, comprising aerial photography of the whole of upland Scotland carried out in 1988. These photographs can be interpreted by experts in order to define vegetation communities, but it is a rather crude way of going about things because it tells you nothing about habitat condition. To counter that, DCS is encouraging estates to enter into a more formal process of habitat assessment.

What we need is a rapid habitat assessment which is accurate, cost effective and sufficiently rigorous to be accepted by bodies such as SNH and the environmental engineers. There is a lot of research ongoing at the moment to discover ways of doing this in a cost effective manner. The initial survey was carried out on Speyside – the Speyside Deer Management Group – where the Macaulay Land Use Research Institute and SNH staff combined over perhaps two or three years to look at every quarter km² within that group's area to categorise the vegetation, define communities and assess grazing impacts in five categories – namely from light grazing through intense grazing to very heavy grazing. The results from that survey were then presented and stimulated immense interest amongst landowners in the Speyside area but it was extremely costly. The costly element is in the field work and there is a great need to reduce the amount of field work to reduce it. So, currently habitat assessments are designed to look at a random 10% of the quarter km² within an area and the data gathered from that 10% is used to interpret data across the 90% of squares which are unsampled. Habitat assessments using this basis do seem to be acceptably accurate, the cost has dropped to an estimated £5k per Deer Management Group and that is seen as a very acceptable figure for them and they are so enthusiastic about this approach that quite a few Groups have signed up to carry out habitat assessments next year. What we need now is a clearer process of integrating habitat assessment

data with deer management decision making. We have the Hill Deer model but that is, as has been said, a first step; it is non spatial. The whole process needs to be refined and developed over time and it is an important task for DCS to take that process forward.

Looking ahead, there is a need to incorporate hill deer computer predictions and habitat assessment data in some form of formalised deer management planning process. The purpose of deer management plans as we envisage them is to attempt to integrate more fully deer management with other land uses and to encourage perhaps longer-term strategic thinking from deer managers. In the past, deer management has been perceived as being isolated from decision-making in other land uses, and it has almost certainly been characterised by short-term thinking. We want to change that approach. The deer management planning process will also allow deer managers an opportunity to re-assess their aims and objectives in the light of the rapidly changing land use patterns and the rapidly changing political situation – for instance the Land Reform Debate will probably loom large in all our lives in the future.

Looking to the Future

Progress? Well, to date DCS have written 7 pilot deer management plans for Deer Management Groups scattered through the length and breadth of the country. The experience gained in writing those plans has been used to write a guide for co-operative deer management planning for deer and all habitats. That guide was written under the guidance of DCS, the Association of Deer Management Groups, Scottish Natural Heritage and the Forestry Commission and within those bodies there is a broad consensus on the way forward. Once that guide has been made available to deer managers, an important task for DCS will be to encourage Deer Management Groups to produce their own plans. These will need to include regular counts, regular habitat assessments, and management policies which flow from both sets of data. In conclusion, the ideal situation is that Deer Management Groups in the future should know the numbers of deer they hold, the number of deer they want to hold, and the impact of those deer numbers on the range on which they graze, together with all other relevant land uses.

Moorland Conservation and Hill Sheep

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Summary

1. Reducing sheep stocking rate is advocated as a means of rehabilitating degraded semi-natural rough grazing (SNRG), particularly where heather (*Calluna vulgaris*) is a suppressed species. The effects of this approach on sheep performance and on financial returns are being quantified under contrasting farming conditions.
2. From 1989 to 1995, data were collected for sheep stocked at either the Cambrian Mountains ESA prescribed stocking rate or at 30% below this level at ADAS Pwllpeiran, and at 2.1 ewes/ha and 1.5 ewes/ha at ADAS Redesdale.
3. Since April 1995, data have been collected at stocking rates of 1.5 ewes/ha and 1 ewe/ha (redesignated Cambrian Mountains ESA Tier 1A and Tier 2A) at ADAS Pwllpeiran, and 1.5 ewes/ha and 0.66 ewes/ha (English dwarf-shrub heath ESA Tier 1 and Tier 2) at ADAS Redesdale.
4. Improved sheep performance resulted in Gross Margin per ewe being higher on the low stocking rate treatment (£130.14 *vs* £73.78), but even an enhanced ESA payment was insufficient to compensate fully for the reduced number of ewes and Gross Margin per hectare was lower (£86.34/ha *vs* £109.66/ha).
5. Current ESA payments are likely to be sufficient to maintain Gross Margin per hectare for a hill farm entering an **overall** ESA agreement.

Introduction

Agricultural policy until the mid 1980s encouraged a large increase in the numbers of sheep maintained in hill and upland areas. This has resulted in a deterioration in the cover and quality of semi-natural rough grazing (SNRG), particularly those where heather (*Calluna vulgaris*) is a dominant or co-dominant species (Felton and Marsden, 1990; Bardgett *et al*, 1995; Tudor and Mackey 1995). Recognising the ecological importance of heather moors, several voluntary extensification schemes have been introduced in recent years, such as the Environmentally Sensitive Area Scheme (ESA) and the Moorland Scheme, aimed at reversing this trend. Although these schemes differ slightly in their prescriptions, all require a reduction in the numbers of sheep grazing on SNRG. Whereas a considerable amount of research has been done to provide information on the effects of reducing sheep numbers on hill vegetation dynamics (Hill *et al*, 1992; Anderson and Radford 1994; Nolan *et al*, 1995; Hulme *et al*, 1996), few studies have collected information on sheep physical and financial performance or, where such data were collected (Waterhouse, 1994) then other inputs including feed and labour were reduced considerably, also mediating the effects on performance of reducing sheep numbers *per se*. Consequently, the costs to farm businesses of adopting an extensification policy are largely unknown. To address this important issue, long-term, MAFF-funded farm scale projects were established in 1989 under contrasting climatic and management conditions, representative of farming systems in the Cambrian Mountains ESA and Northumberland National Park. Animal performance data and financial returns are reported for these studies.

Materials and Methods

The experiment has two distinct phases. Phase I commenced in 1989 and was successfully completed in 1995. Phase II commenced in 1995, with data collection ongoing, and will be completed in March 2001.

Site Description

The experiments are being done under contrasting climatic and management conditions provided by sites at ADAS Pwllpeiran and ADAS Redesdale.

ADAS Pwllpeiran

ADAS Pwllpeiran is located twelve miles inland from Cardigan Bay and is within the Cambrian Mountains ESA. It is representative of high altitude (range 305m to 625m), high rainfall (mean annual rainfall 1905mm) hill farms. A discrete 300ha, hard, exposed mountain unit with much of the land north facing, comprising predominantly SNRG with a limited amount (44ha) of improved, sown grassland is being used for this farm scale study. Soils are predominantly raw peat (with an organic horizon of between 40cm and 5m thick), Stagnopodzols with peaty top soils of the Hiraethog and Hafren series, or shallow soils of the Powys series with bedrock at 30cm. The SNRG comprises three separate and enclosed areas; the Ffridd area (85ha) where vegetation is predominantly dry heath with *Nardus stricta*, *Festuca ovina* and *Vaccinium myrtillus*, the Garn (29ha) which is a mixture of *Nardus* and *Calluna* dominant dry heath and wet blanket mire with *Eriophorum vaginatum* and *Calluna vulgaris*, and the Mountain area (141.5ha) of *Calluna vulgaris* dominant wet and dry heath and *Eriophorum vaginatum* bog. Based on comprehensive vegetation monitoring, in 1971 and 1989 the area as a whole was divided into a series of 20 large paddocks (10 of SNRG and 10 of semi-improved pastures) which were then allocated to form two comparable sub-units, each of 10 paddocks balanced for vegetation type. Each sub-unit was stocked with a balanced, regular aged flock of pure-bred Welsh Mountain ewes. These sub-units provided the experimental resource for this farm-scale experiment.

ADAS Redesdale

ADAS Redesdale is located in the Rede Valley in North West Northumberland and, although not situated within an ESA, lies within the Northumberland National Park. It is representative of a low altitude (range 240m to 350m), low rainfall (mean annual rainfall 875-mm) progressively managed Northumberland hill farm. A single heft (discrete, self contained flock) extending to approximately 105ha of SNRG was used as the basis for this experiment. It has areas of more fertile mineral soils intermixed with peat above stagno-humic gley all overlying clay. Drainage is impeded particularly where slopes are minimal or absent. Vegetation cover is a mosaic of four main NVC communities (*Calluna vulgaris/Vaccinium myrtillus* (H12); *Scirpus cespitosa/Erica tetralix* wet heath with appreciable amounts of *Molinia caerulea* (M15); *Festuca ovina/Agrostis capillaris/Gallium saxatile* (U4) and *Nardus stricta/Galium saxatile* (U5)). The numbers of Scottish Blackface ewes carried on this heft had increased from 169 to 216 over the period 1973 to 1987. As a result of this increase in sheep numbers, the area of land with greater than 50% cover of *Calluna* had reduced by 40% between 1976 and 1989. The site had been stocked at 2.1 ewes/ha, and the area and quality of *Calluna* were in serious decline by 1989. At this time, the heft was divided to produce two sub-units, balanced for the main vegetation communities. Each sub-unit was stocked with balanced, regular aged flocks of pure-bred Scottish Blackface ewes. These sub-units were used as the experimental resource for this farm scale experiment.

Experiment Design

ADAS Pwllpeiran

From 1989 to 1995, one unit (ten paddocks) was grazed according to the original Cambrian Mountain ESA prescribed stocking rate while the other was stocked at 30% below this level. At that time Cambrian Mountain ESA stocking rates were set differently depending on vegetation type, and areas of semi-improved pastures were not subject to grazing restrictions. The experimental units comprised a series of ten paddocks of different vegetation types on which prescribed stocking rates ranged from 1.2 ewes/ha to 2.7 ewes/ha, with an overall stocking rate on SNRG of 1.74 ewes/ha and 1.17 ewes/ha for the ESA unit and ESA –30% unit respectively. In order to achieve the prescribed stocking rates on SNRG, sheep were in the main displaced to areas of semi-improved pastures and relatively few (7%) sheep were removed entirely from the system. The overall (SNRG and semi-improved pastures combined) stocking rates for the two sub-units were 1.94 ewes/ha and 1.81 ewes/ha for the ESA and ESA – 30% treatments respectively.

Following a redesignation of the Cambrian Mountain ESA in 1995 stocking rates on the two units were further adjusted to reflect changes in the prescription agreement. Since April 1995, areas of SNRG on the sub-unit previously stocked at the former ESA prescriptions (1.74 ewes/ha) has been stocked at 1.5 ewes/ha (redesignated ESA Tier 1A unit) while the unit previously stocked at 30% below ESA prescriptions (1.17 ewes/ha) has been stocked at 1.0 ewes/ha during the summer, decreasing to 0.66 ewes/ha during the winter (redesignated ESA Tier 2A unit). Again the redesignated Cambrian Mountains ESA agreement placed no grazing restriction on areas of semi-improved pastures. The sheep removed from SNRG in order to comply with the redesignated ESA prescription were again concentrated on areas of semi-improved pastures, such that the overall stocking rates on the two sub-units remained unchanged at 1.94 ewes/ha and 1.81 ewes/ha for redesignated ESA Tier 1A and Tier 2A treatments respectively.

ADAS Redesdale

From 1989 to 1995, one sub-unit continued to be stocked at 2.1 ewes/ha while stocking rate on the other was reduced to 1.5 ewes/ha by removing sheep permanently from the system, rather than concentrating them on semi-improved pastures. No other changes to sheep husbandry and management were made during that period.

In April 1995 sheep numbers on the sub-unit previously stocked at 2.1 ewes/ha were reduced further to 0.66 ewes/ha, no stocking rate change was made to the sub-unit stocked at 1.5 ewes/ha. Consequently, since 1995 stocking rates of 1.5 ewes/ha and 0.66 ewes/ha, representative of English dwarf-shrub heath ESA Tier 1 and Tier 2 prescriptions respectively, have been compared. In addition, sheep husbandry and management have been brought in line with ESA prescriptions. Specifically, all hoggs (flock replacements) and 25% of breeding ewes were removed from SNRG from 1 October to 28 February each year, and all breeding ewes were removed from SNRG for three weeks during mating (November) and again for three weeks during lambing (April).

Flock Management

ADAS Pwllpeiran

Ewes were mated on SNRG during November and were pregnancy scanned at the end of January each year. At that time, twin-bearing ewes were housed and fed *ad libitum* grass silage and a total of 30kg per

ewe of a proprietary compound feed from housing to lambing. Single-bearing ewes were wintered on semi-improved pastures and were supplemented with *ad libitum* baled silage plus self-help feed-blocks from early January each year. They were transferred to improved pastures immediately prior to lambing to facilitate management. The ewes lamb during April and those rearing single lambs were returned to SNRG as soon as weather conditions allowed. Twin-rearing ewes remain on improved pastures throughout. Ewe lambs identified as flock replacements were away-wintered from October to March.

During the summer months, maiden heifers were agisted to improved pastures on both units to assist with pasture management. In addition, approximately 6ha of the Tier 1A unit's improved land was cut for silage each year, but no silage was made on the Tier 2A unit.

ADAS Redesdale

All ewes were removed from SNRG for three weeks, commencing on 20 November each year, and were mated on an area of semi-improved pastures. They were returned to SNRG in early December, except for the 25% of ewes from each flock which were to be removed from SNRG for the whole winter period (1 October to 28 February), and were supplemented when necessary with restricted hay and self-help feed-blocks. The rates of supplementary feeding reflected ewe body condition, the amounts of herbage available on the hill and the prevailing weather conditions.

Off-wintered ewes remained on semi-improved pastures until pregnancy diagnosis on 28 February and were fed *ad libitum* baled silage plus self-help feed-blocks if necessary, to maintain ewe body condition. Following pregnancy diagnosis, single-bearing ewes were returned to SNRG and all twin-bearing ewes were housed. All ewes were removed from SNRG for three weeks at lambing time. Female lambs retained as replacement breeding stock (hoggs) remain on SNRG until the ewes were mated in November. Thereafter, they were transferred to improved pastures from October to March each year.

Twin-bearing ewes were housed in late February and fed a basal ration of *ad libitum* baled silage, supplemented with a total of 26kg per ewe of compound feed over the last seven weeks of pregnancy. Mean lambing date was 22 April, and after lambing, twin-rearing ewes continued to be supplemented with compound feed until sufficient grass was available to meet their nutritional requirements. Supplementary feeding post-lambing ceased on average on 20 May. Single-bearing ewes were removed from SNRG immediately prior to lambing and were lambed outside on an area of semi-improved pasture. These ewes and their single lambs were returned to SNRG in early May. After lambing, twin-bearing ewes were initially turned out to sheltered, improved pastures before being transferred back to SNRG on average on 7 June.

At both sites, lambs were weaned in August when all male lambs and any female lambs not required for breeding, were transferred to improved pastures for finishing. Finished lambs were selected for slaughter when judged to carry sufficient finish to classify as fat classes 2 and 3L and lambs were marketed from September to early January.

Assessments

At both sites, ewes and hoggs were weighed and body condition scored at the start of mating each year. Thereafter, ewes only were condition scored at the time of pregnancy diagnosis, at shearing and at weaning.

Lambs were weighed within twenty-four hours of birth, and then at routine intervals up to weaning. Finished lambs were also weighed prior to slaughter, and carcass weights and classifications were recorded at the abattoir by Meat and Livestock Commission staff.

The weights of compound feed, hay and silage consumed were recorded throughout the experiment and comprehensive records of sheep husbandry and management and financial records were maintained.

Statistical Analysis

Ewe, hogg and lamb live weights were analysed by analysis of variance as an unbalanced design and ewe condition scores, carcass fat and carcass conformation scores and litter size were analysed by Chi-squared. For the purpose of statistical analysis, individual animals were treated as replicates, as in the design of the experiments, which were done as whole system studies, there was no true replication of treatments. The limitations of this approach must be recognised and care must be taken when interpreting the results of statistical analysis.

Results and Discussion

The experiment falls into two distinct Phases. Data are presented for the period from October 1989 to March 1995 (Phase I) and from April 1995 to weaning in August 1999 (Phase II) . Stocking rates and management from October 1989 to March 1995 were different to those imposed from April 1995 to weaning 1999 and at both sites the 1995 lambing season represented a transitional year. Despite this, for completeness, the results obtained in 1995 have been included in the overall analyses. For Phase I, data are presented for five complete production cycles and the corresponding number of financial years. For Phase II, where data collection are on-going, sheep physical performance data are presented for five production cycles, up to weaning in 1999. Financial data are presented for four completed financial years with data collection for 1999/00 on-going.

Health and Welfare

Generally, the health and welfare of all sheep has been acceptable with two notable exceptions.

At ADAS Pwllpeiran, mortality rates of Welsh Mountain replacement lambs in 1995 and 1996 were unacceptably high, but similar for both stocking rate treatments (6.3% *vs* 7.5% in 1995 and 10.6% *vs* 8.7% in 1996 for 1.5 ewes/ha and 1.0 ewes/ha treatments respectively). A progressive increase in biomass production on SNRG has resulted in an increase in overall levels of 'wetness' on both sub-units. A major cause of death in 1996 was attributed to yearling ewe lambs becoming trapped in wet areas, and it was assumed that the weight of their saturated fleeces prevented them from escaping and ultimately they died as a consequence of either exhaustion or starvation. Since 1997, ewe lamb replacements have been shorn in October prior to being away-wintered and subsequently mortality rate in ewe lamb replacements has been reduced considerably.

At ADAS Redesdale, in 1995 Scottish Blackface ewes stocked at 1.5 ewes/ha lost excessive amounts of live weight and body condition in the first-third of pregnancy (November 1995 to mid-January 1996). This reflected the policy (ESA prescription) of not providing supplementary feed except during storm conditions. Weather conditions had not been particularly inclement and so supplementary feeding had been withheld.

It became evident that ewes on this treatment were unable to maintain body condition from the nourishment they derived from grazing native hill species alone. Based on this result, and with the agreement of an ESA Project Officer, the policy of supplementing ewes only during storm condition was abandoned in favour of a policy which related supplementary feeding to ewe body condition, available grazing and prevailing weather conditions. After implementing the revised policy, there was no further cause for concern with respect to condition of ewes on the high stocking rate treatment.

Animal welfare has been shown to be compromised in some extensification studies (Waterhouse, 1994) but these results have usually been obtained in the context of reduced inputs and management (shepherding) as well as a reduction in sheep numbers. The results of the studies at Pwllpeiran and Redesdale would suggest that, where inputs were reduced slightly and where proactive shepherding and management were maintained, implementing ESA prescriptions is unlikely to compromise animal health and welfare.

Flock Productivity

Throughout and for both sites, flock output (numbers of lambs weaned), was acceptable for hill farming systems (MLC, 1999). This reflected good, overall standards of husbandry and management. The relatively high numbers of lambs born, for a hill farming system, at both sites and for all treatments reflects the fact that ewes were mated on improved pastures. Ewes were therefore receiving a high plane of nutrition before and during mating which is known to increase ewe reproductive performance (Merrell, 1990).

Phase I (1989-1995)

Implementing a Cambrian Mountain ESA prescribed stocking rate or a rate 30% below this level had little effect on the numbers of ewe deaths or barren ewes and consequently the numbers of productive ewes were similar for both sub-flocks of Welsh Mountain ewes (**Table 1**). Despite ewes on the ESA –30% treatment being significantly heavier and in better body condition at mating, the numbers of lambs born were similar for both treatments, as was lamb mortality rate. This resulted in the numbers of weaned lambs being similar for both treatments.

Reducing the stocking rate of Scottish Blackface ewes from 2.1 ewes/ha to 1.5 ewes/ha slightly increased both the number of productive ewes and the number of lambs born. Lamb mortality rate was low and similar for both treatments and this resulted in ewes on the lower stocking rate weaning slightly more lambs (**Table 1**).

The stocking rate treatments imposed from 1989 to 1995 had little impact on flock productivity of either Welsh Mountain or Scottish Blackface flocks.

Phase II (1995-1999)

Although the redesignated Cambrian Mountains ESA prescription, implemented from 1995 to 1999, required substantially different stocking rates on SNRG (1.5 ewes/ha *vs* 1.0 ewes/ha), no stocking rate restriction applied to semi-improved pastures, and ewes displaced from SNRG were in the main concentrated on semi-improved pastures. This resulted in the two sub-units being stocked at similar levels overall (1.94 ewes/ha *vs* 1.81 ewes/ha, for ESA Tier 1A and Tier 2A respectively). Therefore, as expected, there was little difference in the level of productivity achieved by either of the Welsh Mountain sub-flocks. Ewe deaths, the numbers of barren ewes and consequently the numbers of productive ewes were similar for both treatments, as were the numbers of lambs born and weaned (**Table 2**).

Whereas reducing the stocking rate of Scottish Blackface ewes from 2.1 ewes/ha to 1.5 ewes/ha, during Phase I of the experiment, had little impact on flock productivity, reducing stocking rate still further, to 0.66 ewes/ha, had a considerable effect on flock performance. From 1995 to 1999 flock productivity was considerably greater for ewes stocked at 0.66 ewes/ha compared with ewes stocked at 1.5 ewes/ha because of a reduction in the number of ewe deaths and barren ewes, and because of higher levels of ewe reproductive performance. Ewes stocked at the lower rate weaned on average 12% more lambs than those stocked at 1.5 ewes/ha. Lamb mortality was low overall (mean 2.8%) compared with levels reported on commercial hill farms (Merrell, 1996), and was approximately similar for both treatments (3.4% *vs* 2.3% for ewes stocked at 0.66 ewes/ha and 1.5 ewes/ha respectively), despite ewes stocked at the lower rate rearing considerably more, potentially vulnerable, twin lambs (**Table 2**).

The stocking rate treatments imposed from 1995 to 1999 as expected had little impact on flock productivity of the Welsh Mountain sub-flocks where the stocking rates of the units as a whole were not greatly different (1.94 ewes/ha *vs* 1.81 ewes/ha). By contrast reducing stocking rate had a large impact on flock productivity of the Scottish Blackface sub-flock, where stocking rate on the ESA Tier 2 unit was 56% lower than on the ESA Tier 1 unit (0.66 ewes/ha *vs* 1.5 ewes/ha respectively).

Ewe Live Weights and Condition Scores

Phase I (1989-1995)

Although implementing the Cambrian Mountains ESA prescribed stocking rate on SNRG, or reducing stocking rate by 30% below this level, resulted in relatively large differences in stocking rate on SNRG (1.74 ewes/ha *vs* 1.17 ewes/ha, for ESA and ESA –30% respectively), the differences in stocking rates imposed on the units as a whole were not as marked (1.94 ewes/ha *vs* 1.81 ewes/ha). Nevertheless, ewes on the ESA –30% treatment were significantly heavier and in better body condition at mating than those on the ESA treatment (**Table 3**). However, this did not lead to an improvement in reproductive performance of ewes on the ESA –30% treatment as would have been expected (**Table 1**). This lack of response in reproductive performance would suggest that, although differences in live weights and condition scores at mating were significant, they were insufficient to reach the response threshold for the breed, whereby improved body condition results in increased numbers of lambs born (Gunn *et al*, 1984).

Reducing the stocking rate of Scottish Blackface ewes from 2.1 ewes/ha to 1.5 ewes/ha unexpectedly had no significant beneficial effects on the live weights or condition scores of ewes at mating. This result was in good agreement with that reported by Waterhouse (1994) who also showed that reducing stocking rate by 30% had no beneficial effect on most aspects of sheep performance. It can only be assumed that over a relatively short time-span, the magnitude of the stocking rate reduction was insufficient to affect animal performance, because the amount and quality of SNRG had not changed sufficiently to provided a better level of year-round nutrition. Changes in hill vegetation types to reduced grazing pressure are recognised as being slow to manifest themselves.

Phase II (1995-1999)

Welsh Mountain ewes on the low stocking rate were significantly (P<0.001) heavier than those on the Tier 1A treatment at mating (**Table 4**), but this was not associated with a difference in ewe condition scores.

Reducing the stocking rate of Scottish Blackface ewes from 1.5 ewes/ha to 0.66 ewes/ha impacted considerably on ewe live weights and condition scores. As expected, ewes on the lower stocking rate were significantly heavier and had significantly higher body condition scores at mating (**Table 4**). This, as would be expected (Gunn *et al*, 1984: Merrell, 1990), impacted significantly on ewe reproductive performance and ewes stocked at the low rate produced on average 14% more lambs (**Table 2**).

Lamb Live Weights

Phase I (1989-1995)

Reducing stocking rate on SNRG by 30% below a Cambrian mountains ESA prescribed stocking rate increased the live weights of Welsh Mountain lambs up to weaning, but only the difference in live weights in June was significant (**Table 5**).

By contrast reducing the stocking rate of Scottish Blackface ewes from 2.1 ewes/ha to 1.5 ewes/ha had no beneficial effect of lamb live weights up to weaning. This probably reflected the fact that changes in vegetation types and quality over this period were small and consequently the diet selected by ewes on the low stocking rate was of similar nutritional value to that consumed by ewes stocked at the high rate, with no beneficial impact on milk yield.

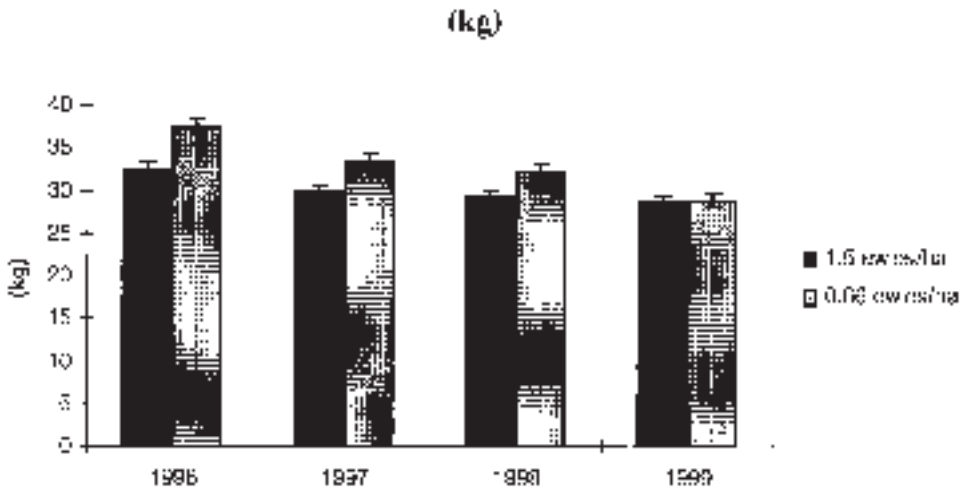
Phase II (1995-1999)

For Phase II an initial analysis showed that although there was no significant difference in the sex ratio of lambs, the number of twin-reared lamb differed significantly (mean rearing status 1.59 *vs* 1.67, P<0.05) for the Scottish Blackface flocks, with ewes on the low stocking rate rearing significantly more twin-lambs than those stocked at 1.5 ewes/ha. Lamb growth performance data and carcass information were therefore corrected using rearing status as a covariate. No such adjustment was necessary for Welsh Mountain lambs where the proportion of twin-reared lambs was similar for both sub-flocks.

For both extensification systems, stocking rate impacted on most aspects of lamb growth performance, except lamb birth weights which were not affected by treatment. Lamb birth weights on all treatments were acceptable reflecting adequate levels of feeding in mid-pregnancy (Waterhouse and McClelland, 1987) and late pregnancy (Robinson, 1990). Thereafter, lambs born to ewes on the low stocking rate treatments were significantly heavier than those born to ewes on the high stocking rate treatments for both breeds and at all times up to weaning (**Table 6**). The superior growth performance to weaning of lambs born to ewes on the low stocking rate treatments probably reflected the fact that these ewes were of higher live weight and in better condition at lambing and were therefore able to sustain better milk yields. Live weights of all lambs were acceptable for hill production systems.

While the mean weaning weights of both Welsh Mountain and Scottish Blackface lambs born to ewes stocked at the low rates were higher than those born to ewes stocked at the high rates, annually the magnitude of these differences appears to be declining (**Figure 1**).

Figure 1 Weaning weights of Scottish Blackface lambs.



Whereas lamb growth performance on the two stocking rates diverged initially, there is evidence that lamb performance since 1998 has started to converge. The decline in relative growth performance of lambs on the low stocking rate treatments may be a result of reduced grazing pressure, leading to a progressive build up of grasses of low nutritional value, such as *Molinia caerulea*, in the sward as was the case at ADAS Redesdale (Rushton *et al* 1996, Gardner, 1998). Alternatively, at ADAS Pwllpeiran, where changes in vegetation have been minor, it may provide an early indication that the improved pastures, so heavily relied upon to maintain overall sub-unit stocking rates at a similar level, are unable to sustain the higher number of displaced ewes on the Tier 2A system. The likely extent of any further convergence in individual animal performance cannot be quantified at present and may take several more years to manifest itself fully, as changes in vegetation cover and quality are slow to develop. While it is generally accepted that a reduction in grazing pressure can enhance the vigour and cover of *Calluna*, the relationship between grazing pressure and changes in the extent of *Calluna* or other key moorland vegetation types is not straight forward, and other authors have reported non-beneficial changes in vegetation type, as seen at ADAS Redesdale, in response to reduced stocking rate (ADAS, 1998).

Live Weights of Flock Replacements

As with all lambs up to weaning, female lambs born to ewes stocked at the low rates and selected as replacements (hoggs) were also significantly heavier in October/November each year (24.3kg *vs* 25.1kg for Welsh Mountain ewes at 1.5 ewes/ha and 1.0 ewe/ha respectively, and 33.5kg *vs* 38.7kg for Scottish Blackface ewes at 1.5 ewes/ha and 0.66 ewe/ha respectively, $P<0.001$). This has implications for the subsequent life-time reproductive performance of flock replacements, as the weight of hoggs at this time is known to affect reproductive performance. It is likely that retained ewe lambs on the low stocking rate treatments will produce more lambs in their life-time than those on the high stocking rate treatments (Gunn, 1977; Gunn *et al* 1986).

Weight of Weaned Lamb per Hectare

As expected, over both Phases of the experiment, the weights of weaned lamb per hectare were similar from both Welsh Mountain sub-flocks (41.6 kg/ha *vs* 41.2 kg/ha for ESA and ESA –30% and 41.5 kg/ha *vs* 42.6 kg/ha for ESA Tier 1A and Tier 2A), reflecting similar levels of individual animal performance and, more importantly, similar overall stocking rates on the two units.

Reducing the stocking rate of Scottish Blackface ewes from 2.1 ewes/ha to 1.5 ewes/ha during Phase I of the experiment impacted only slightly on lamb weaning percentage (**Table 2**) and lamb weaning weights (**Table 5**). This resulted in the weight of weaned lamb per hectare being considerably lower where ewes were stocked at 1.5 ewes/ha (78.5 kg/ha *vs* 56.8 kg/ha). The magnitude of this reduction at 27%, was in-line with the 30% reduction in stocking rate. During Phase II, despite Scottish Blackface ewes stocked at 0.66 ewes/ha rearing 14% more lambs which were on average 4.0kg heavier at weaning (**Table 6**), these increases in individual ewe and lamb performance were insufficient to compensate for the reduced numbers of ewes carried. Again the weight of weaned lamb per hectare was considerably lower for ewes stocked at the low rate (58.9 kg/ha *vs* 32.4 kg/ha). However, because of better individual animal performance proportionately the reduction in output of weaned lamb was slightly less marked in Phase II than it was in Phase I, and the weight of weaned lamb per hectare fell by only 44% in response to a 56% reduction in stocking rate. The relationship between stocking rate and weight of weaned lamb per hectare would appear therefore not to be linear but curvilinear.

Financial Returns

Phase I (1989-1995)

Implementing a Cambrian Mountains ESA prescribed stocking rate or 30% below this level on SNRG impacted only slightly on most aspects of individual animal and flock performance of Welsh Mountain ewes. Therefore revenue from sales of produce was similar for both units but ewes on the ESA –30% treatment realised a higher total revenue per ewe (**Table 7**) which reflected in the main an enhanced ESA payment, equivalent to approximately £4 per ewe. As variable costs of production were similar for both treatments this resulted in Gross Margin per ewe being higher for ewes stocked at the low rate. However, because the number of ewes maintained overall was approximately 7% lower on the ESA –30% unit, Gross Margin per hectare was slightly less on this treatment (**Table 7**). Between 1989 and 1995 treatment difference in financial returns were relatively small and the additional ESA payments paid to the ESA –30% treatment were approximately sufficient to compensate for the lower stocking rate on SNRG.

Reducing the stocking rate of Scottish Blackface ewes from 2.1 ewes/ha to 1.5 ewes/ha improved slightly the numbers of lambs per ewe for sale and also slightly increased carcass weights (15.9kg *vs* 15.7kg, $P>0.05$). This resulted in ewes stocked at the low rate achieving a higher revenue per ewe than those stocked at the high rate but, because they also incurred slightly higher variable costs, as a consequence of more twin-lambs in the system, Gross Margin per ewe was similar for both treatments. However, because of the reduced number of ewes carried Gross Margin per hectare was considerably lower on the unit stocked at 1.5 ewes/ha (**Table 7**).

ADAS Redesdale is not within an ESA and was therefore not eligible to claim ESA payments. Nor were the stocking rates imposed between 1989 and 1995 in-line with English ESA dwarf-shrub heath prescriptions. Therefore, Gross Margin data are reported net of any extensification payments. However, by reducing stocking rate from 2.1 ewes/ha to 1.5 ewes/ha it would have been possible to participate in the MAFF Moorland Scheme. This would have provided an additional net revenue of £13/ewe for each ewe removed from the system. This equated to an additional revenue of £8.04/ha which was insufficient to compensate for the reduced numbers of ewes carried.

Phase II (1995-1999)

Although the redesignated Cambrian Mountains ESA Tier 1A unit carried slightly more stock than the Tier 2A unit revenue per ewe from sale of produce was higher on the Tier 2A unit (£24.10 *vs* £23.28) which reflected a higher number of lambs sold per ewe, which had higher carcass weights (12.7kg *vs* 12.2kg, $P<0.05$) and better quality draft ewes for sale. This combined with an enhanced ESA payment, associated with the lower stocking rate, resulted in the Tier 2A unit producing a total revenue per ewe which was approximately £10 greater than that achieved by ewes on the Tier 1A unit (**Table 8**).

To achieve the prescribed stocking rates on SNRG, a higher proportion of ewes needed to be displaced to improved pastures from the Tier 2A unit than from the Tier 1A unit. This resulted in an increase in variable cost, particularly purchased feeds. Despite slightly higher variable costs, Gross Margin per ewe and Gross Margin per hectare were considerably higher on the Tier 2A unit. The differential between Cambrian Mountains ESA Tier 1A and Tier 2A payments were sufficient to compensate fully for the reduced stocking rate on SNRG and for the low stocking rate unit carrying slightly fewer ewes overall. The financial benefit of intensifying production on areas of improved land while reducing grazing pressure on SNRG is in good agreement with that reported by Waterhouse and Ashworth (1997).

Reducing the stocking rate of Scottish Blackface ewes from 1.5 ewes/ha to 0.66 ewes/ha improved significantly most aspects of individual animal performance. This resulted in more lambs per ewe being finished on the low stocking rate treatment which were also of superior carcass weight (16.5kg *vs* 14.8kg, $P<0.001$) and quality. Consequently, the revenue derived from sale of produce was considerably higher on the unit stocked at 0.66 ewes/ha (**Table 8**). This, combined with a notional ESA payment equivalent to £75.75 per ewe (English dwarf-shrub heath ESA Tier 2 payment of £50/ha) and other subsidy payments (HLCA & SAPS) resulted in total revenue on the unit stocked at 0.66 ewes/ha being approximately £59/ewe higher than that achieved by ewes stocked at 1.5 ewes/ha. Variable costs of production, when expressed on a per ewe basis, were similar for both treatments. Consequently Gross Margin per ewe was appreciable higher on the low stocking rate unit, but the additional ESA payment was insufficient to compensate for the large reduction in the number of ewes carried, as indicated by the lower Gross Margin per hectare. An additional payment equivalent to £23.32/ha was required to compensate fully for the Tier 2 unit carrying less stock.

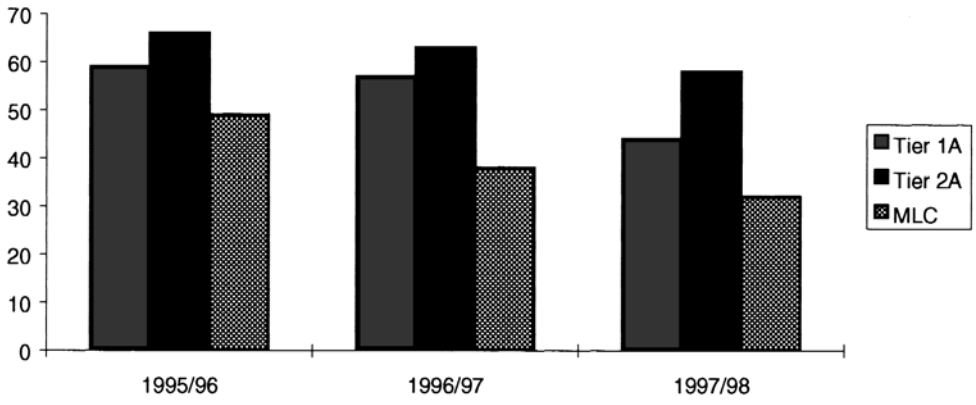
It could be argued that when sheep are removed from the system totally, to effect a lower stocking rate on SNRG, that the differential between ESA Tier 1 and ESA Tier 2 payments is insufficient to encourage producers to adopt a Tier 2 agreement. However, it must be remembered that generally the largest proportion of a farm enters a Tier 1 agreement with a relative small area usually entering a Tier 2 agreement. Of greater importance, at least in financial terms, is whether or not it is financially viable for a progressive, relatively high performing hill farm stocked initially at 2.1 ewes/ha to adopted an overall ESA agreement.

Although not a controlled experiment, between 1989 and 1999 the unit at ADAS Redesdale has been progressively stocked at 2.1 ewes/ha, 1.5 ewes/ha and 0.66 ewes/ha and this resource can be used to examine the likely impact of adopting an ESA agreement, on what was originally a progressively managed hill farm. This comparison (**Table 9**) shows clearly that the additional revenue derived from implementing an

ESA Tier 1 agreement was more than adequate to compensate for the reduction in stocking rate from 2.1 ewes/ha to 1/5 ewes/ha, but that the ESA Tier 2 payment was inadequate to compensate for a reduction in stocking rate from 2.1 ewes/ha to 0.66 ewes/ha. Nevertheless, the data suggest that current levels of ESA payment would be sufficient to compensate for a hill farm entering an overall ESA agreement, with some land in Tier 1 and some in Tier 2, even when sheep were removed permanently from the system.

Where sheep are merely displaced to another area on the unit then the financial returns from implementing an ESA agreement on SNRG are likely to increase the Gross Margin of participating hill farms above those achieved by non-participating farms. This can be shown by comparing the financial performance of the ADAS Pwllpeiran ESA units with those achieved by hill farms, with similar levels of physical output, and which participate in the MLC (1996, 1997, 1998 & 1999) Flockplan recording system (**Figure 2**). In each of the three financial years 1995/96, 1996/97 and 1997/98 the Gross Margin achieved by both the Pwllpeiran ESA units were considerably higher than those achieved by MLC recorded hill flocks. However, to achieve this level of financial performance the two ESA units were highly dependent on support payments which in financial year 1997/98 accounted for 73% and 75% of Total Revenue on the ESA Tier 1A and Tier 2A units respectively. The corresponding figure for MLC (1999) recorded flocks was only 53%.

Figure 2 Gross Margin analysis for ADAS Pwllpeiran's ESA units and MLC recorded hill farms (£/ewe).



Both these studies have shown that Gross Margin per hectare can potentially be higher where ESA prescription are implemented compared with Gross Margins achieved on non participating hill farms. This in turn will impact beneficially on Net Farm Income as reported by Colman (1994) and Hughes (1994). This in turn is likely to safeguard or increase rural employment and help stabilise a vulnerable rural economy.

Clearly, extensification on SNRG has a major potential impact on financial returns and, hence on the financial viability of hill farms, depending on whether or not sheep are removed permanently from the system or are merely displaced to other areas on the unit. For producers considering entering extensification agreements, then the extent of the reduction in financial returns must be given due consideration. However, Gross Margin per hectare should not be the only consideration, as factors like the potential to reduce fixed costs and the age, family structure and aspirations of each producer must also be taken into account during the decision-making process.

Conclusion

Implementing the original Cambrian Mountains ESA prescription or a stocking rate 30% below this level from 1989 to 1995 had little impact on flock productivity and on individual animal performance. Output of weaned lamb was also little affected, as the total number of sheep carried was similar for both units. This resulted in revenue per ewe being similar for both units and as variable costs were also similar there was little difference in Gross Margin per ewe and Gross Margin per hectare between the units.

Reducing stocking rates further on SNRG in-line with redesignated Cambrian Mountains ESA Tier 1A and Tier 2A prescriptions from 1995 to 1999 resulted in an increase in individual animal performance for ewes on the low stocking rate. Output of weaned lamb per hectare was again similar reflecting the fact that overall sheep numbers on the units as a whole were little different. Revenue per ewe from sale of produce was higher on the Tier 2A unit which reflected a higher number of lambs sold per ewe, which were of slightly better quality and hence realised a better return. This, combined with an enhanced ESA payment, associated with the lower stocking rate, resulted in the Tier 2A unit producing a total revenue per ewe which was considerably higher than that achieved by ewes on the Tier 1A unit. Despite slightly higher variable costs on the Tier 2A unit Gross Margin per ewe and Gross Margin per hectare were considerably higher. The results highlight the importance of the limited area of improved land to both units, and the ability of this area to carry a relatively high stocking rate over most of the summer. Providing sufficient improved land is available to mediate the necessity to reduce sheep numbers on the unit as a whole, then the differential between Cambrian Mountains ESA Tier 1A and Tier 2A payments were sufficient to compensate for the reduced stocking rates on SNRG and for the low stocking rate unit carrying slightly fewer ewes.

Reducing the stocking rate of Scottish Blackface ewes from 2.1 ewes/ha to 1.5 ewes/ha impacted little on flock productivity and individual animal performance. This resulted in the weight of weaned lamb per hectare being similar for both treatments but, because of the reduced number of ewes maintained on the low stocking rate unit, weight of weaned lamb per hectare was considerably lower when ewes were stocked at 1.5 ewes/ha. Slight improvements in the numbers of lambs finished and in carcass weights resulted in Gross Margin per ewe being higher on the low stocking rate treatment but Gross Margin per hectare was appreciably higher for the high stocking rate treatment.

Reducing stocking rate still further, to 0.66 ewes/ha impacted significantly on most aspects of sheep physical performance. However, even when individual animal performance was improved this was insufficient to compensate for the numbers of ewes removed from the system and output, expressed as weight of weaned lamb per hectare, was reduced considerably at the low stocking rate. Improvements in flock output and individual animal performance resulted in Gross Margin per ewe being higher for ewes stocked at the low rate but, because of reduced sheep numbers Gross Margin per hectare was appreciably lower. At current rates, English dwarf-shrub heath ESA Tier 1 and ESA Tier 2 payments were, overall, sufficient to compensate for reduced stocking rates on SNRG even when this was achieved by removing sheep permanently from the system.

Extensification on SNRG has potentially a major impact on financial returns and, hence on the financial viability of hill farms, depending on whether or not sheep are removed permanently from the system or are merely displaced to other areas on the unit. Both these studies have shown that potentially Gross Margin per hectare can be higher where ESA prescription are implemented compared with Gross Margins achieved on non participating hill farms.

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Table 1 Effects of stocking rate on flock productivity per 100 ewes mated (mean 1989-1995).

	Ewes per ha			
	Welsh Mountain		Scottish Blackface	
	1.74†	1.17‡	2.1	1.5
Ewe deaths	2	1	3	2
Ewes barren	3	3	6	4
Productive ewes	95	96	91	94
Number of lambs scanned	112	112	125	131
Number of lambs born	104	105	120	122
Number of lambs weaned	101	99	118	120

† ESA stocking rate on SNRG (overall stocking rate on unit 1.94 ewes/ha)

‡ ESA stocking rate –30% on SNRG (overall stocking rate on unit 1.81 ewes/ha)

Table 2 Effects of stocking rate on flock productivity per 100 ewes mated (mean 1995-1999).

	Ewes per ha			
	Welsh Mountain		Scottish Blackface	
	1.5†	1.0‡	1.5	0.66
Ewe deaths	1	2	2	1
Ewes barren	4	3	4	1
Productive ewes	95	95	94	98
Number of lambs scanned	109	111	134	150
Number of lambs born	107	108	132	146
Number of lambs weaned	100	101	129	141

† ESA Tier 1A stocking rate on SNRG (overall stocking rate on unit 1.94 ewes/ha)

‡ ESA Tier 2A stocking rate on SNRG (overall stocking rate on unit 1.81 ewes/ha)

Table 3 Effects of stocking rate on live weights and condition scores of Welsh Mountain and Scottish Blackface ewes at mating (mean 1989-1995).

	Ewes per ha					
	Welsh Mountain			Scottish Blackface		
	1.74†	1.17‡		2.1	1.5	
Live weight (kg)	34.3	35.5	**	56.0	55.3	NS
Condition score Ψ	2.56	2.70	*	2.66	2.71	NS

† ESA stocking rate on SNRG (overall stocking rate on unit 1.94 ewes/ha)

‡ ESA stocking rate –30% on SNRG (overall stocking rate on unit 1.81 ewes/ha)

Ψ score 0 to 5, where 0 = very thin and 5 = very fat

Within breed NS = not significant, ** = P <0.01, * = P <0.05

Table 4 Effects of stocking rate on live weights and condition scores of Welsh Mountain and Scottish Blackface ewes at mating (mean 1995-1999).

	Ewes per ha			
	Welsh Mountain		Scottish Blackface	
	1.5†	1.0‡	1.5	0.66
Live weight (kg)	37.2	37.9 ***	55.6	60.5 ***
Condition score Ψ	3.1	3.1 NS	2.7	3.1 ***

† ESA Tier 1A stocking rate on SNRG (overall stocking rate on unit 1.94 ewes/ha)

‡ ESA Tier 2A stocking rate on SNRG (overall stocking rate on unit 1.81 ewes/ha)

Ψ score 0 to 5, where 0 = very thin and 5 = very fat

Within breed NS = not significant, *** = P <0.001

Table 5 Effects of stocking rate on live weights (kg) of Welsh Mountain and Scottish Blackface lambs (mean 1989-1994).

	Ewes per ha			
	Welsh Mountain		Scottish Blackface	
	1.74†	1.17‡	2.1	1.5
At birth	3.3	3.3 NS	4.0	4.0 NS
At marking	–	–	12.4	12.4 NS
At shearing	17.5	18.0 *	–	–
At weaning	23.1	23.9 NS	32.4	31.9 NS

† ESA stocking rate on SNRG (overall stocking rate on unit 1.94 ewes/ha)

‡ ESA stocking rate –30% on SNRG (overall stocking rate on unit 1.81 ewes/ha)

Within breed NS = not significant, * = P <0.05

Table 6 Effects of stocking rate on live weights (kg) of Welsh Mountain and Scottish Blackface lambs (mean 1995-1999).

	Ewes per ha			
	Welsh Mountain		Scottish Blackface	
	1.5†	1.0‡	1.5	0.66
At birth	3.5	3.6 NS	4.1	4.0 NS
At marking	–	–	11.7	12.6 ***
At shearing	19.2	19.7 **	–	–
At weaning	24.7	25.8 ***	30.5	34.5 ***

† ESA Tier 1A stocking rate on SNRG (overall stocking rate on unit 1.94 ewes/ha)

‡ ESA Tier 2A stocking rate on SNRG (overall stocking rate on unit 1.81 ewes/ha)

Within breed NS = not significant. *** = P <0.001, ** = P <0.01

Table 7 Effects of stocking rate on Gross Margins (mean 1989 to 1995).

	Ewes per ha			
	Welsh Mountain		Scottish Blackface	
	1.74†	1.17‡	2.1	1.5
Revenue (£/ewe) Sale of produce	21.50	21.29	30.30	33.30
Subsidy (HLCA + SAPS)	23.31	23.31	25.49	25.89
ESA payments	23.00	26.39	–	–
Cattle agistment payment	0.16	0.22	–	–
Total Revenue (£/ewe)	67.97	71.21	55.79	59.19
Replacement costs (£/ewe)	1.75	1.75	1.30	1.63
Total variable costs (£/ewe)	13.04	13.36	15.12	16.35
Gross Margin (£/ewe)	53.18	56.10	39.37	41.21
Gross Margin per ha (£/ha)	103.22	100.97	81.70	61.40

† ESA stocking rate on SNRG (overall stocking rate on unit 1.94 ewes/ha)

‡ ESA stocking rate –30% on SNRG (overall stocking rate on unit 1.81 ewes/ha)

Table 8 Effects of stocking rate on Gross Margins (mean 1995-1999).

	Ewes per ha			
	Welsh Mountain		Scottish Blackface	
	1.5†	1.00‡	1.5	0.66
Revenue (£/ewe) Sale of produce	23.28	24.10	44.19	53.31
Subsidy (HLCA + SAPS)	26.85	26.58	24.29	23.82
ESA payments	21.14Θ	32.55ϕ	25.33∝	75.75§
Cattle agistment payment	3.79	1.82	–	–
Total Revenue (£/ewe)	75.06	85.05	93.81	152.88
Replacement costs (£/ewe)	2.45	2.30	2.13	5.47
Total variable costs (£/ewe)	16.84	18.20	17.9	17.27
Gross Margin (£/ewe)	55.77	64.55	73.78	130.14
Gross Margin per ha (£/ha)	97.93	107.96	109.66	86.34

† ESA Tier 1A stocking rate on SNRG (overall stocking rate on unit 1.94 ewes/ha)

‡ ESA Tier 2A stocking rate on SNRG (overall stocking rate on unit 1.81 ewes/ha)

Θ Cambrian Mountains ESA Tier 1A equivalent to £35 per hectare

ϕ Cambrian Mountains ESA Tier 2A equivalent to £55 per hectare

∝ English dwarf-shrub heath ESA Tier 1 equivalent to £38 per hectare

§ English dwarf-shrub heath ESA Tier 2 equivalent to £50 per hectare

Table 9 Effects of stocking rate on Gross Margins (financial data correct to a mean of 1995-1998).

	Ewes per ha		
	2.1	**1.5**	**0.66**
Gross margin (£/ewe)	42.68	48.41	54.39
Gross margin (£/ha)	90.26	71.66	36.34
ESA payments (£/ha)	–	38.00	50.00
Gross margin (£/ha)	**90.26**	**109.66**	**86.34**

[∝] English dwarf-shrub heath ESA Tier 1 equivalent to £38 per hectare

[§] English dwarf-shrub heath ESA Tier 2 equivalent to £50 per hectare

Overview of Upland Management Perspectives

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I shall not attempt systematically to summarise the preceding papers. Rather, I shall firstly highlight points in each paper that particularly seized me. Secondly I shall try to draw some of the various strands together, and thirdly I shall venture to suggest certain of the things that have not been put in the papers! I would stress that I am seeking to provoke thought. I must also stress that all the views and opinions I express are entirely personal, and should not be taken as those of the Scottish Executive.

Highlights from the Papers

John Milne introduced us to the science principles of upland range management. This was a *tour de force* given he had been set the totally impossible task of summarising this subject in just 25 minutes. I picked up three things in particular from what he said, namely the importance of resource inventory, of monitoring results, and of multiple objectives for land management. The importance of making an inventory of the resource to be managed was strongly stressed. I am sure that no commercial enterprise today would ignore stock control or consider not having a good inventory of the organisation's assets, their present value, and whether they were depreciating or appreciating. But I wonder how many upland managers have appropriate resource inventories? Secondly, John Milne also stressed the importance of monitoring, in other words, not just managing, but trying to check whether management is achieving its aims. How many upland enterprises do this? And thirdly, he mentioned multiple objectives, rightly stressing, as does the title of this conference, that the uplands are used for many different objectives, sometimes compatible but sometimes incompatible.

Eigil Reimers considers management for large mammals – ungulates and their predators – in Norwegian circumstances. Unlike Scotland, Norway is still substantially forested, and little management for large mammals is needed, because by and large, populations of the herbivores are below the carrying capacity of the woodlands, No direct range management *per se* is practised. However, Dr Reimers noted when the woodlands stopped regenerating naturally because of increasing grazing pressure, managers responded by shooting more deer until natural regeneration began again, Similarly, over-utilisation of lichen swards by reindeer in mountain areas was met by increasing shooting levels.

John Phillips' excellent paper focuses just on managing range for one species – red grouse. He raised the notion of grouse management groups, which I thought was particularly interesting. Management groups for red deer have come a long way since the first one was initiated in the 1960s in Wester Ross by Dick Balharry, and they are usually acknowledged to have been a success, showing yet again that collaboration can pay dividends. While the animal concerned is different, the resource – the rangeland – is similar and often identical. So what hinders greater collaboration among those managing to increase red grouse numbers? In the discussion following John's talk, I felt it was a pity that we did not have time to allow the debate to emerge betwemmen him and Jean Balfour on the merits of different kinds of land uses. The British uplands do represent at least ten major land uses and functions – depending how they are lumped or divided – and not all of them are listed on the programme for today and tomorrow (and I am sorry I can't be with you tomorrow).

Robert Robel gives us a fascinating continent-wide sweep about four species of American prairie grouse. His prognosis for these grouse and for prairie wildlife generally was rather gloomy, with apparently inexorable creeping loss of these species' habitat. We were told that this habitat, rangeland, extending to some thirty times the area of Scotland, is subject to the activities of range managers who are motivated solely by profit, which is derived mainly from cattle ranching. Perhaps the relevant authorities in the USA feel that enough wildlife will be protected inside National Parks and other protected areas, and by this means wide-scale extinctions will be prevented? In Scotland, specially protected wildlife areas cover some the 12-13% of the land, and although most of our wildlife lives outside these areas, Agri-Environment schemes and forestry grant-aid conditions are increasingly beneficial.

John Swift discussed the role of field sports in wildlife conservation, and stressed the major contribution of fields sports to maintaining landscape and scenery in the countryside. I suspect it is seldom appreciated that today's tapestry of landscape colour and texture over more than half of Scotland probably owes as much to the effects of past management for sport as to extensive agriculture and to forestry. Even in the more intensively managed agricultural lowlands, management for gamebirds commonly enhances the structural diversity of landscapes. It may be equally poorly appreciated that most of this landscape maintenance work is done at no cost to the taxpayer.

Alan Dozier explaining the important role of prescribing burning in managing the native forests of south-eastern USA, where it is estimated such fires for management burn *c.*2.5 million hectares each year. He mentioned that the Smoky Bear Campaign against forest fires, begun in 1942, and which was enormously successful for many years, had been based on totally false assumptions! Effectively, the earlier European idea that fire was bad in itself had been applied to unknown ecosystems with very damaging results. It was not realised at the time that many forest ecosystems, from the long-leafed pine and cedar forests of the south-west to the giant sequoia stands in the Sierras, were naturally fire-dependent, needing near annual fires caused by lightning. These swept across the forest floor, consuming fallen needles and branches, and providing the necessary seedbed conditions for these species eventually to regenerate. In contrast, controlling fires caused litter to accumulate so that eventual fires were intense, often becoming crown fires that killed the entire stand. Then other tree species colonised, resulting in quite different kinds of woodland developing.

Prescribed burning simulates lightning fires, but is done under controlled conditions. It was alarming to hear that in Georgia it may be under threat because people who were brought up in towns and cities have moved into the country and see these fires just as a cause of air pollution! Alan Dozier notes, however, that he hoped that educating the public about the benefits to the forests and their wildlife from burning would overcome this problem. Two points that we should take to heart are his stress on the need in his job for partnership with the public and others, and the routine use by his and similar organisations in the USA of fire prediction models. In burning our heather moorlands to benefit red grouse, we should remember that we are using a technique derived empirically in the 19th century. If we adapted one of the many existing fire prediction models used in forestry, could we burn our grouse moors better, or perhaps make better use of the opportunities given by our chancy weather? Michael Bruce advocated this notion during the discussion.

Colin McLean considered managing red deer, noting that the Deer Commission for Scotland now use the deer management model produced by the Macaulay Land Use Research Institute and are actively involved in producing deer management plans. He notes that deer stalking is estimated to generate *c.*£15 million per annum, and to support the equivalent of some 1000 full-time jobs in Scotland. However, on the negative

side he stressed the enormous increase of red deer numbers in the past 50 years, and he showed many slides of moribund woodland where the trees can no longer regenerate themselves because of grazing pressure from red deer. Many of you will know that a few years ago on the southern edge of the Cairngorms, Mar Lodge Estate became something of a *cause célébre* because the ancient Caledonian forest there was not regenerating because of excessive red deer numbers. That situation is now being tackled, but many of Colin McLean's pictures (used in his talk) were taken in nearby Glenfeshie Estate in the northern Cairngorms, where the same situation prevails and nothing has yet been done to reverse it. However, because the Glenfeshie woodlands are part of the special interest of the candidate Cairngorms Special Area of Conservation under the EEC Habitats Directive, the UK will shortly have an obligation to ensure that these woodlands begin to regenerate. Large daily fines on the State are a possible eventual consequence of inaction! If the Estate managers do nothing, the State would appear to be forced to meet its obligations by compulsory means. Continuing with the *status quo* will no longer be a management option.

Brian Merrell touches on both environmental overgrazing and agronomic undergrazing. He suggests that subsidies gave up to 75% of sheep farmers' gross income, and a much higher percentage of their net income. Sheep farmers probably think that they run private businesses, but if they get most of their income from public funds, are they not in effect Civil Servants, like me? I have to do what I am told, so should they? While much of Scotland's outstanding wildlife resource exists because of – rather than in spite of – past management by farmers and sporting interests, overgrazing is nevertheless a bugbear of our times, and the statutory wildlife agencies and many NGOs have argued strongly for more cross-compliance.

Cross-cutting Issues

Let me try to draw a few of these strands together. In thinking about the theme of this conference, integrated upland management, there are many factors to be taken into account which can be seen as benefits or disadvantages depending on one's perspective. Brian Merrell's talk highlighted for me the great contrast in our moorlands and uplands between the subsidised land uses of sheep farming and forestry, and the unsubsidised grouse moors and deer forests, with nature conservation somewhere in the middle. These subsidies influence land values and management decisions across most of Scotland.

In considering the land, Scotland's natural heritage presents a curious contradiction. It is valued highly, with the vegetation of perhaps half of Scotland falling within the scope of Annex I of the 1992 Habitats Directive, yet most of Scotland's natural vegetation has been destroyed! For example, only around 1% of native woodlands and lowland wetlands remain. Curiously, the man-made and ecologically degraded vegetation of grouse moor and deer forest that is now prized by nature conservationists as well as sporting interests!

Three of the presenters, John Phillips, John Swift and Colin McLean, noted that sport shooting supports rural employment. This has been well documented. Thus McGilvray and Perman (1991) estimated that in 1989 grouse shooting contributed £10.3 million to Scotland's gross GDP and, directly sustained the equivalent of 2323 full-time jobs, albeit that with a decline in grouse stocks the latter had fallen in 1994 to the equivalent of 1240 full-time jobs (McGilvray 1995). As a local-scale example, Professor Robel tells me that during the past 25 years, annual grouse and deer shooting parties led by him have spent around £3.4 million in just one small part of Deeside in Aberdeenshire.

Our upland landscapes are greatly valued by large numbers of people living in the urban areas. But how many of these people know, as both John Phillips and John Swift pointed out, that sport shooting maintains scenery and upland landscape at no cost to the taxpayers?

John Phillips touched on what he saw as a possible threat to sport shooting, namely the growing animal rights lobby in Britain, and I would note here that I suffered myself in 1991 when my office was burned down by animal rights arsonists, and I lost 29 years' accumulation of scientific papers, journals and books! But with over 5% of the electorate said to be at least occasional anglers, and many people enjoying rough shooting and wildfowling, it may be unlikely that extreme views will prevail. Nevertheless, public relations are important. While grouse shooting does create local employment, maintain heather moorland and produce a tasty harvest, many probably think of it just as the pursuit of the rich.

What Has Not Been Said?

Let me think briefly of a few things that have not been written in the previous papers (and which were not said by the presenters at the Conference), and I shall be deliberately provocative. First, let us remember that importance is relative. The conference appears to ignore the water industry, but it can be argued that the main economic value of the uplands for human society is for water collection! Some 96% of water supplied by Scotland's three water authorities comes from lochs, reservoirs, streams and rivers (Government Statistical Service 1998), mainly from upland catchments. Indeed, many of the UK's main urban centres in the UK get their water from the uplands. Hydroelectricity generation is also a significant economic activity. The value of water from the uplands could mean that almost everything else discussed today is almost irrelevant!

Second, what would happen if heather moorland was no longer managed for red grouse, and would it matter? My own answers are I don't know and I doubt it! Although John Phillips and John Swift identified many benefits to wildlife from grouse moors and other sport shooting, as an ecologist I am not aware that any species would go extinct if grouse moors disappeared! What are the alternatives? Today little land goes under forestry without receipt of grant aid, and the Forestry Commission's guidelines now fairly comprehensively protect key aspects of the natural and cultural heritage. Also, the EEC Wild Birds Directive inhibits afforestation in certain areas, and it also constrains the potential locations of windfarms. Brian Merrell mentioned the current economic pressures facing sheep farmers; a would-be sheep farmer needs to buy quota; and the regulations governing sheep subsidy should prevent overgrazing. Cessation of all management would allow natural processes of vegetation succession to occur, producing different (and more natural!) landscapes. But landscapes are changing all the time. For example, between 1947 and 1988, there was around 50% or more change in the kinds of vegetation over some half of Scotland, with smaller changes in the other half (Mackey *et al* 1998)!

Nothing has been said today about cattle, on which I have already been lobbied today. I agree with the lobbyist that there are not enough cattle in the hills. I think we are losing wild plant diversity at a local scale because we have gone over largely to sheep husbandry.

Grouse moors and raptors were briefly touched on by John Phillips. On this we await the final report of the UK Raptor Working Group, though most of you are probably aware that last year the Scottish Office published a report that indicated widespread illegal killing of raptors in Scotland (Scottish Office 1998; Scottish Raptor Study Groups 1998). Suppose Scottish Executive Ministers were to ask me for briefing on the issue of grouse moors and raptors. I can imagine myself saying something along the following lines. "Well, grouse moors are managed for sport shooting, and on the positive side they provide valuable rural employment, valued biodiversity (heather moorland and associated wildlife), valued scenery and cultural landscapes, and protect large amounts of archaeology. All these benefits come at no direct cost to taxpayers. But on the negative side these grouse moors were created 150-odd years ago by regular burning

to create monocultures of heather, so reducing plant species diversity, and by killing all bird and mammal predators of red grouse. Also, while the traditionally recommended burning regime benefits certain wildlife, I am not aware that it is optimal for any species other than heather and red grouse. Further, recent evidence implies that many estates continue to kill raptors illegally as a routine part of grouse moor management. I don't think the 19th century management practices have really changed much, and no industry would be allowed to continue in business today if it could only do so by breaking the law." This puts pretty starkly what I think John Phillips implied earlier. With these pros and cons, where do the scales sit? Although some may argue that the Birds Directive is not necessarily 100% sensible nor scientifically defensible, it is implemented in the UK through the Wildlife and Countryside Act 1981, and we all break the law at our peril.

What is the way forward? I suggest that we still need continuing but carefully targeted research, better partnership, and, above all, innovative attitudes to aims and management. We are only half-way through this particular conference. However, while John Milne said that the uplands of Scotland have been some of the best researched areas in the world, and Colin McLean said that red deer had been one of the best researched animals in the world, I think that we still need more research in certain areas. I don't remember the last time anybody researched the ecology of hill cattle in a serious way in Britain. John Milne showed a diagrammatic synopsis of vegetation change under different densities of sheep that I originally pieced together in 1979. He noted that it contained some large uncertainties, but these remain uncertainties 20 years after I did this synthesis! Bob Robel said he thought that in the USA they didn't know enough about the ecology of some of their species of prairie grouse to specify their habitat needs precisely, and I think that's partly true with us. I don't think we know quite what black grouse need of their habitat, though we now have rules of thumb for their management. We do know much of the answer for capercaillie, thanks to the efforts in particular of the Institute of Terrestrial Ecology and the Game Conservancy Trust. However, there is a long lead time to getting the habitats back that capercaillie and black grouse need; we're probably talking of decades in order to make order-of-magnitude changes in their numbers.

On partnership, the nub of the *Statement of Intent* signed at SNH's Moorland Summit, that all parties should go ahead together, is surely the only sensible way forward. Partnership could include finding escape mechanisms for gamekeepers who believe they can only keep their jobs by breaking the law. More education for all concerned should help (and my personal credo is that learning never stops). Demonstration areas are very important. Someone (I think it was Alan Dozier) mentioned that he had been to RSPB's estate at Abernethy, and seen what was going on there. There are other places where one can see innovative approaches to range management. And I do strongly believe that there is a need to be innovative in grouse-moor management; no other industry has survived by just apparently assuming that nineteenth-century practices are right! Is it ecologically and legally sustainable on all moors to aim to produce enough red grouse to make it worthwhile driving them to the butts? I know that all the grouse-moor owners and factors I have talked to in recent years have said that the great fun of grouse shooting is getting behind the butts and having the driven grouse come to you, and that this is an experience obtainable nowhere else in the world. But if this cannot be achieved within the law, I would suggest, as I have said privately to many people, that the alternative is to walk up the moor. Apart from people wanting to shoot driven rather than walked-up grouse, I have been told that a problem here is that the rental income is only a half or less of that from a driven grouse moor, and that this cannot support enough keepers to undertake pest control and muirburn. But these moors were never designed to be economic! Let's not kid ourselves; grouse moors are not, and never were, a hobby for the poor. Still, perhaps the grouse management groups suggested by John Phillips could promote more cost-effective management? Also, better targeted burning should help some

of these moors to develop a greater variety of game; most heather moorland in Scotland shows no evidence of recent burning (Bayley *et al* 1991; Hester & Sydes 1992)! Why not try to get more black grouse, and more snipe, and in Scotland more mountain hares, and at higher altitudes, more ptarmigan? If there was an increase in the variety of game that could be shot during a day's walking with dogs, would the rental value for sport increase through time?

These remarks on what was not said today, and on the way forward, may sound unhelpful to many, but I have tried to be honest. I cannot see how those interested in maintaining moorlands can do better than follow the *Statement of Intent*, without confrontations, but trying to be innovative.

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PART 2. LAND USE ISSUES AND EXPERIENCES OF PEOPLE IN THE UPLANDS

Agriculture, Forestry & Wildlife Management

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Summary

1. This paper provides an aversion of conservation and political issues impacting on the uplands.
2. I highlight forestry and agricultural issues.

The Current Problems

When I was appointed chairman of English Nature, one of my Scottish acquaintances came up with the epic phrase "what's a good Scottish girl like you doing running an English organisation?". Nevertheless, I am delighted to be back here in my home county and though I am unavoidably going to speak from the perspective of English Nature, I hope that some of the messages and models have a relevance in principle right across the UK. The uplands as we know them have been shaped in the past by a whole series of economic inferences – agriculture, forestry, recreation and sporting practices. In some circumstances, those practices have been in harmony with wildlife and benefited them. For example, the management of heather for grouse shooting can have benefits for a whole assemblage of upland species. At other times, the practices have not been in tune with wildlife. The increasing number of sheep and deer, the increasing overgrazing, the wrong trees in the wrong places, the debacle of the Flow Country are examples of that. So today I want to talk about current issues in each of the various sectors, to see whether we have got room for hope or not.

Forestry and Conservation

The 1980's were a period of argument between forestry and conservation over the management and expansion of woodland in the uplands. Happily that situation has now changed dramatically. Conservation bodies, the Forestry Commission, private foresters and woodland managers are being encouraged to co-operate in various ways to encourage not only woodland expansion but harmonised management of existing woodland and I was delighted when the recent Forest Strategy for England was published, because that typified the commitment to multi-purpose forestry – delivering benefits for conservation as well as for recreation, for landscape, for timber production and for local economies. Here in Scotland, much of the forestry focus as far as conservation is concerned is on Caledonian Pine forest. English Nature's particular interest is in the expansion of woods of native species as part of habitat action plans for things like upland oak woods, upland mixed ash woods, wet woodland and the like, and there are a number of initiatives. I think that gives us room for encouragement in terms of multi-purpose forestry based on scientific research. A number of schemes have been introduced to expand new woodland without compromising existing habitats. Again one asks, "Is the right tree in the right place?". In the Yorkshire Dales National Park, for example, we are using a wildlife enhancement scheme to create new woodland and there are similar schemes in other National Parks. In terms of the management of existing woods, we support initiatives such as the Cumbrian broadleaves, and the Marches Woodland Initiative. Now that is quite an interesting initiative, because it seeks to help owners get the most from their woods while fostering wildlife value.

It involves a whole range of activities, but most particularly, it is looking at how to develop local markets for local products – for example, charcoal and how to add value to local timber production such as oak.

Of course, a particular concern about conservation in upland woods is the role of grazing. Now I think all of our work is beginning to show that light grazing is desirable from a conservation point of view. It helps regeneration and plant diversity, but over-grazing by sheep and the growing problem of deer in woodlands in England needs to be tackled and we are involved with the England Deer Initiative that helps support co-operation between land managers over deer management. If you turn from conservation woodland to commercial conifer woodland, I think the conservation contribution even of that rather unpopular source of woodland in the past has also changed. Some of our most commercial woodlands have acquired considerable conservation interests as they have matured, and others are increasing in diversity as they are restructured at the end of their first rotation. However, I think we would continue to say that the Lowlands are a better focus for future commercial intensive planting and we would want to see some of the current crops of plantations that are in the most sensitive locations not being replaced when they are felled. Instead, the former natural and semi-natural habitats should be restored – with more open, mixed woodlands, grassland, bogland etc. and we very much welcome in that respect the work that Forest Enterprise is doing in removing pine on the top of Whitbarrow in Cumbria and around some of the Kielderhead Mires. So for me, forestry conservation, and the recreational role of forestry, give us optimism and a belief that we are beginning to find a way through in multi-purpose forestry. They obviously have problems with the challenge of over-grazing by sheep and the growing number of deer and in Scotland, the issue of fences is still one that we need to work on.

Agricultural Reform

Black grouse are a symbol of the sort of co-operative and multi-purpose management of the uplands we're beginning to see. From earlier times, their home has been the woodland fringe where forestry and open land management need to combine in the right way, and I think in two or three of the experimental areas where work is being done on black grouse, particularly the North Pennine Black Grouse Recovery Project and also some of the work that RSPB and Game Conservancy are involved in in Wales, are showing that we can find ways of managing habitats and see a recovery in black grouse. The latest figures from that North Pennine Scheme is a 30% increase over 3 years so, for me, the black grouse is a totemic kind of bird; if we can get things right for the black grouse, we may well be getting things right for a whole variety of upland land uses. But the black grouse is also what I want to do about my next sectoral subject because I want to have a big black grouse about agriculture. For those of you who come from England, you can ask the Scot sitting next to you what a big black grouse is in that context. It means a terrible moan, because there is no doubt about it, the biggest factor influencing land-use in the uplands is the Common Agriculture Policy. And, I make no bones about it at all. The Common Agriculture Policy is bad for upland conservation and it is bad for upland sporting management. We have seen drainage, re-seeding and over-grazing driven by CAP resulting in the growth of a commodity that my mother keeps telling me I ought not to talk about, which is "totally buggered heather" and of course, the loss of some of the wet rushy flush land that is so important for many species of upland birds. But it is not just bad for birds in conservation and sporting management terms, the CAP is bad for upland farmers as well. We are now seeing the average upland farm profit being £5,000 per year and that is wholly accounted for, and more, by the level of subsidy received by farmers taking part in the Hill Livestock Compensation Allowance arrangements. Farmers are suffering under the Common Agriculture Policy and it is also therefore bad for rural communities and bad for services. We are seeing losses of employment with the impact that has on villages, on shops, on schools, on transport and the abandonment of some of these very valuable remote upland communities.

I hesitate to say this, but I think the CAP is even bad for sheep, as several sheep who have found themselves recently in phone boxes, on demos and probably those driven down the main streets of Bournemouth next week will testify, and I can sympathise with them. I have got to go to the Labour Party Conference next week as well, and it is a sheep's life at a Party conference. So the Common Agriculture Policy is significantly broken on every single objective that it is trying to achieve. I think that if you were a little man arriving from Mars and you looked at the Common Agriculture Policy, you would not believe that such an illogical, wasteful and perverse policy as that could possibly be embraced by a whole series of European Governments. However, there is a bit of hope at hand, though it's a very small hope. We have had the Agenda 2000 Reforms, although it was a bit like the straining of an elephant to deliver a midge. The fact that Heads of States became involved in the last round of negotiations only goes to show that you should never let Prime Ministers negotiate agriculture policy. But there is one ray of hope in the Agenda 2000 Reforms and that is that Member States have now been given the right to a degree of local decision-making on a number of issues that they can use and grasp if they are brave and resolute. So the old argument that we always used to get from Agriculture Ministers here in the UK – namely that they couldn't do this, and they couldn't do that because Europe would not let them, is not now absolutely true; there are a number of decisions that can be made locally in the UK and I am going to list some of those in a minute. Basically and in overall terms, the Common Agriculture Policy has one major advantage and that is there is a tremendous amount of money tied up in it, so I don't think we are talking about the Common Agriculture Policy needing more money; there is plenty of money but it is just spent on the wrong things. What we need is to redirect payments to deliver what I would call a sort of quadruple whammy.

First of all, safe healthy food; secondly, viable upland farms in rural communities; thirdly, effective sporting businesses and fourthly, conservation objectives which, in my view, also embrace amenity objectives because there is no point in walking over the uplands if the uplands haven't got a wildlife interest – that's part of that upland experience. So we need that big sum of Common Agriculture Policy money to work for its living seven times over and it always reminds me of an old Aberdonian farmer called Sandy Reid who at an advanced age passed away, and his son who was a very thrifty man – as Aberdeen farmers generally are – went to the local office of the Press & Journal to put in the obituary notice. He was very cautious of costs, so he kept it to the minimum possible, and he wrote it down for the wee girl on the desk and the message said "Sandy Reid, Bogheid, deid". Well, the wee girl on the desk said to him, "You actually get more words for the basic price than you have put down. You can have another three words and you'll still get it at the same price". So Sandy Reid's son went away and scratched his head and came back later. The following morning the obituary appeared in the Press & Journal and it read "Sandy Reid, Bogheid, deid, Volvo for sale".

There was an example of money working for its keep twice over and I think it is that sort of way that we want to see Common Agriculture Policy money working, to deliver not just a single objective at any one time, but all four of those objectives that I outlined. So we are at a cross-roads; there is the possibility of agriculture Ministers grasping that local discretion that they have now got, and really making a decision about what sort of uplands we want. Do we want massive farm restructuring and intensification? Do we want ranching in the uplands? Do we want abandonment with what I believe would be detriment to wildlife as well as rural communities in spite of what John Miles said yesterday? Do we want really tough times for sporting management? Do we want to see the collapse of our remoter rural communities and do we want to see a continuation of conservation damage, or do we want to grasp the opportunities of Agenda 2000 and create a truly multi-purpose agriculture as we have created a truly multi-purpose forestry which supports conservation and local communities?

The five opportunities which Ministers are going to have to grasp if they want to do the latter rather than the former are these:

1. They are going to have to increase money available for agri-environment schemes, from the meagre 4% of spend of Common Agriculture Policy currently channelled to these schemes. Useful current examples of where agri-environment payments are beginning to produce these multi-purpose outcomes that we are looking for are, for example the Northern Uplands Objective 5 area which the Moorland Association has been involved in; it is very much looking at multi-purpose management of the uplands. The mass upland pilot areas on Bowland and Bodmin are looking at farms in the uplands as businesses as well as food production units and conservation groups. The new countryside stewardship uplands option is also taking a much broader approach to multi-purpose agriculture, but they are all incredibly small and these schemes are all very over-subscribed. We need strength to divert money from the huge mainstream subsidy payments into these agri-environment schemes and make the common way of people gaining this "Government" money to be through funding for multi-purpose upland management rather than simply for food production. And there are opportunities in the current Agenda 2000 package; for example there is the ability for UK Agriculture Ministers to divert money from the beef envelope by taking the top slice off old payments in a very modest way which would create huge additional sums of money for agri-environment schemes;

2. We have got to grasp the new Rural Development Regulation. It is very much about how farming, sporting management and conservation can be brought together to support strong rural communities and this would be a real step forward in a more integrated policy. There is hardly any money under Agenda 2000 for growth of that scheme but we must get the Rural Development Regulation structured properly so that when money does begin to be removed from mainstream subsidies, it can function as a useful and valuable implement;

3. Ministers have got to grasp the reform of the Less Favoured Areas, to make those payments on an area rather than a headage basis in order to try and move away from rewarding farmers for something in the uplands that has actually been part of the source of their ruination. We have bribed farmers for years and years through headage payments to go for increased sheep numbers and now what we are seeing is a glut of sheep on the market. This was entirely predictable if we had thought about it, so we have to move away from headage payments;

4. Agriculture Ministers have got to grasp a good piece of Sandy Reidism. We need minimum environment conditions for all payments – not onerous conditions but just a minimum, so that if people are in receipt of that 96% of CAP payments that are currently not related to the environment in any way, and which are not heading in the direction of integrated countryside and rural development schemes, that nevertheless there is a minimum environmental benefit to be gained from these huge sums of money;

5. The issue of common land, where we need revised legislation.

The need for Government Action

So all of those things are within the Agriculture Ministers' grasp and I think they need to grasp them, but they are going to need encouragement. It strikes me that with the current public interest in support for agriculture, I believe we can only see continued public support for massive subsidy to agriculture if the public can be reassured that they are getting some of the things that they want and also that is the sort of thing I have

outlined: safe food, viable rural communities, conservation and effective rural businesses. So quite frankly, I was really distressed when the recent bale-out package for farmers ignored all that. We've just seen Ministers decide to throw another slug of money at agriculture in a way that is about putting your finger in a hole in the dyke rather than moving agriculture into safer waters and into a much more integrated process. I think that if Sandy Reid had been listening to what was happening on the bale-out package for agriculture this week he would be turning in his grave and asking for his money back from the Aberdeen Press & Journal.

Recreation and Access

The issues are different in Scotland than they are in England, but we are about to have (in the Queen's Speech I suspect), an Access Bill in England. Now, I recognise that landowners, and sporting landowners in particular, have considerable concerns about open access. In principle, we in English Nature welcome additional access but that needs to be tempered by looking at what is going to be the impact on conservation objectives because they need to be taken into account. Our scientists would tend to demonstrate that in many parts of the open land there is comparatively little danger to conservation from disturbance except in particularly sensitive locations and particularly sensitive times, such as when ground-nesting birds are breeding. We would like to see temporal restrictions at those times by perhaps encouraging people to be restricted to paths. Indeed, as a general rule of thumb, we would like to see a lot more provision of paths because, to be honest, most folk want to walk on paths; they don't want to wade through knee-high heather and I think adequate provision of the right source of access on designated paths could discourage some of the untrammelled roaming that many people are worried about. But there is one other issue that we would also be concerned about in terms of access and I am sure that most upland landowners are as well, and that's the issue of dogs. I don't think we have really cracked this yet or realised generally just how disruptive dogs, not properly controlled, can and will be if we have open access. So English Nature is riding heavy shotgun on the Countryside Agency in its work in drawing up the map for access in England and indeed we are delighted to get advice from landowners, as we do both bidden and unbidden, both here in Scotland and in England, about their experiences of access and access management.

Management for Field Sports and Conservation

We conservationists have some very, very close common interests. We are interested in excellent heather and woodland management, we are interested in viable rural communities and we will be even more interested in common objectives if the vision of multi-purpose forestry and agricultural policy unfolds as we hope, but I would suggest that you need us as conservationists perhaps more than we need you as sporting managers at this precise point in time.

Conclusion

It is important that conservationists are able to stand up and support sporting management of the uplands but that can only happen if we join together to get multi-purpose management and if persecution of raptors ceases. Translocation of hen harriers isn't the answer.

I would want all of us to cluster round the range of post-Langholm experiments that are beginning to give us some hope. The basis of the whole matter is habitat management; that is the key, and I want to finish just by commending the work of the Heather Trust in this. I always laugh about the joke of Christopher Columbus.

When he set off, he didn't know where he was going and when he got there he didn't know where he was, and when he got back he couldn't tell anybody where he had been, but the important thing was that he did it all on somebody else's money.

The Heather Trust isn't like that because it has a very clear sense of purpose and direction, it has a very good process of documenting where it has been and when it comes back it organises conferences like this in order to tell the World what it has learned. And I commend the Heather Trust's work in setting up this conference, and the nice thing is that in setting up this conference, it did it all on somebody else's money!

Red Deer Culls, Scots Pine & The Stalking Client[1]

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Summary

1. This study examines the prospects for changes in deer management which meet the needs of both the stalking fraternity and conservationists.

2. We approach the problem from a less familiar angle, namely that of the needs of people who pay for stalking and of deer managers.

3. The study applied an economic method called choice experimentation to establish the weight and the monetary value that stalkers attach to *attributes* of their stalking trip. Attributes include such factors as "numbers of stags", "trophy value" and "the stalking landscape". Their respective parameters can be combined to arrive at paying amateur stalkers' valuation of alternative stalking *packages*, including such factors as higher quality stags typical of better deer management or more forested environments.

Introduction: The "Problem of High Deer Numbers"

In the last 40 years, the red deer population has doubled to over 300,000 animals. Deer no longer have natural predators and this, together with an inadequate level of culling, a succession of mild winters and the expansion of forestry, has led to a massive increase in the density of animals and their expansion into new areas. The increase is leading to:

- damage of habitats that are sensitive to grazing pressure, both in the mountain zone and in the lower glens where deer winter;
- poor regeneration of Caledonian Pine forest where deer numbers are in excess of 5 animals/km^2, as is commonly the case. What forest we have left is a valuable habitat for rare or localised species such as capercaillie, crested tit and pine marten. It is also a highly valued landscape feature;
- losses to commercial forestry when fencing is necessary to exclude deer from eating the growing shoots in young plantations;
- problems for agriculture, particularly sheep farms, who need good grazing;
- problems for traditional grouse moor, both from over-grazing and the spread of parasites – particularly ticks.

Most pertinently, overgrazing is also a problem for stalking estates themselves. High deer numbers mean that estates are not realising the full value of their stags. The lack of shelter and impoverished grazing means that the quality of stags is poor compared with those elsewhere. "Quality" refers to mean body and antler weight. Stalkers clearly value these characteristics and, in principle, should be willing to pay more for them.

There are, though, many formidable constraints to improved deer management. In the first instance, deer are often represented as a "common property" problem. In a sense, this isn't quite accurate as the deer are owned

by nobody. However, deer do often follow a seasonal migration from higher to lower elevations and their movement will typically take them across several estate boundaries. It is this *mobility* of the species which is at the heart of the problem.

Landowners will be dependent on one another both for the maintenance of a healthy deer population and of their habitat; although not everybody gains to the same extent, even where all estates have sporting interests. Much of the most valuable grazing will be on higher summer pastures or, in winter, in the lower glens. Estates who only have this land will not have an income from stalking as they will hold the bulk of their deer outside the stalking season.

There is an element of *strategic uncertainty* in that individual owners can't be sure what others are doing. This is exacerbated by an increasingly diverse range of landowners now found in the Highlands. These include stalking interests, conservation interests and forestry interests. Often, a combination of these interests can be found on one estate.

The interdependence and mix of objectives causes conflict over the management of the deer, including culling, the level of sport shooting or the maintenance of the rangeland. The pay-off to any one owner's good management is therefore threatened by the poor management of others. It is precisely for this reason that the DCS has encouraged the formation of Deer Management Groups.

There is also *environmental uncertainty* in that while hind numbers have been increasing, the quality, and often the numbers, of stags have been decreasing. The argument that it is the denuded environment that is the reason for the poor quality of our stags is now accepted by many stalking estates. Nevertheless, uncertainty arises because it is quite another thing to demonstrate that costly culls or rehabilitation of the environment will improve matters. This is especially so where several landowners are involved or the exact origin of migrating deer is unclear.

Moreover, it is the deer manager or professional stalker – not the owner – who must implement any new deer management strategy. It is his job that is on the line in the event that stag numbers do not increase, such that the owner suffers a loss in stalking income or a reduction in his estate value.

Raising the Financial Return from Stalking

To reduce the perception of risk involved in either radical hind culls or allowing forest regeneration, it is necessary to provide landowners with a clear incentive. For instance, to demonstrate to all the landowners in a management group, that there are financial benefits at the end of the tunnel.

Namely, would stalking clients pay *more* for a different (higher quality) stalking experience?

To answer this question, our study included a survey of amateur stalkers designed to find out what attributes they valued of their stalking experience. The attributes mentioned included:

Numbers: The typical expectation (and one which sporting agents consider critical) is of one stag per day's stalking. However, higher numbers increase the prospect of a kill. Many stalkers (particularly foreigners), also enjoy seeing large herds.

Body weight and antler size: While always important factors, sporting agents advise that, while foreigners like to collect a *trophy*, Scottish stalkers are more excited by the stalk itself.

The stalking environment: Stalkers are attracted by rugged hunting terrain. In the study, we were also interested to know if they'd accept a proportion of pine forest or a mix of shooting environments.

Wildlife sightings: These are a drawing factor for some stalkers. Although the rarities are to be found in the forest; the more spectacular sightings – of eagles and the like – are available on the open hill.

Other activities: Agents said that clients were becoming more interested in mixed shooting or a range of family activities. These can help to compensate for a poor week's shooting in the event of bad weather or bad luck.

In addition, there are various other attributes such as the type of accommodation, traditional hospitality, the character of the professional stalker, shooting before, during or after the rut, etc.

Survey and Questionnaire Design

In the survey of paying stalkers, we asked stalkers for details of their last trip and also presented them with a variety of alternative stalking trips.

This involved the use of a *choice experiment* (Adamowicz *et al* 1984). In this, subjects are asked to select between alternative packages of attributes, or stalking trips (choice sets). The choice approach is more realistic than expressed 'willingness to pay' or rating exercises. In real life we are forced to *choose* between buying one package of goods or another, travelling to one place or another, etc.

However, to arrive at a value for each attribute, the choice experiment requires that subjects are presented with a systematically varied sample of the full range of attributes and their various levels of provision. This requires a factorial design. While there are literally thousands of possible combinations of attributes, the particular design adopted by the study allowed subjects to be presented with a full one-third of all the possible attribute combinations.

This did, however, require the number of *attributes* to be limited to five, namely trip price, stag numbers, stag quality, alternative activities and landscape (mix of open hill or forest stalking). This meant combining in the description of the attribute, such factors as landscape or prospect of wildlife sightings, or neutralising others. An example of the latter was 'accommodation' for which subjects were asked to imagine they were staying in the same accommodation as their last trip.

The design also required limiting the number of *levels* of each attribute to three. "Levels" are the degree of provision, for example "less than one stag per day", "one stag per day", "more than one stag per day". The exception was "trip price". Price needed to be represented at the maximum possible number of levels (ie nine) to get an accurate indication of what stalkers would be prepared to pay.

In all, the following attribute levels were used in the survey. Each of these was described in more detail on a preceding page of the survey (including a description and photograph of Caledonian pine forest which was intended especially for foreign hunters unfamiliar with this landscape).

Table 1 Attributes and Attribute Levels.

Numbers	N1	It is difficult to locate animals and so it is likely that 2 out of 6 days will be blank.
	N2	Each rifle has one chance to shoot a stag each day.
	N3	There are many deer … more than one chance to shoot at least one stag each day.
Quality	**Q1**	Most of the stags are light (8 points or less and 80kg max).
	Q2	Most stags are mature 8-10 pointers of 90-110kg.
	Q3	All stags are mature, but some are Royals over 120kg.
Activities	**A1**	No other activities are available.
	A2	In season, you can also fish or shoot grouse.
	A3	You can also fish or shoot grouse as well as play golf, sail, etc.
Landscape	**L1**	Deer here are found in high open mountain scenery.
	L2	Mixed days are possible as deer are found in both open mountain areas and pine forest.
	L3	Deer here are found only in low density Caledonian pine forest.

The levels highlighted in bold are the reference levels that represent typical expectations for Scotland (although naturally there are variations).

The big advantage of using this technique – as also with contingent valuation – is that subjects can be presented with *hypothetical* situations, although it is important that these fall within the realms of acceptability.

The attributes were selected using the factorial design and inserted into each questionnaire using a computer program so that each subject received an almost *unique* combination of six choice sets such as the example below.

Figure 1 Example choice sets.

Trip A	**Trip B**
There are many deer and each rifle has more than one chance to shoot at least one stag each day.	**It is difficult to locate animals and so it is likely that 2 out of 6 days will be blank despite good weather.**
Most stags are mature 8-10 pointers of 90-110kg.	**Most of the stags are light (8 points or less and 80kg max).**
The estate offers few other activities, is in open moorland and stalking here will cost you **the same** per stag as you usually pay.	The estate offers few other activities, is in open moorland and stalking here will cost you **25% less** per stag than you usually pay.

Do you prefer the characteristics of either of the trips above to the same characteristics of your last trip? yes A & B? just A? just B? *neither*

Considering just A & B, which do you prefer? A or B

For simplicity of response only two of the attributes were varied each time. In this example, those in bold, the Numbers and Quality attributes.

Respondents were asked which alternative they preferred to their last stalking trip (if any). An earlier question had already asked for the attributes of that last trip. They were then simply asked which of the two choice set alternatives they preferred.

Note that if you take these two questions together you have an implicit (rather than a directly expressed) preference ranking. This ranking provided valuable data for the analysis.

Response

In total, 854 replies were received, 483 of which were for Red Deer with the balance being for a separate Roe Deer survey. This represented a reasonable response rate of 45%. As there have been no detailed socio-economic surveys of stalkers it was impossible to show the exact characteristics of the sampled population. Rather, the objective was to achieve a reasonable cross-section. North American hunters, who represent possibly 10-20% of stalking visitors to Scotland, were the only subset that was under-represented, responses being too few for an adequate analysis.

In addition, many questionnaires were distributed via sporting agencies. There are no licences issued for shooting, so it is not easy to locate stalkers. Therefore a lot of preparation went into establishing a good relationship with sporting agencies, many of whom, for reasons of confidentiality, sent the questionnaires on directly.

Questionnaires were sent to stalkers in the UK, North America and Continental Europe, the last of these having to be translated into French and German. An effort was also made to survey hunters who had never visited Scotland for stalking. Although too few replies from this group were received to conduct a separate analysis, these returns did provide a reasonable insight into foreign hunters' expectations.

The Analysis

The data were analysed using an econometric package. Three lots of analyses were performed:

a. A 'binomial' analysis, ie of the question "Do you prefer Trip A or Trip B?";

b. A 'multinomial' analysis of the question "Do you prefer Trip A, Trip B or your last stalking trip?" This included the data on the characteristics of the respondent's last trip (the *status-quo*);

c. An analysis of the implicit ranking data derived from the two choice questions.

The analysis was performed for Scottish, British and European subsets as well as a subset for those stalkers who usually prefer Roe deer (Roe deer are generally hunted in forests and we were interested in the forest question).

As some respondents *always* express a preference for their last trip, ie the type of stalking they're accustomed to, the analysis was run both with and without these individuals. The more statistically significant analysis was that which excluded those who always prefer the *status-quo*. Although, while stalkers are often presented as a rather conservative group, in fact only 14% always stuck with the *status-quo*.

Results

Statistically significant results were obtained from each of the principal three sets of analyses. The best results were produced by an ordered logit analysis of the rank data. This is not surprising given that the analysis depended on the responses from two questions and therefore contained more data.

Table 2 Results – coefficients.

Attribute	Scots	All British	Other Europeans	"prefer Roe"
Numbers 1	–0.56	–0.35	*–0.11*	–0.33
Numbers 3	*0.16*	0.39	0.74	0.42
Quality 2	*0.15*	0.36	0.61	0.28
Quality 3	0.48	0.83	0.89	0.44
Activities 2	0.69	0.66	0.53	0.51
Activities 3	0.28	0.42	*0.12*	*0.18*
Landscape 2	–0.50	–0.43	*–0.01*	*0.04*
Landscape 3	–1.26	–1.46	–0.82	–0.87
Price	–0.27	–0.20	–0.32	–0.25

Note: figures in italics are not statistically significant.

Table 2 provides a summary of the results. The analysis required the omission of the *status-quo* (typical) levels. High figures show that the attribute level is a desirable change over the preceding level. Hence, European hunters are very fond of a large number of stags (Numbers 3 = 0.74) compared to the typical one stag per day (Numbers 2). They would like to have some more sporting activities available (Activities 2 = 0.53), but are less interested in many more activities (Activities 3 = 0.12).

Negative figures indicate dissatisfaction. Hence, Price always has a negative figure (because nobody *enjoys* paying). Note too that the coefficient for Numbers 1 is negative, ie stalkers are disinclined to accept a reduction in the cull expectation to below one stag/day.

For the objectives of the study, the most interesting results relate to Quality and Landscape attributes.

Quality, at both levels Quality 2 and 3, has a strong positive weighting. Europeans especially appreciate improvements in stag quality, ie Quality 2 and 3 (respectively 0.61 & 0.89). They clearly prefer this more than British stalkers (0.36 & 0.83), although British stalkers do have an interest in quality and trophy animals (Quality 3) *despite* the impressions of some stalking agents.

In relation to **Landscape**, a forested landscape, Landscape 3, is viewed very negatively by all stalkers. However, European stalkers appear ready to accept the option of stalking in a mixed open/wooded landscape. On this they are neutral. Most roe deer stalkers prefer a mixed landscape for red deer stalking, although the low coefficient of 0.04 suggests this preference is not strong.

Converting Coefficients into Willingness to Pay

By dividing the weighting for each attribute level by that for Price, it is possible to transform these into the *actual prices* that stalkers are willing to pay for changes in these attributes. For example, an increase in the cull expectation from one stag per day to more than one stag per day is worth an extra £68 to British stalkers. An increase in Quality, from "light stags" to "mature, heavy 8-10 pointers", is worth £71. Various figures can be estimated for different income groups.

These figures give an indication of the monetary value of improvements in the stalking attributes. They are, however, less robust than the original coefficients given that the actual amount that stalkers pay varies a lot around the typical £250 per day. Somewhat better results are given by a *percentage* change in price.

Nevertheless, if we use actual prices as a means of illustration, we can take a "bundle of attributes" to represent alternative stalking packages and reveal how much stalkers would be willing to pay for these alternatives. **Table 3** gives the value of different stalking trips for Britons and continental Europeans.

Table 3 Value of different stalking experience.

Typical Scottish expectation =	N2,Q1,A1,L1	£0
British stalkers		
open range – abundant deer/poor quality	N3,Q1,A1,L1	+£104
open range – better quality	N2,Q2,A1,L1	+£70
mixed hill/forest – other game	N2,Q2,A2,L2	+£110
full Caledonian Pine Forest	N1,Q3,A2,L3	–£207
European stalkers		
open range – abundant deer/poor quality	N3,Q1,A1,L1	+£68
open range – better quality	N2,Q2,A1,L1	+£63
mixed forest/hill – other game	N2,Q2,A2,L2	+£114
full Caledonian Pine Forest	N1,Q3,A2,L3	–£36

Note that British stalkers are willing to pay less for a Mixed Landscape when considered on its own. However, the higher amounts that they will pay for the better quality stags that are generally to be found in such a landscape means that they are prepared to pay £110 more for such a trip.

Conclusions

The research had two objectives:

1. To develop a methodology;
2. To investigate the incentives for better deer management.

Methodology

The Choice Experimental approach can be used to estimate the value of the individual attributes of an environmental good. This makes it more useful from a policy perspective than approaches that are used to value a total change.

We believe that it is also a more realistic approach than methods, such as contingent valuation, which ask people directly how much they are 'willing to pay' for a composite change. Furthermore, the results were plausible compared with prior expectations.

Stalking Provision

In relation to stalking, the results show that the single most valued attribute was stag quality. They also show that mixed open hill/woodland stalking, and especially stalking in forests, is viewed negatively. At first sight, this appears to be a disappointment to conservationists anxious to encourage the re-establishment of Caledonian pine stands.

However, the results reveal that stalkers are prepared to pay more for higher quality stags. Such stags can be supplied by an artificial feeding regime, but will also be found in richer, especially more forested environments. Moreover, stalkers appear to be willing to pay more for the shooting of other game species that are likewise to be found in a mixed landscape, eg roe deer, blackcock, woodcock, etc.

There is therefore a clear financial incentive for sporting estates to adopt co-operative strategies that, either, reduce total deer numbers or directly aim to develop a richer vegetation. Given that afforestation, including the regeneration of woodland, is now being supported by grants, there is even more of an incentive to manage deer numbers and their habitat. Some estates argue that stalking can continue even where deer numbers have been reduced to five animals per km^2. However, as stalkers evidently value clear expectations of a successful trip (the Numbers attribute), any reduction in expectations would need to be compensated by other benefits (eg stag quality or other game). Alternatively, afforestation could be gradual, although estates should remove excessive fencing if game bird mortalities are to be avoided.

A final point is that any survey will be based mainly on *existing* stalkers. Future sportsmen could be persuaded to prefer a different stalking experience, such as varied species, less guarantee of success, mixed woodland open-hill stalking, etc. Perhaps, it is time that estates experimented by offering more than the traditional stalking experience.

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Integration of Enterprises

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Summary

1. People and wildlife in the hills face severe difficulties: the land-uses which have been the backbone of the uplands, farming and forestry, have suffered serious economic downturns; the social structure of rural villages has fragmented; wildlife populations have been sliding; and running a grouse shoot has become more challenging. For deer managers the sliding price of venison and the high pound are key issues. All have resulted, to some extent, from misplaced production subsidies, which have encouraged monocultures and ultimately proved not to be sustainable, either economically or ecologically. Current policies have led to a situation where no one appears to benefit. Not only do they create conflicts by distorting the value of economic inputs, but the current system doesn't identify the 'hidden' costs of these policies.

2. Our shared challenge is to find a new way to make the uplands prosper. We all recognise the need for change, but we must also recognise that no single policy will work alone. Coherent policies, reflecting local needs, must integrate the demands of those who live in the uplands, and those who support them through taxation. Wildlife conservation is part of the solution, not an obstacle. It is a worthy end in itself, but should also be part of the agenda for agriculture, forestry and grouse shooting. It can provide a means to maintain farming incomes and employment without distorting the global marketplace; it can provide opportunities from tourism for rural businesses; it can demonstrate to the public the positive role of game management in the countryside; for wildlife, such habitat enhancement is the only means of existence.

3. Conservation is not about turning the clock back to some imaginary golden era. It is the future of life. Integration is joined-up thinking, making the system work for everyone. In Bowland and Bodmin, there are the first attempts at turning fine words into action. There is even now the means to deliver it, through the Rural Development Regulations, though we all have a job to do to ensure that the scheme is properly funded and persuade the administrations of the UK to take advantage of the opportunities offered. It is an opportunity, which must not be wasted, but it needs real action from all parties if we are to meet our collective responsibilities to upland communities.

Introduction: The Uplands in Trouble

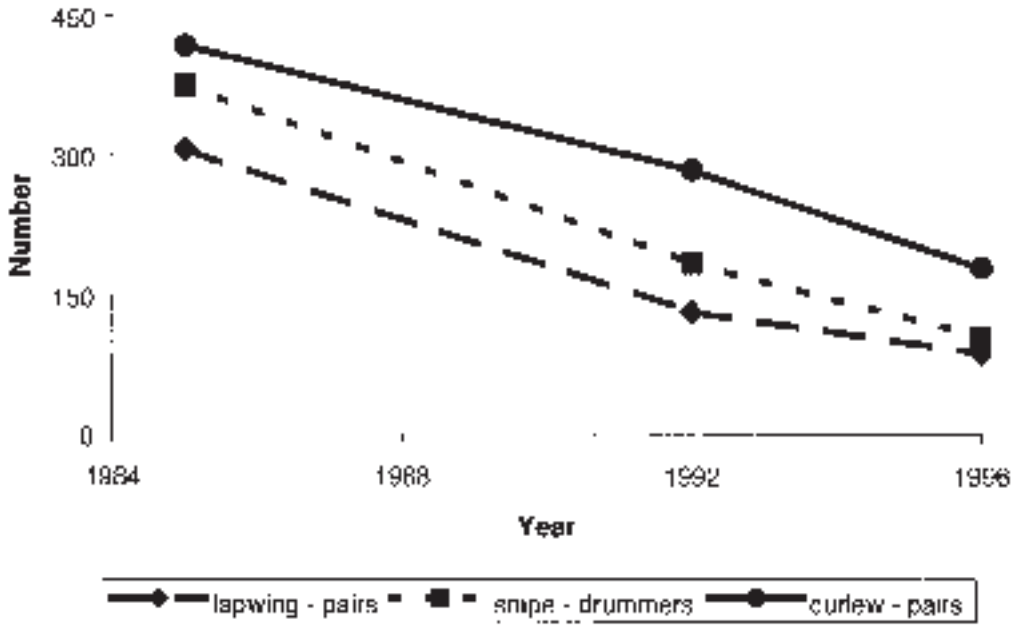
There is no doubt that the uplands have had a tough time. We have absolute sympathy with livestock farmers. The bottom has dropped out of the forestry market. Rural communities face reductions in services and out-migration of young people.

Populations of many wildlife species have collapsed:

- lapwing population halved in England and Wales since 1987 (Wilson *et al* 2001);
- black grouse: now just 6,500 lekking males and their range has contracted by 30-40% from the late 1960s to the late 1980s (Hancock *et al* 1999, Gibbons *et al* 1993);
- capercaillie now numbers *c.*1000 individuals, having been in steep decline since the mid-1970s and having numbered 2000-3000 just six years ago (unpubl. data, Catt *et al* 1998);

- declines of between 60-80% since 1980 in golden plover, lapwing and curlew at a range of sites in the Southern Uplands of Scotland (Smith & Green 2000). -steep declines in three key breeding wader species in ten years to 1996, at one relatively well monitored upland site in the north of England (**Figure 1**);
- fewer than 1500 hectares of hay meadow (rich in wood cranesbill, pignut, bugle) remain in the North Pennines;
- 36% decline in juniper scrub in Co. Durham between 1973 and '84;
- golden eagle and hen harrier broadly stable, but absent from suitable areas in many parts of upland Britain (Green 1996 , Sim *et al*, in press).

Figure1 Trends in breeding wader numbers on the North Staffordshire Moors. Curlew and lapwing abundance is assessed by the numbers of breeding pairs, snipe abundance by the number of drumming males. After McKnight *et al* 1996.



Problems that each face are indicative of unsustainable nature of current policies and practices. Wildlife is threatened by some of the same factors which are reducing availability of habitat for game and which has led to an over-supply of livestock in the hills, threatening the incomes of family farmers. Misplaced production subsidies – we've been complaining about them for more than 15 years, yet still politicians only chip away at the edges.

Each part of the uplands is working to its own agenda. Now is the time for joined up thinking. We should share common ground. There is more to be gained by working together than arguing. I want to outline some thoughts on how we might achieve joined-up thinking. No solutions will be easy. 'We' is not RSPB, nor just conservation organisations. 'We' is everyone here. Everyone with a stake in the land. Landowners, farmers, foresters, 'keepers, ghillies, local school, pub landlord, owner of village shop and conservation bodies. Solutions must involve government, from parish and community councils to the European Union. All hold the keys to some of the policies which need fixing.

Inherent Conflicts

We shouldn't see this as a choice between interests: that somehow if you have one, you can't have another. We should be looking for integration. The results might be that our preconceived ideas have to change, that things are done differently. We have a shared challenge: to find ways of drawing together the needs of those who live and work in the uplands, with the needs of semi-natural habitats and the management which sustains them which in some cases have developed over hundreds or thousands of years.

It is important to look at the big picture: economic, social and environmental. Traditionally, we think of the uplands as dominated by four land-use pillars: agriculture, forestry, grouse shooting and, unique to Scotland, deer stalking.

There are inherent conflicts between each:

- during the past few decades substantial changes have taken place on our main upland habitats. Such changes have impacted most upon the semi-natural moorlands and blanket bogs, as agricultural intensification, sheep and deer densities, and afforestation have all increased;
- thus, between the 1940s and the 1980s heather moorland and blanket mire in Scotland declined in extent by 23% and 21%, respectively (Mackey *et al* 1998), while in England and Wales 20% of upland heather moorland was lost over a similar period (Huntings Surveys 1986). Additionally, it seems likely that further losses of heather moorland are to be expected if current trends in sheep grazing pressures persist, at least in England and Wales (Bardgett *et al* 1995);
- much loss of moorland and bog resulted from large scale afforestation, particularly in Scotland where it accounts for almost 50% of the losses of heather moorland and blanket mire since the 1940s (Mackey *et al* 1998). Plantations of sitka spruce and lodgepole pine have marched their way across the moors (constituting 10% of land area). Lost habitat – planting on the hills continues in Scotland, though has largely ceased south of the border. The land surface of Dumfries & Galloway and Strathclyde is over 20% forest – and in the uplands a much greater percentage is devoted to forestry plantations. Additionally, corvids and foxes may increase in abundance due to the provision of secure nesting and denning sites;
- heavy grazing pressure causing conversion of heather to grassland is the other major cause of decline in heather moorland, accounting for 67% of the losses of heather moorland since the 1940s in England and Wales and approximately 25% of this in Scotland. Increases in sheep numbers, fuelled by the headage payment system, have been the main driving force causing this change (Fuller 1996), but in the Scottish Highlands there has also been a near doubling in red deer numbers over the past 40 years (Staines *et al* 1995). The effects of these increases in grazing pressure on the wildlife of our uplands is poorly understood and is in urgent need of investigation. However, for some threatened bird species, such as black grouse, there is already evidence that it may be a cause for concern (Baines 1996);
- large scale afforestation combined with high sheep and deer densities, have caused substantial losses of heather moorland, driving the long term decline in grouse. Intensification of grassland management may encourage corvids. High densities of deer can prevent regeneration of Caledonian pinewoods, the natural symbol of Scotland; deer fences may kill off the last of the capercaillies (Moss *et al* 2000), arguably Scotland's national bird.

However, it is not a black-and-white issue: many estates have tried to produce sheep, trees *and* grouse for profit – rapidly concluding the folly of this enterprise. Nevertheless, many have benefited from some generous public subsidies for forestry and agriculture, at least in the recent past, but conservation and sporting management often cannot compete with these subsidy-driven sheep and forestry enterprises.

Conservation: The Fifth Land Use

I would suggest a fifth pillar in the uplands. Think of Conservation as integral to resolving some of the problems faced by the other four. The UK Government has entered into commitments to conserve Biodiversity and has legal duties under EU Conservation law – this provides us all with leverage.

Conservation is not something to think of as an afterthought, or a bonus. It is a real player. It is the right thing to do in itself – the UK has international commitments to biodiversity etc. But it is not just that. It is the right thing to do because people care about wildlife and habitats. But it is more than simply that:

- It is right because it is an economic driver. In South-west England, for example, environmental activity accounts for 5%-10% of the regions GDP: 100,000 jobs and £1.6 billion in the economy;
- It is a fast-growing sector. It is estimated that there are potentially another 38,000 jobs and £675 million in the pot in that region of England alone;
- If a similar study was undertaken in northern England this would surely show the important role of conservation to tourism and land management.
- Think of the millions of visitors to Scotland who come to see the mountains, the heather moors, the ancient Caledonian forests, the otters, the eagles and the seabirds. Scotland-wide tourism to the 'countryside' earns £730 million and supports 29,000 Full Time Equivalent [FTE] jobs;
- We recognise that game and fieldsports play a valuable economic role in parts of Britain. But I ask you to recognise the role of wildlife conservation too.

The Road Ahead

Let us look ahead to the way the world is going. Two factors could make a huge difference and enable us each to achieve our objectives. The next round of World Trade Organisation talks are on the horizon. The USA, Canada and Australia have given warning to Europe that massive production subsidies in agriculture are not acceptable.

Surely here is an opportunity for Europe to play a green card. Production subsidies may not be acceptable, but farmers will continue to need support if livelihoods are to be maintained. The alternative is depopulation, larger-scale farms, and the loss of farming entirely from some disadvantaged areas.

Payments to manage land for wildlife wouldn't imbalance the market, but would maintain and enhance rural employment and benefit the biodiversity which we all value, and produce quality farming products which could have value-added marketing opportunities. Surely a win-win result which we should all agree on, and be promoting to the decision-makers in Europe? This is increasingly recognised by the NFU's, SLF and others. But naturally they wish to see a lead from government.

Secondly, I have heard it said that the taxpayer should not be funding this land-management. Why not? Countryside and wildlife are part of our national heritage. Even those who do not live in the country will visit it. Even those that don't visit want reassurance that it is being looked after and that wildlife is prospering.

Role of Grouse Management

It might be argued that we don't need a box labelled 'wildlife conservation', since game management already does the job. I know you want me to say that for wildlife, grouse moors are the best thing since

sliced bread. Certainly, given a choice between overgrazed heather and in-bye or dense plantations of trees, grouse moors are a far better option for a range of threatened wildlife.

Management for grouse has almost certainly helped to retain more semi-natural habitat than there might otherwise be (Barton & Robertson 1997). Legal control of predators probably gives some other species a helping hand, particularly in the face of habitat loss and deterioration. Conditions which are good for young grouse are often good for wader chicks too. A recent study, conducted by RSPB and GCT, has demonstrated that within heather moorland habitats, management for red grouse produces higher breeding densities of golden plover, lapwing and curlew (Tharme *et al*, in press). Whether this is due to beneficial effects of heather management, of legal predator control or a combination of these is not clear. Further studies are required to elucidate this.

However the jury is still out on whether it's the optimum way to manage moorlands. No-one would pretend that a heather monoculture managed for grouse is a diverse habitat and clearly greater diversity in habitat composition is likely to support greater biodiversity. Management for conservation has to include the montane and the moorland edge as well.

At this point I should pay tribute to the work of the Heather Trust: a walk around Misty Law demonstrates what can be achieved by sound habitat management in the face of other pressures (eg forestry). Arnfield Moor in Cheshire also looks very promising.

A Shared Vision

Conservation is not about turning the clock back to some golden era. We are not trying to get rid of one land use in favour of another, but we do want to see land-uses that can be sustained and a level economic playing field to achieve this.

On many key issues, conservation groups and the game community share common ground:

- a dislike of inappropriate forestry that swallows up valuable wildlife habitat;
- a desire to see better managed sheep on the hill – a wish to see wildlife thriving on the open moor;
- deer managed in ways which benefit all biodiversity;
- a wish to see the local economy and employment benefiting from our activities.

Last year, the RSPB produced two documents examining *England's Rural Future* and *Scotland's Rural Future*. They propose a shared vision for all those who live in, work in and care about the uplands. They have resulted in the development of initiatives with farming, social and conservation organisations. There are some big policy issues on which we're seeking solutions that work for everyone. We believe that game organisations could be playing a more influential role in this search and this would be welcomed by the RSPB.

Making it Happen

In England, we're already starting to see some attempts at marrying the different land-uses in Bowland (grouse-shooting and hill farming in an important area for breeding waders, twite and birds of prey) and on Bodmin moor.

These projects (co-ordinated by MAFF) are designed to show how agricultural, rural development, social and environmental needs can be brought together. Everyone knew it wouldn't be easy, but it's going surprisingly well. There is an enthusiasm from everyone – landowners, tenant farmers, villagers, conservationists – to make it work. The litmus test is how it delivers for rural incomes and wildlife populations. It is early days, but the building blocks are there.

The Scottish Executive and Parliament need to look at such schemes, learn from them, use the bits that work and adapt them for Scotland's local needs. Scotland needs to be bold and challenging, to really strive for integration. Integration which is both bottom-up and top-down: it requires determination from the ground, supported by incentive payment systems that are trying to achieve a range of objectives, not biased in favour of one alone.

The European Rural Development Regulations are an opportunity which should be grasped. And we should collectively be lobbying for schemes and structures which encourage integrated land-use policies in the future which sustain good practice and management. Again, this is an opportunity where the Scottish Executive has real influence.

On the ground, integrated thinking is more difficult for an individual landowner, (especially on land with common grazing rights). Some estates are doing a good job in recognising that – under current conditions – you can't make stacks of money from sheep, forestry, grouse and wildlife. Some estates are using agri-environment measures to reduce grazing to allow grouse and wildlife to flourish. However, in Scotland our Agri-Environment Schemes are a pale reflection of what is on offer in Wales, England and Northern Ireland.

We believe that tailored and targeted agri-environment programmes must be the way forward. They can help enhance some of our most special areas of landscape and biodiversity, yet still provide for the continuation of farming in the hills. Farming that wildlife habitat will be needed, albeit in a different way in the future.

However, this will only work if the resources are there. It is ridiculous that we can agree on so much, yet be handicapped by only 3% of government's £3.4 billion support of agriculture being spent on agri-environment measures. In Scotland, Countryside Premium grants are capped at such a low level that it acts as a disincentive to do anything worthwhile for conservation. Sensible resourcing and integration must be a priority for the new Scottish agri-environment scheme. We also need to share best practice and improve the quality of advice offered and available to land managers.

Conclusion

- Integration is not easy, it requires enthusiasm and a willingness to accept and understand how upland land-uses must fit together for them all to be sustainable.
- It requires political will and long term vision. It is up to everyone who cares about the uplands to demonstrate that we can embrace this new world, see the pressures around the corner and join together in making it happen.
- The public will expect an equitable, social return on their subsidy of land management. The competitive marketplace could leave a trail of casualties – social, economic and environmental – in its wake if alternative solutions are not sought quickly.
- The countryside needs a vision which it can be proud of and that the wider population can rally around. Dare I say it, arguing about raptors hampers finding the long term solutions and lets our politicians off the hook.

- We need to work together on the big picture issues, the common ground we share, not those things that divide us. Let us take a step back, and agree that fixing the big policies will be far more advantageous to everyone than dividing over the specific problems.

Let's look for a future which is bright; uplands which have vitality and land-use systems which serve the needs of the whole community, including sporting managers and wildlife.

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Public Perceptions and Enjoyment

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Summary

Enjoyment is now a prime use of much of our uplands – whether the private or commercial use for field sports or the public enjoyment of active open-air pursuits. The main field sports on hill ground are deer stalking and grouse shooting, while the main public recreations are walking and climbing, and ancillary activities such as watching wildlife. Both private and public enjoyment of the hills depend heavily on the quality of Scotland's natural heritage: for some people the outdoors is the attractive arena within which they pursue their different activities, but for many it is the main attraction.

Introduction: Who Enjoys the Countryside, and Why?

Participants in field sports and in the open-air recreations followed by the public in the hills might consider that these pursuits have little in common. However, a social psychologist would tell us that they are closely linked. Our psychologist would identify that a day out for both field sports and climbing will have required the exercise of skills in a rugged outdoor setting and the sense of achievement which arises from this will have added to participants' stock of self-esteem or worth. Participants in each activity will have conformed with the norms of their own social group and through their experience, will have confirmed their social identity. Each may have done something notable in the eyes of their peers and therefore their personal standing with their associates will have been maintained or enhanced. All outdoor activities involve close contact with the natural world and people gain something intangible from that experience, as well as the physical benefits of hard exercise in challenging settings.

But if there is a difference, we might say that it is tribal. That is, each activity has affiliations with different social groups, which have their own shared values and norms in behaviour. Leisure is a social phenomenon which has many tribes because it allows people to escape from the conventions and normative behaviour of their daily life. Leisure is also a major force in society and in the economy of the nation; it is hugely diverse in the range of activities and pastimes; it is very varied in its social structure and associated values – and its commercial status ranges widely, from a very competitive market place for some leisure pursuits, to many non-market activities, such as going for a walk.

Some of this diversity is to be seen on the hills. One way or another, a hunter will have paid for his day out and the services it entails, while a climber will simply have taken his or her enjoyment from the natural elements of the hill. Many of the recreation values which each of these participants espouses will be in accord, but others will differ and sometimes there is a conflict between them. Resolution of such conflict does need better understanding of how the public use the hills and it also needs communication and better awareness of land managers' needs.

Most open-air recreation occurs on the high hills rather than on moorland, which is only lightly visited by the general public. There has been an apparent growth in use of the high hills for the active pursuits over recent decades. This growth is part of expansion of the wider leisure world, of which open-air recreation is part and the most active pursuits are but a small part of that sector. It is difficult to assemble comprehensive data

on the growth of leisure in general – far less the outdoor pursuits. It might be thought remarkable that there is no regular and overall public survey of leisure – given its significance to the nation, both socially and as a huge feature in the national economy. There are many surveys which cover different sectors of leisure, especially for tourism and sport; there are many local surveys of open-air recreation, or surveys of particular recreation activities. There is also much market research in the commercial sectors of leisure, most of which is not generally available.

It is difficult to draw these varied surveys together. The tourism surveys focus on marketing and don't tell us much about the use of the outdoors. Most recreational surveys of visitors to the countryside consist of either single surveys or short runs of data, from which it is not possible to determine long-term trends; many of these surveys are otherwise limited by geographical extent or scope of inquiry. Nonetheless, there is much empirical evidence that outdoor activities have grown in popularity over the years: our eyes tell us this, including the evidence of the visible physical effects on the hills from more feet.

Who, then, are those people walking and climbing on the hills? SNH has recently conducted three major surveys of the recreational use of extensive hill areas – for Glen Shiel in the west (Herries, 1998); for the Eastern Grampians (Mather, 1998) and for the Cairngorms (Taylor & MacGregor, 1999). Surveys of this kind are not easily done. For each of these extensive hill areas people disperse from various starting points; they return at unpredictable times and, at the end of a long day, they aren't amenable to participating in a long interview. So these surveys mainly use self-completion postal questionnaires. Response rates to these surveys are very high for a self-completion postal-return questionnaires – all greater than 50%, with returns in some cases close to 70%. The following commentary draws mainly from the Glen Shiel survey, which perhaps represents better a more typical Highland hillwalking area than the all-year-round tourism focus of the Cairngorms.

From general surveys of walking we know that about 8-9% of walks (defined as any walk taken in the countryside or at the coast or in towns) are taken in the hills. So the majority of recreational walking by the public is on low ground in a range of different settings, and with the coast being the single main destination. Of these walks in the hills, we know that most are also at a low level – amongst, rather than on the hills. From other surveys we can be confident that only around 2-3% of all trips out to the countryside in any one survey period had a main purpose of hill climbing or mountaineering.

Obviously, some people participate more frequently than others and that 2% or 3% will include occasional and frequent participants. By some not wholly robust extrapolations we can estimate what percentage of the population falls within the infrequent participants, and it would appear that around 10% of the population will go to the hills either regularly or infrequently. And if we stretch these data a little further using evidence on frequency of participation, we can come to a gross estimate of around 1.5-2.0 million ascents of Scotland's hills annually, for active mountain-based recreation.

This is beginning to look like a largish figure, but it comes from data gathered about open-air recreation by people resident in Scotland and there are no robust data for trips to the hills by visitors from furth of Scotland. These might fall into several categories: first, and perhaps the most numerous, will be those coming north for relatively short breaks, either the winter climbing market or people taking second short holidays at the main seasonal breaks. Or they might be people here on longer-term holidays from home or abroad. An HIE survey of the economic impacts of mountaineering in the Highland & Islands suggested 5.6 million visitor days overall on the hills, for visitors from within the UK (Highlands & Islands Enterprise, 1996).

However the three local surveys listed above now provide some good, detailed information about the practice of a walker's day on the hill: how long they spent out and whether they camped overnight; how well prepared and informed these visitors were for their day out; on where they come from; and on various peripheral issues about their visits, such as accommodation and transport. Importantly we now know more about who they are; on their perceptions of their day out, and what they think about the use of hills for other management purposes.

The Glen Shiel Study

Described here are some salient facts about visits to and routes taken by walkers in Glen Shiel. This glen is narrow, with two long and challenging east-west ridges, and with the main part of the north side of the glen being in the ownership of The National Trust for Scotland – the Trust's well-known Five Sisters of Kintail property. The equally attractive hills on the south-side of the Glen, mainly comprising the South Cluanie Ridge, are in private ownership. With its seven Munros, this ridge is a challenging target for a very long day out. Most of this terrain is visited for hill-walking – it is challenging terrain by the length of the ridges, which also attract some winter mountaineering, although there is very little climbing *per se*.

Examination of the routes of 1,070 walkers (derived from 432 questionnaire respondents on 44 survey days between July and October 1997) gives a good indication of how these ridges are used. Evidently the dominant pattern is of ridge walking, and with an emphasis on favoured hills such as the well known peak of The Saddle at the western end of the south-side of the glen. There is a pattern of access routes to-and-from the hill, taken from various points along the A87 trunk road through the glen, with most walkers following a small number of routes. But there is also a moderate scatter of people taking independent routes or perceived short-cuts, and it is some of this dispersed use of the hill between the main access routes which causes local deer managers to have concerns about disturbance, both to stalking and to the way in which deer occupy the main grazings.

A footpath counter was also installed half-way along the South Cluanie Ridge at the point of expected maximum use, and gained the record shown in **Figure 1**. This record covers only the period of the survey, but additional data exist, apart from the months of hard winter conditions, when frozen ground makes the counter inoperable. From these data, and realistic estimates for the months on which data were absent, an estimate of the annual numbers passing the counter (which is close to the mid-point of the ridge) is around 2,500 persons. In comparison, across the glen – and here extrapolating from counter to the field survey data – we can estimate around 1,800-2,000 persons on the Five Sisters. Some of the less-visited Munros on the north side of the Glen appear (pro-rata) to have around 1,000 visits *per annum*.

Some interesting estimates of the use of some of the remoter Cairngorm Munros, from the survey of that area, indicate around 2,000 visitors *per annum*. So it looks as if we are beginning to have some feel for the numbers visiting Scotland's most popular mountains: Ben Lomond has visitation in the order of 30,000 per annum and Ben Nevis exceeds this by a factor of two or two and a half (or more), according to seasonal weather conditions. But beyond the most popular tourist destinations, an initial indication from these surveys is that 2,000-3,000 will be a reasonable annual visitation to a moderately popular Munro, while those of poorer accessibility or less attractiveness are bound to have less – say around 1,000 annually. These are snapshots only. But perhaps they are indicating somewhat lower numbers than might be expected, and they are at a lower level than the gross figures for mountain based activities mentioned above. Yet it is clear that even this level of visitation – in the low thousands, year-on-year – is sufficient to generate significant wear and tear on high ground.

But who are these visitors? First, it is a male dominated group with a 70:30 gender balance (in Glen Shiel); it is middle-aged with a mean age of around 40 and with young people in their teens being relatively infrequent. For any one survey area, the origins and the split of visitors between those resident in Scotland and those from furth of Scotland will vary according to location and season. But for Glen Shiel in mid-summer, some 60% of visitors reside in Scotland, with 37% coming from England and Wales and a just-measurable 3% from overseas. Of these same visitors, 45% were on a short break, 28% on a longer holiday, and 27% on a day visit. Most of the day-visit group come from the Highlands or Moray Firth populations, but some had travelled a very significant day-trip distance, from destinations in the Central Belt and beyond, as far as the Borders or Dumfries & Galloway.

But the most interesting data demonstrate the degree to which this is a very middle-class, professional group of visitors. Three sets of data (**Figure 1**) on the social class or educational status of those going to the hills for hill-climbing or mountaineering are all skewed towards the top two social class groupings. The data from the now defunct Scottish Leisure Day Visit Survey are likely to be the most reliable, as the figures from the two area surveys for the lower categories of social class or educational attainment may well be depressed. But the broad pattern here is robust: it is not so much a group of tinker, tailor, soldier, sailor on the hills; it is more the case of teacher, doctor, bureaucrat and business executive.

Figure 1 Hill Climbers – Social Class or Educational Status.

East Grampian Survey		**Cairngorms Survey**		**Scottish Leisure Day-Trip Survey**	
Socio-economic Class	%	*Educational Background*	%	*Social Class*	%
1	25	Degree/Diploma	61	AB	39
2	40	Others beyond Higher/	9	C1	25
3	16	A Level		C2	
4	1	School-Higher/A level	4		19
5	1	Others	26	DE	16
Other/unclassified	19				

Evidently this is an audience which is well educated, and which is likely to have opinions about the land and how it is used, even though many of these visitors will be not well informed about the technicalities of land-use. But there will be some people with considerable understanding of the issues which concern those who manage the land. This affects the upland manager in two ways: first, in how they can best communicate with and influence these visitors and, second, the public relations implications of their messages.

Communication with visitors going to the hills is normally done through signs. In the past many of the messages tended to adopt an aggressive, patronising or over-stated tone. This is not a fruitful approach to a relatively sophisticated audience, although there is now a welcome trend towards much more positive text on signs. It is important to treat the giving of messages as a form of marketing. This involves understanding the needs of the visitor, and taking an approach which addresses his or her concerns.

For example, the emphasis in advisory material for walkers prepared for the Glen Shiel Estate by SNH was put on welcoming the visitor, and on explaining how he or she could positively help the Estate, rather than signal by negative messages that the visitor is a nuisance and a problem to management. Presenting messages to the public is more than an exercise in marketing good information to ensure that it is well received and acted upon. It also involves the image of estates, and with significant numbers of well-educated, informed and perhaps a few influential visitors, the need for good public relations is not to be ignored.

The Visitor's Reactions

What then does this great tribe of recreational visitors think about the hills and how they are managed? Surveys of the kind described above usually try to capture some flavour of what it is that people enjoy or value from their day out on the hills. This is usually gathered from open questions to ask what people most enjoyed, but in truth, these are rather simplistic questions, which fail to do justice to the depth of people's appreciation of their day out. Perhaps, we don't really need complex surveys to tell us what it is that people really like or value about their day out on the hills. This is already evident from literature about different kinds of enjoyment of the outdoors. The most valued features in these writings are usually described in emotive language, reflecting the popular values people hold for their enjoyment of the outdoors, and also the physical and inspirational challenges people find in wild places.

The same kind of responses can be found from perception surveys amongst the wider population. A survey of public attitudes to moorland (Mackay, 1995) (as elicited through responses to a question about what people most associate with the word 'moorland') drew out a range of perceptions which are also emotive or aesthetic in their origins. The depth of responses from this survey was surprising given that, for most of these respondents, moorland is not a place which they visit and use for recreation, although many of them might often view moorland from the roadside. So from these snapshots, we can draw some general conclusions that both the special-interest recreation groups and the general population espouse a very strong aesthetic response to the values and qualities of Scotland's mountains and moorlands. There is nothing new in this, of course, but it is important to keep the strength of these popular values in mind.

This links to the issue of public relations. Looking back at some of the recent irritability between land managers and recreational visitors to the hills, it can be argued that relations worsened when bulldozed roads were first put on to higher ground, often creating scars which seriously damage the very aesthetic qualities which people value there. There is less of this damage being done now (although some new roads are still being constructed) but there is a trend towards more ground damage by off-road vehicles, and the old scars remain. The opinions and attitudes of visitors to the management impacts of vehicular use may not stand high with those who take decisions about means of access into the hills, but there is always risk of damage to public relations when wider public values and concerns are set aside.

More depth in visitors' attitudes can be explored through asking questions about the specifics of individual land management issues. Broadly, public attitudes are generally not against the sporting uses of the uplands – perhaps overall they can be described as neutral. In many cases, respondents recognise the positive benefits which accrue to the local economy from these uses of land which, otherwise, has limited productive capacity.

For example, the responses to an open-ended question on the relationships between stalking and hill-walking in the Glen Shiel survey spanned the range of attitudes summarised in **Figure 2**. Throughout many of these

responses from hill walkers there was a strong sense of the legitimacy of their own recreation activity; a strong sense of commitment to the value of these places; that they were entitled to have an opinion about these matters, and also to be there. But only a minority of respondents – about 4-5% – declared any fundamental opposition to deer stalking.

Figure 2 Classified responses to the question:

Do you have any comments or views on relations between hillwalking and deer stalking?		
Suggestions for improving the situation		
Co-operation/communication required on both sides – both have equal right to use hills	70	20%
Information on stalking should be more readily available/more specific	40	11%
Whether stalking necessary or not		
Recognise that stalking necessary (economic reasons, controlling numbers)	28	8%
Disagree with deer stalking	15	4%
Acceptable and unacceptable restrictions		
Against blanket bans (unreasonable, cause resentment)	21	6%
Happy to co-operate/restrict visits for limited periods	10	3%
Who should take priority on the hills		
Stalkers should take priority/hillwalkers should co-operate with stalkers	14	4%
Hillwalkers should take priority/free access	5	1%
Opinion of recent efforts to improve communication		
Any mention of Concordat/Hillphones/leaflets	8	2%
Other	40	11%
Total number of respondents commenting (multi-response)	202	58%

The Access Forum and Legal Changes

The matter of a right to be on land for recreation is under discussion following the Government's manifesto commitment to legislate on access. The present debate about legal change has been conducted through the Access Forum. The Forum had previously agreed the Concordat on Access to Scotland's Hills & Mountains but, in continued debate, the Forum came to the view that the way in which we provide for and manage recreational access needs to be modernised. This need is especially pressing for access on low ground and it arises from a range of factors, of which the following are the most important:

- The law is neither clear for the visitor nor helpful to the land manager;
- There is a wide range of existing public policies which assume that good access is available – health, outdoor education and sports and, in a competitive tourism world, we need to have unambiguous welcoming arrangements for our visitors;
- Although some land managers have been welcoming to the public, the present arrangements of working for access through the voluntary principle haven't been working well on low ground;
- The systems for agreeing and managing access – especially the protection of rights of way – are ineffective and therefore have had limited use;
- The support to those land managers who have problems from the numbers of people on their land (or water) is not adequate.

In addition we urgently need to give access work a political impetus, to create more effective systems for management, to engender more political commitment to action, and to command more resources for this work.

In 1998 the Forum agreed the principle that there should be legal change to create a general right of access to land and water for informal recreation and passage. This would be subject to responsibility in the exercise of the right, and to safeguards for privacy, for land management needs, and for conservation. The Forum subsequently addressed the difficult task of working out the details of how this proposed legal change might be implemented. Again it has reached a positive outcome, mainly detailed in a Scottish Outdoor Access Code, which will be the reference point for defining responsibility. The Forum is clear that the proposed changes will have to form an integrated package – the right with responsibilities on visitors and land managers, allied to new powers and duties for local authorities, all backed by sufficient resources to make the new arrangements work effectively.

Conclusion

The proposed changes in the law are now a matter for the Scottish Parliament, but legal change has to be matched by good practice on the ground. There is an opportunity here to build a shared commitment to what it is that the hills deliver to the common good of the nation. It is an opportunity to help to promote better understanding between land management needs and open-air recreation interests through the obligation for responsibility in access and there is an opportunity for all to work collectively for the care of these special places. In a rapidly changing society, the use and management of land should accommodate a diversity of needs and aspirations. This should also secure the longer term care of the greatly valued resource of Scotland's hills and mountains.

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What the Public Seeks

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Introduction

I don't think we would be here today asking that question if there wasn't quite a bit of anxiety lying behind it. With all the talk of land reform and access in the run-up to the new Scottish Parliament, we now know it wasn't just talk, it was, and is now regarded as a priority. It is not surprising that searching questions are being asked.

Does the public merely want a bit more space for recreation or is this the thin end of the wedge? Will one thing lead to another – for instance – community buy-outs *ie* communities more or less managing the land? (This will be the case if the SNP has its way).

The question for landowners is, presumably, do you go along with this and hope that, providing a little bit more access, the public will be satisfied; or do you man the barricades and fight it with every means available? Will it be enough to instruct employees not to order walkers off your estates and keep paths clear of obstacles, or will you have to start providing more facilities – car parks, signposts, toilets, etc.? Where will it all end? The anti-blood sports lobby has got the bit between its teeth; fox hunting is just the start, it will be grouse shooting, deer stalking and fishing next. The way some people talk really makes you think the countryside is under siege. While some landowners, seeing the writing on the wall, seem to be going out of their way to accommodate access, others appear to be making it more difficult.

What does the Scottish Landowners' Federation really want? On the one hand it has accepted the Access Forum's proposals; on the other, it reports serious reservations about the draft *Access Code* – it does not like its tone or its lack of balance. For the public, it is hard to read between the lines. Do landowners simply dislike the way the wind is blowing? Are they holding out for grants and compensation or do they have legitimate anxieties about being exploited by the public's desire to be on their land?

So, What Does the Public Seek?

I mentioned to someone the other day what I would be talking about today and they said "but the public hasn't got a clue about what it wants".

It might be easier to tackle what the public doesn't want. In other words, the public doesn't want its countryside, particularly the open moors, to be turned into a battleground from which it is excluded, or where at best, it is grudgingly tolerated; where even on the best known walks among the hills it is portrayed as a destructive mob eroding the fragile landscape.

I heard a lovely quip the other day – "so and so can't see a top without going over it". Well, I shall try not to let my language go over the top today, but sitting on the receiving end of all these opinions about access to the countryside, I fear the various claims are becoming increasingly exaggerated.

John Phillips has already mentioned imminent changes to the way access is managed. I've been asked to talk in more detail about public perceptions. So I want to address not only what the public wants in terms of access, but in terms of the kind of countryside and the kind of experience it would like.

And, of course, I can't pretend to speak for the whole of the public; it is obviously a collection of individuals whose perceptions will vary widely. While many want little more than to be able to take off up a hill-path on a Sunday afternoon, with somewhere to park the car and a tea-room or pub close at hand – others prefer to roam and camp without encountering anyone else.

Some believe the Scottish uplands are a wild and natural landscape and are more or less content with that image; others know it is a largely man-made environment and either quite like the way it is or want it to be altered.

Most of my talk will be on access issues but, in the end, they are inextricably linked to land ownership and management and we can't escape the fact that there **is** a climate for change.

And if the "access to upland" debate seems fraught with conflict (and you can never have too many occasions like this to debate the topic), I should like to question a little further: Why are we here?

Why should a large audience of landowners, managers and environmentalists give up their weekend to discuss it? Few subjects arouse more emotion than land ownership, even when it concerns a tiny strip of urban ground. But I don't think that explains entirely why we are here. Access isn't simply a matter of rights of ownership. Our need to be able to roam in the open countryside comes down to some very basic instincts. Once I suppose it was a matter of self preservation (going back to when we were hunter gatherers); more recently our needs have become more "romantic" (I don't mean sentimental – but there is an emotional need which must be satisfied).

It has been said there are some who <u>can</u> live without wild things and some who <u>cannot</u> and I guess we all fall into the latter category.

The strong British passion for the land seems to be a driving force which has to be accommodated. I'm sure there isn't a single person in this room who can't recall (depending on your point of view) a defining moment: reaching a hill or mountain top, spotting a rare bird, bagging a grouse or catching a fish!

And that is why the remoter countryside matters so much to people and that is why I don't want to dwell on it purely as a question of ownership or as a consumer issue. Our passion for the land isn't shaped by whether or not we own the title deeds or whether we are wealthy enough to take advantage of it.

I think one of the most unpleasant aspects of the current debate on the future of the countryside is the way some people want to polarise it, with those who apparently "understand" the countryside and those who seemingly "do not", pushed further and further apart.

I received an interesting piece of research from the Countryside Alliance which purported to show that one in ten British children believed that lions, tigers, elephants and kangaroos were native to Britain while some thought eggs were laid by pigs and bacon came from chickens. One in three believed badgers were not to be found in this country though the same number thought wolves roamed wild here.

The press release stated that ignorance amongst the majority of the population was one of the key reasons for the formation of the Countryside Alliance. Well perhaps, but I wish I could detect a sense of country dwellers rushing to embrace their urban cousins and dispel such myths.

Did you see the latest this week? Those campaigning to save fox hunting have rounded on the domestic cat as the greatest killer of wildlife and suggested it would do more good if people kept their cats indoors rather than ban fox hunting. I fear the divisions between town and country are being driven deeper and deeper.

And that's the context in which we approach access to Scotland's countryside.

Whenever I am among farmers and landowners and the subject of access comes up, it is not long before horrifying allegations of urban ignorance are cited: out-of-control dogs, litter louts, vandals and thieves. I am not saying some of these stories aren't true; what is worrying is the enthusiasm with which people seize upon them and the smugness with which they tell them.

On the other side of the fence – our largely urban population has an equally rich fund of stories of purple-faced farmers armed with fierce dogs and shotguns, electric fences and barbed wire. The more pressure there is on the countryside [and we know it is increasing] the more stories we are going to hear. So how can we avoid guerrilla warfare in the countryside?

While access to low-lying areas near main centres of population is a highly complex issue, the uplands at least present more opportunity for compromise, to allow people to make a living without shutting out those who are there to enjoy themselves.

So what is the current position? Scottish Natural Heritage's *Advice to the Government* published nearly a year ago underlined the confusing situation in which landowners and the public found themselves. The so-called "freedom to roam" which many believe is a birthright, is no more than an implied right of access, dependent on the tolerance of the landowner and unprotected in law. And while there is no civil law of trespass, in the sense of nothing to stop someone crossing another person's land, landowners can, in theory, take action against those perceived as being a nuisance by asking them to leave or applying for an interdict against the named person.

In reality, of course, most people can walk in the open countryside without being shouted at while rarely, if ever, do landowners apply, *let al*one successfully apply, for interdicts to keep people off their land. As the SNH advice concludes, there is an uneasy balance between the public not having very many clear legal rights and the landowner not having many remedies against trespass or irresponsible behaviour. The upshot is an unsatisfactory situation where the one with the most brass neck usually wins.

I think, however, that the public debate on access so far has left another assumption or "myth" largely unchallenged. This is the belief that while access to low-lying areas can be fraught with difficulties and needs to be sorted out, it is rarely such a contentious issue in the uplands. I've said that it is not as problematic – but that doesn't mean it is without difficulty.

Yes, the image of a mountaineer or hillwalker astride a rocky peak does symbolise untrammelled freedom and the ultimate outdoor experience, but the reality down below is often badly eroded paths and litter caused by hikers, or intimidating signs and deer fencing introduced by the landowner.

Of course public perceptions are often shaped by people like me and a report I did on the Glenfeshie estate is perhaps typical. It asked the question, "to what extent is the great outdoors a private domain or part of the public's natural heritage?"

And so we come to one of the running sores of the access problem. Who is doing the most damage? The more landowners claim that an influx of walkers and hikers will destroy the landscape and experience they are seeking, the more recreational bodies will complain that nothing they do can match the destruction caused by bad land management in the first place: overgrazing, deforestation, soil loss and landrover tracks would seem to outdo any destruction caused by the walker.

But while land managers are under pressure to clean up their act, through such measures as deer control and forest regeneration, with improved signing, so that people are not, for example, warned to keep off hundreds of acres of moorland for several months a year because high velocity rifles are being used for stalking – or even for vague conservation reasons such as nesting birds all year round! – what should be expected of the public?

So far I have more or less had in my mind's eye the image of a small party of fit walkers, suitably clad, without dogs, knowledgeable about the area they are hiking in and sufficiently well-informed to stick to any good, rocky paths that are available rather than tramping off onto fragile grassy cover. I have assumed their car is not parked across a farm gate and that they have not come to mountain bike, hang glide, horse ride or, perhaps in a large party, enjoy a noisy overnight camp.

And I haven't even touched on those who want access to water, ranging from someone enjoying a private skinny-dip during a long hot walk, to those who want to go fishing, canoeing or jet-skiing.

As more and more people want to enjoy the countryside and as they are encouraged to do so (the Scottish Tourist Board has welcomed access reforms as it sees walking holidays as a major growth area) the more we shall have to find ways of informing the people who want countryside recreation and making it clear about what is and what is not acceptable.

And I don't mean the creation of a kind of nanny state with the countryside sprouting a forest of signs **FORBIDDING** this, that and the next thing.

The American Walter Hickel said "You cannot separate man and nature so the environmentalist's job is to make 'em compatible."

Let's start with land ownership.

I think one of the most offensive phrases I hear repeated over and over by farmers is that the countryside is their factory floor. I think what they mean is that <u>if</u> people want <u>access</u> they can't simply stumble through the countryside without due consideration for those making a living from it. But the phrase also gives the impression, somewhat reinforced by the reality of modern farming, that it is a process designed to squeeze the last drop out of the production line – field margins reduced to a minimum, acres of weed-free monoculture and a turnover so rapid that opportunities to walk across stubble fields, for example, are reduced to a minimum (which is my own experience).

There is an argument which states that by improving access to lowland routes [and that is where the majority of people want to be] some pressure could be removed from fragile upland areas. But given a choice between a fraught few hours trying to negotiate a walk in central Scotland and the prospect of some relatively untrammelled hiking in the hills, I think most people with the time and mobility would opt for the latter.

Unfortunately there is a tendency for some upland managers to behave in the same way as lowland ones. Some moorland and hill areas, vast as they are, can be virtually turned into "no go" areas by warning signs. As an example, I was told about a permanent sign which baldly stated "*Deer Cull in Progress – For Your Own Safety climbing and hillwalking is inadvisable*". Thankfully the new Hill Phones system is introducing a more sensible and sophisticated approach, whereby people aren't treated like idiots and can be told on any given day exactly where stalking is taking place.

We are sometimes told that rich shooting parties haven't paid vast sums of money to encounter brightly clad ramblers on the hills, but it is a very mixed picture with mixed messages. Public bodies, like The National Trust for Scotland and the Forestry Commission, as well as a number of private owners, seem perfectly able to shoot grouse and control deer without excluding us, while others claim sporting activity is incompatible with other recreation and that not only estate workers but whole local communities depend on the income it brings. Andy Wightman argues that "the sporting estate in reality is indulgence by wealthy people who like hunting." Is that reason enough to exclude those who don't want or cannot afford to hunt?

So What Does the Public Want?

It seems to me people want wide access and not purely on the landowners' terms. The public image of landowners, even though we know there are many exceptions, is a poor one. It is one of people wealthy enough to exploit and damage the landscape and to prevent others enjoying it; one of landowners who continue to poison and trap raptors which we are fond of using to symbolise Scotland's remoter places.

Public discontent is exemplified by the comparatively recent movement of conservation groups which buy estates. These groups, representing thousands of individuals, believe they can look after the uplands better. Some, like the RSPB at Abernethy, say they have now been running places long enough to be able to claim they have increased grouse numbers and jobs as well as retaining access and not killing birds of prey.

Meanwhile, the growing membership of such groups (the RSPB has reached a million in Britain, the Ramblers Association has the fastest growing membership in Scotland while the NTS has a membership of 200,000) suggests a growing knowledge and interest in the countryside. Even the armchair conservationists, who rarely set foot on the moors, begin to develop an expectation of what is out there.

So What do People Want?

At one level, it is perhaps just some bracing exercise, the wind in their hair and, on a good day, a splendid panorama of distant hills and mountains. But as people become better informed, they want other things as well. They do not want blocks of spruce, or barren hillsides worn down by the nibbling of deer and sheep (they are sometimes referred to as wet desert) and not even rivers heavily constrained by human activity. They want the uplands to be given a new lease of life.

If you look at Scotland from the air it is stunning to see just how much land and water there is, especially in the Highlands, where there are no concentrations of population. I think a stranger would find the debate over access incredible in a countryside with so much land and so few people.

So there is a growing cross section of the public which seeks improvements to the countryside, in the sense of more diverse flora and fauna, while the wider public simply seeks more access.

And first of all, people want an end to the confusion surrounding where you can and cannot go: we are rapidly moving towards legislation designed to enshrine in statute the traditional rights of access

And there are going to be codes of conduct for both landowners and recreationalists. I think that is a very good thing and a useful tool. Of course it won't deter those bent on trouble, but to have a code should help everyone who wants to enjoy the countryside, but who finds it a complicated place in which it can be difficult to judge what are sensible rules and what are merely examples of intimidation and hostility.

John Mackay has reminded us of the type of people that visit the country (the professional middle classes). On the whole, they are looking for fairly gentle pastimes; we are not talking about competitive sport or mass rallies, but walking, climbing, bird watching, painting, cross country skiing, cycling, etc. These are not, in theory, threatening activities.

There are others, such as 4x4 driving, camping, lighting fires and so on, but they are already covered by law.

So, what would the public expect from an access code? There are the obvious things like shutting gates, using stiles and keeping your dog under control. And there are the slightly less obvious ones, such as information about bird breeding seasons, which livestock to take special care over, what the rules are for picking flowers, collecting mushrooms and so forth.

There should also be detailed guidelines for mountain biking and horse riding.

There should be some rules for landowners and their employees. The matter of out-of- control dogs cuts both ways and landowners should be encouraged not to block paths with sacks of silage or farm machinery.

By leaving wider field margins, and even providing stiles or kissing gates, people will also be encouraged to stick to routes where no damage can be done. This applies in upland areas also, where you sometimes have to pass through farmland to reach the hills.

People worry a lot about erosion. Sometimes it occurs because there is just one place to park your car and only one obvious route. Perhaps damage could be lessened if wider access was encouraged.

The most common complaint I hear from ordinary walkers is how access is denied either directly by barriers or by the total absence of paths (along the River Dee for example) or by direct intimidation. Even some of the most self-assured people who feel they know their rights, admit a day out has been ruined by being ordered off an estate road or shouted at. Someone told me the other day they regarded vast tracts of Perthshire as no-go areas because it wasn't worth the hassle of going there. Every person with whom I've raised the subject has mentioned entire glens from which they feel excluded or at least highly contained either by signs, barriers or direct intimidation.

Conclusion

Pressure for more access is not going to go away; our politicians are committed to supplying it. And the thought I'd like to end with is that it is about a great deal more than mere practicalities. I would suggest that virtually every argument about privacy, crop damage, erosion, etc. can be met with a practical solution.

It is important to remember that it is also a highly charged issue, embracing everyone from the radical campaigner who believes the land is in the wrong hands to the landowner who thinks he is the only responsible steward.

It worries me that despite all the fine words spoken so far on access and the progress achieved by bodies like the Access Forum and the Scottish Landowners' Federation, we are now entering a period where the wider and highly acrimonious debate on fox hunting, blood sports and the future of the countryside will spill over into access which will drive people further into entrenched positions.

Conservation Constraints and Public Access to Open Countryside in Wales

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Summary

1. On the 8th March 1999, the Right Hon. Michael Meacher MP announced to Parliament that the Government had decided to legislate to provide a public right of access to open country in England and Wales. The announcement followed an extensive consultation during which views were sought on the efficacy of voluntary versus statutory means of delivering the Labour party's manifesto commitment to provide access to the '*open countryside*'.

2. The Countryside Council for Wales (CCW) welcomed the announcement and the accompanying 'Framework for Action' document in which the Government spells out how it intends to deliver its proposals (DETR 1999a).

3. The Framework document charges the Countryside Council for Wales and the Countryside Agency with the delivery of several key tasks including, defining and mapping areas of '*open countryside*' to which the new rights will apply. As its statutory advisor on sustaining natural beauty, wildlife and opportunity for outdoor enjoyment in Wales the Government expects CCW additionally to "*take steps to manage public access so as to prevent damage to nature conservation interests in particularly sensitive areas*".

4. In our view the Government's proposals to grant a public right of access on foot to open countryside need not prejudice conservation interests if properly managed. We made this clear in our response to the Government's consultation 'Access to open countryside in England and Wales' (DETR/Welsh Office 1998) where we went on to describe how this might be achieved (CCW 1998). The Council is pleased that the Government accepted our advice which is based on our experience of managing a suite of 62 National Nature Reserves, the great majority of which are accessible to the public and include the most popular and prized areas of '*open countryside*' in Wales.

This paper examines:

- the Government's proposals to give the public a right of access to open country;
- the extent of '*open countryside*' in Wales to which the new right will apply;
- existing public access opportunities in Wales;
- nature conservation interest and likely constraints on access; and
- how the Government's proposals might be implemented in the Berwyn, one of the most sensitive upland areas in Wales.

Introduction: The Government's Proposals

The Government has confirmed that it plans to introduce '*as soon as Parliamentary time permits*', a new statutory right of access on foot for open-air recreation to specified categories of open countryside. The new

statutory right will apply – in the first instance – to mountain, moor, heath, down and registered common land in England and Wales. The new rights will not apply to developed land or to agricultural land other than that used for extensive grazing.

Maps will be produced by CCW and the Countryside Agency showing where the new statutory right will apply. Draft maps will be produced first for wide consultation.

Legislation will give landowners discretion to close land or restrict access for at least 28 days for land management reasons such as heather burning or shooting. Prior notice of closure will normally have to be given to '*the appropriate authority*' but no formal consent will be required.

Provision will be made for temporary or permanent closures, for health and safety, defence, nature conservation and other '*sound land management reasons*'.

Legislation will specify that dogs should be on leads and other restrictions can be applied by local authorities as necessary.

The new rights of access will be accompanied by responsibilities on users and these will be spelt out in Codes of Practice to be drafted by CCW and the Countryside Agency.

There will be no general right of compensation. However, consideration is to be given to the rights of landowners to appeal against decisions, for example on mapping and to whether occupiers' liability should be reduced more generally to recreational users of open countryside.

More is to be done to publicise the new access opportunities and National and Local Access Forums will be developed to advise on the implementation and management of the new rights access.

The Extent of Open Countryside in Wales

The Government has asked CCW and the Countryside Agency to define '*open countryside*' synonymous with '*mountain, moor, heath down and common land*'. It has been estimated that these areas cover some 1,240,000 hectares, or 8% of the land area of England and Wales. The proportion of '*open countryside*' in Wales has been estimated at 40% (*c.* 800,000 hectares) of the land area of the Principality.

We have been asked to start work at once on the important and substantial task of preparing maps to show where the new rights of access will apply. In order that the new public access opportunity should be defined and mapped as objectively as possible, we have recommended that our maps of open countryside should be based on Phase 1 and Upland Surveys supplemented with digitised details of common land (**Figures 1 & 2**). We propose that the map of open country be published at 1:25,000 scale and be made available to the Ordnance Survey and others for wider dissemination. Work has been undertaken to pilot map '*open country*' in four areas of Wales. This exercise involved extensive consultation with landowners and user groups. The findings of this research will help us conclude our advice to Government in October this year.

It was the Government's wish that the proposed right of public access to open country should not extend to agricultural land other than that used for extensive grazing. CCW concurred with this and recommended to

Government that the new access should also exclude '*ffridd*' land in Wales. This land is typically grazed extensively but is also used for more intensive farming operations, such as shearing, marking and feeding. This view was supported by a wide range of landowning interests together with local and national park authorities in Wales who expressed concern about the potential disruption to farming practices if unfettered public access was permitted to '*ffridd*' land.

Existing Access to Open Countryside in Wales

When issuing its consultation paper the Government invited views on the efficacy of statutory versus voluntary arrangements for delivering its manifesto commitment to give '*greater freedom for people to explore our open countryside*'. It asked that the two options be tested against six criteria, namely:

- the extent of land secured for access;
- the quality of the access secured;
- how permanent it was;
- how clear and certain access opportunity is in the minds of the public;
- the cost-effectiveness of voluntary and statutory approaches to providing access; and
- monitoring and enforcement arrangements.

CCW concluded that on all six counts statutory arrangements were superior to voluntary, and particularly so in respect of securing permanency of access and the clarity and certainty of access in the minds of the public. **Figure 3** shows the geographical distribution of current access opportunities. The situation can be summarised as follows:

- Up to 40% of Wales could be described as 'open countryside' (ie mountain, moor, heath,down and common land),
- *De facto* access takes place – and is in the main tolerated – over most open country,
- Less than 5% of this land offers statutory (permanent public rights of access),
- Voluntary access arrangements apply over approximately 10% of 'open country', and
- Public awareness of opportunities for access to these areas is generally poor.

It is worth noting that there has long been a presumption in favour of access to open country in Scotland and Wales. It was in defence of long standing traditions of access that the earliest attempts to secure legal recognition of rights of access to such land occurred in the two countries. The Access to Mountains (Scotland) Bill, 1884 was followed four years later by the Mountains, Rivers and Pathways (Wales) Bill, presented to Parliament by Tom Ellis, MP for the Parliamentary constituency of Meirioneth. The Bill, which was unsuccessful, proposed that:

'the public shall have the free right to enter upon, and have access to, mountain land, moorland and wasteland, and to have access to walk along the bed of any river, stream, or lake, to ride in any boat, coracle or canoe upon any river or lake, for the purpose of recreation, winberry gathering, sketching or antiquarian research.'

Ironically, the farmers and landowners in Meirionnydd – Tom Ellis' former constituency – today are among the most vehemently opposed to the Government's proposal with Elfyn Llwyd, the present MP for Meirionnydd-Nant Conwy being reported as describing it as 'a right to traipse'.

Nature Conservation Interest and Constraints on Access to Open Countryside

Mountains, moor, heath, down and common land contain extensive areas of conservation interest in Wales. There are 965 SSSI in Wales, 800 of which are biological. Of these, 80 (10%), are to be found in the uplands of Wales (**Figure 4**). They include the most extensive sites such as Berwyn and Elennydd and incorporate some large commons. Common land – which comprises 9% of Wales – accounts for 30% of the total area of SSSI. 65,800 hectares or approximately one-third of the area of common land in Wales is designated SSSI.

CCW has a duty to keep the conservation status of its SSSI under constant review. In the past 50 years recreational activity has had relatively little adverse impact on upland SSSI compared to the effects of afforestation, agricultural improvement and over-grazing.

The relatively favourable conservation status of the high proportion of commons in Wales today when compared to other upland areas is due to the fact that it has proved difficult to secure the support of all commoners to undertake agricultural improvements and to receive the necessary express consent from the Secretary of State to instigate land use changes such as fencing. The characteristically open character of commons has long made them particularly favoured venues for public access and enjoyment of the countryside. Britain's first amenity society (the Commons Preservation Society), was established in 1865 to defend commons against encroachment and enclosure. The alliance between conservation and recreational interests goes back a long way. The establishment of CCW and SNH in the early 1990s is a testament to the efficacy of twinning these two land management purposes.

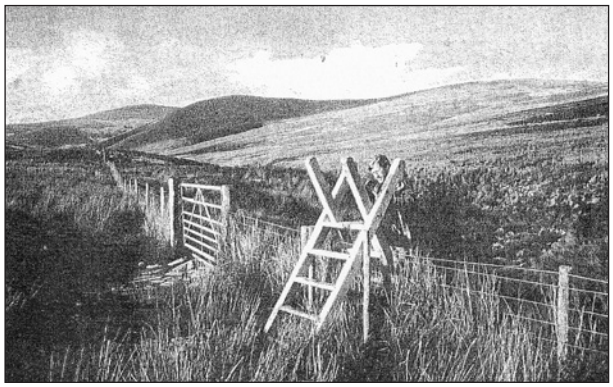
The prospect of allowing the public freedom to explore open country did not unduly worry the conservation NGOs who responded to the Government's consultation paper. None opposed the proposals outright and several including the RSPB and the Wildlife Trusts declared their qualified support for the Government's proposals. CCW reached a similar conclusion after a careful review of its past experience of managing its suite of National Nature Reserves – including the 10 located in 'open country' – 6 of which are proposed as candidate Special Areas of Conservation (SAC) and 2 which are Special Protection Areas (SPA) designated under European Directives.

CCW has welcomed the Government's announcement that it will be given powers – along with the Countryside Agency, and in national parks, the National Park Authorities – to close land or otherwise restrict access to open country either permanently or temporarily for conservation reasons. In its response to the Government's consultation paper the Council advocated that access to all but the most sensitive sites could probably be effectively managed without recourse to closures.

The Council envisages that the need to impose restrictions on access will be minimal eg moorlands with important populations of ground nesting birds and other fragile habitats. In many cases it is considered that temporary closure (eg during the bird-breeding season) may be sufficient, but for some sites permanent restrictions may be required.

Managing Public Access in the Berwyn

The Berwyn, one of the most attractive areas of moorland remaining in Wales, is a case in point.



Photograph 1: Y Berwyn – the most important upland for breeding birds in Wales.

The Berwyn is a long spine of upland country in North Wales running from Mallwyd on the Gwynedd – Powys border for over forty kilometres to just south of Llangollen in Denbighshire (**Figures 5a and 5b**). The topography is characterised by gently contoured ridges and spurs rising to 827 metres at Cadair Berwyn. It became the focus of conflict between conservationists, farmers and foresters in the early 1980s when the Nature Conservancy Council proposed an extension to the Moel Sych SSSI (10,000 acres) first designated in 1957 to over 53,000 acres (24,540 hectares) of the Berwyn. The controversy surrounding this episode prompted the formation of the Berwyn Society comprising representatives of the farming and landowning interests, the Forestry Commission and the Nature Conservancy Council with the express aims of '*"promoting" practical methods of providing for conservation whilst safeguarding the interests of Berwyn farmers and landowners*'. Public access was not referred to in the Society's terms of reference, though an understanding appears to have developed amongst its members that access interests were not compatible with nature conservation.

At that time neither the NCC or the Forestry Commission had a statutory remit for access and recreation and nor was there much use being made of the area by walkers. Public rights of way were few and far between and the Snowdonia National Park which had been established with access as one of its express purposes, was adjacent and convenient to visitors to North Wales.

The merger of the Nature Conservancy Council and the Countryside Commission to form CCW in 1991 brought together for the first time in Britain, responsibilities for the conservation of landscape and nature and public enjoyment and access to the countryside under the auspices of one public body. In the past 10 years CCW has witnessed a steadily growing demand for access on to the Berwyn. A Countryside Service was established by Clwyd County Council in 1989 to help manage this demand. Since 1994, the Countryside Service has been continued by Denbighshire Council with grant aid support from CCW. It is charged with looking at ways to improve access and resolving some of the problems associated with recreational, particularly motor cycle, trespass.

Photograph 2: Parts of the Berwyn have suffered considerable damage from illegal motor cycle activity.

The Government's proposals to grant public rights of access to open country are controversial with farmers on the Berwyn and elsewhere in Wales. Apart from their objection in principle to people being allowed to wander at will over their land they cite problems associated with damage to walls and fences, disturbance to stock caused particularly by dogs, and added occupiers' liability associated with the new rights. CCW is sympathetic to these concerns and committed to work with landowners to overcome them. We consider that they can be overcome in ways which will bring wider social, economic and environmental benefits in their wake.

Managing access to sensitive upland areas such as the Berwyn is a particular challenge for CCW which is to be uniquely charged both with defining and mapping the areas to which the new access is to apply and deciding whether access to this land should be closed or otherwise restricted when conservation interests are threatened. The designation of part of the Berwyn as a SPA and its status as a candidate SAC brings with it added responsibilities.

CCW is pleased that the Government intends to give us powers to close or otherwise restrict access where necessary. We are expected to prepare Codes of Practice for land managers, users, and local authorities which will set out rights and responsibilities. The Government recognises the additional funding implications that its proposals entail. Additional resources will be needed for mapping, closure arrangements and other restrictions, servicing of access forums, the provision of information, signs and stiles, and, in places, ranger services.

The Government has declared that it wishes to see the new rights of access in place within the lifetime of this Parliament (*ie* before Spring 2001).

As the Government's statutory advisors on access conservation and open air enjoyment of the countryside we are uniquely placed in Wales to reconcile conservation and access interests. This job is not going to be easy. We have already been criticised for our attitude to access to the Berwyn by blocking a proposal by The Rambler's Association where they claim a public right of way across the Berwyn based on more than 20 years continuous use. We are concerned about an unfettered right to roam in the Berwyn in particular, because of its outstanding conservation interest but we are not against access to the Berwyn *per se*. We are investing resources in improving opportunities for people to gain access to key viewing points and making that access easier for many more people than before by installing board-walks and interpretation facilities along popular routes.

Photograph 3: Board-walk to help facilitate and manage public access to the Berwyn.

We are also investing heavily in monitoring recreational use and increasing efforts to stop unauthorised recreational uses such as motorbike scrambling and paragliding through the appointment of wardens and gamekeepers.

Conclusion

We believe that the Government's proposals will help enhance rather than prejudice conservation interest by giving us express responsibilities to control access where necessary, confirm rights and responsibilities associated with the new opportunities and dedicate resources to the management of the new opportunities.

If these resources are forthcoming we will endeavour to work closely with the Berwyn Society, to better integrate and enhance access and conservation interests in ways which in turn will also bring social and economic benefits to the local community – that must be our overall aim.

References

CCW (1998). 'Access to the open countryside in England and Wales – the Countryside Council for Wales' response to the Government's consultation paper. Paper to the CCW, July 1998.

DETR (1999a). 'Access to the countryside in England and Wales – The Government's Framework for Action'. March 1999.

DETR (1999b). Access to the open countryside in England and Wales – Analysis of responses to the consultation paper. February 1999.

DETR/ Welsh Office (1998). 'Access to the Open Countryside in England and Wales – A Consultation paper'. February 1998

The Countryside & Rights of Way Act 2000 received Royal Assent on 30 November 2000. Part 1 introduces a new right of access for open-air recreation to mountain, moor, heath, down (collectively described as open country) and registered common land in England and Wales. There will be restrictions on the new right, including restrictions on dogs and provisions for landowners to exclude or restrict access

for any reason for up to 28 days a year without seeking permission. There is also provision for further restrictions on access for reasons of land management, conservation, fire prevention and to avoid danger to the public.

CCW has begun work to help implement the new right including confirming a methodology for mapping access land. By March 2001 the Council will have completed the digital mapping of registered common land and the Phase 1 survey data from which the access maps will be prepared. CCW has also helped establish Local Access Forums in several parts of Wales in readiness for the publication of access maps later this year. Arrangements for the detailed implementation of the new access rights will set out in Regulations to be issued by the National Assembly for Wales. Current estimates suggest that the public will be able to exercise the new right throughout Wales by early in 2005 and that up to 450,000 hectares of land in the Principality will be affected.

Figure 1 Extent of "open countryside" in Wales.

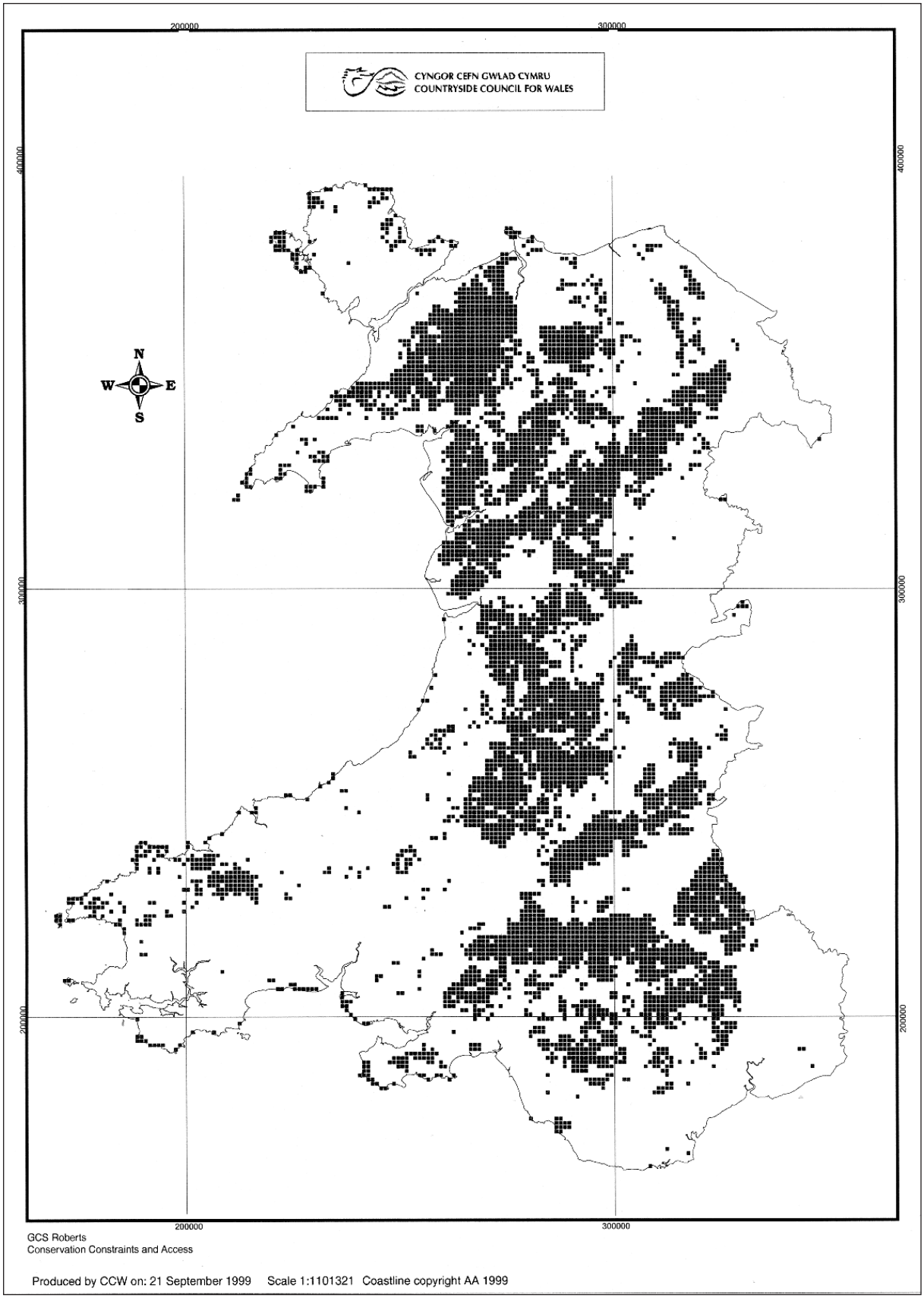


Figure 2 Common Land.

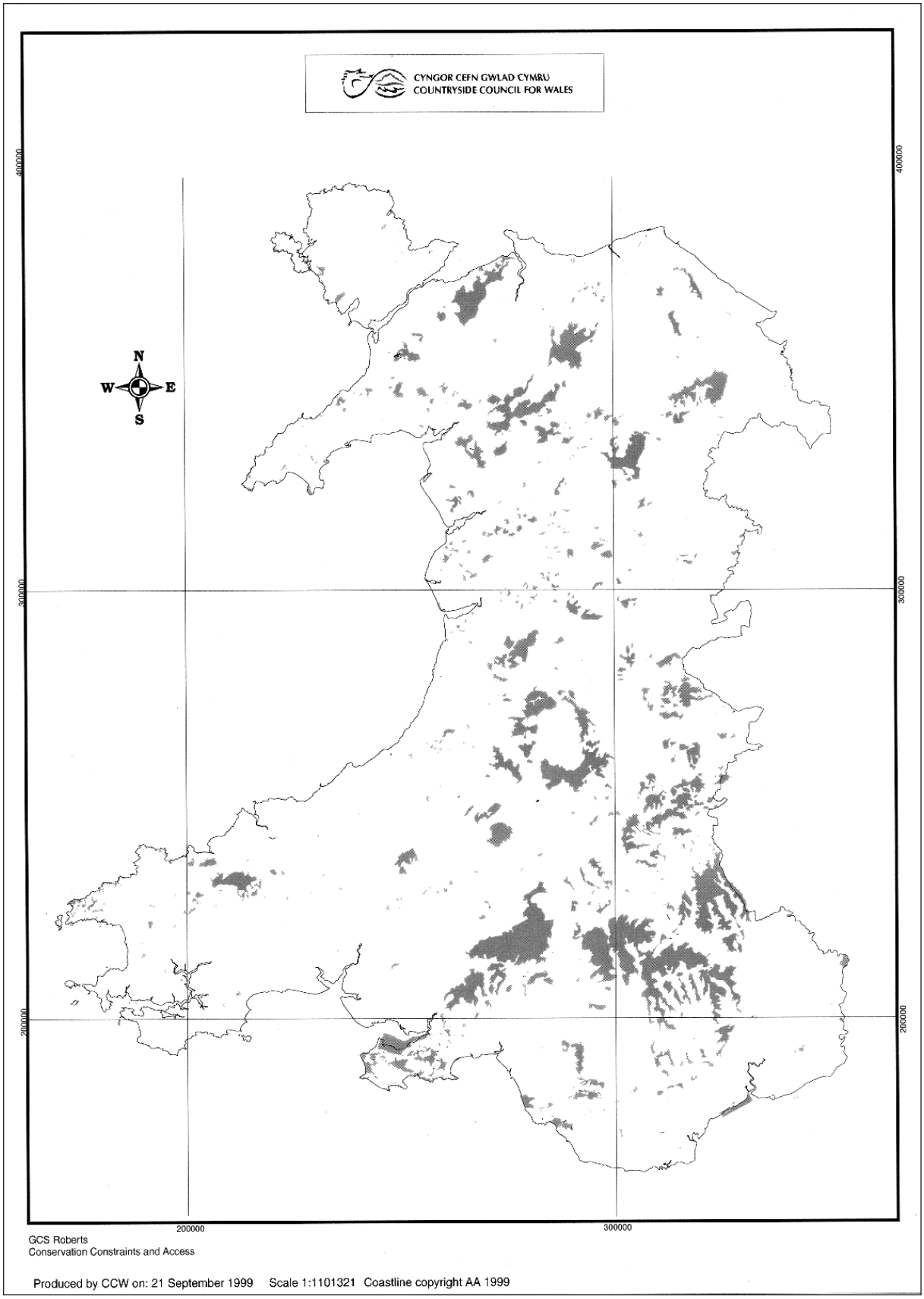


Figure 3 Extent of "open access" in Wales.

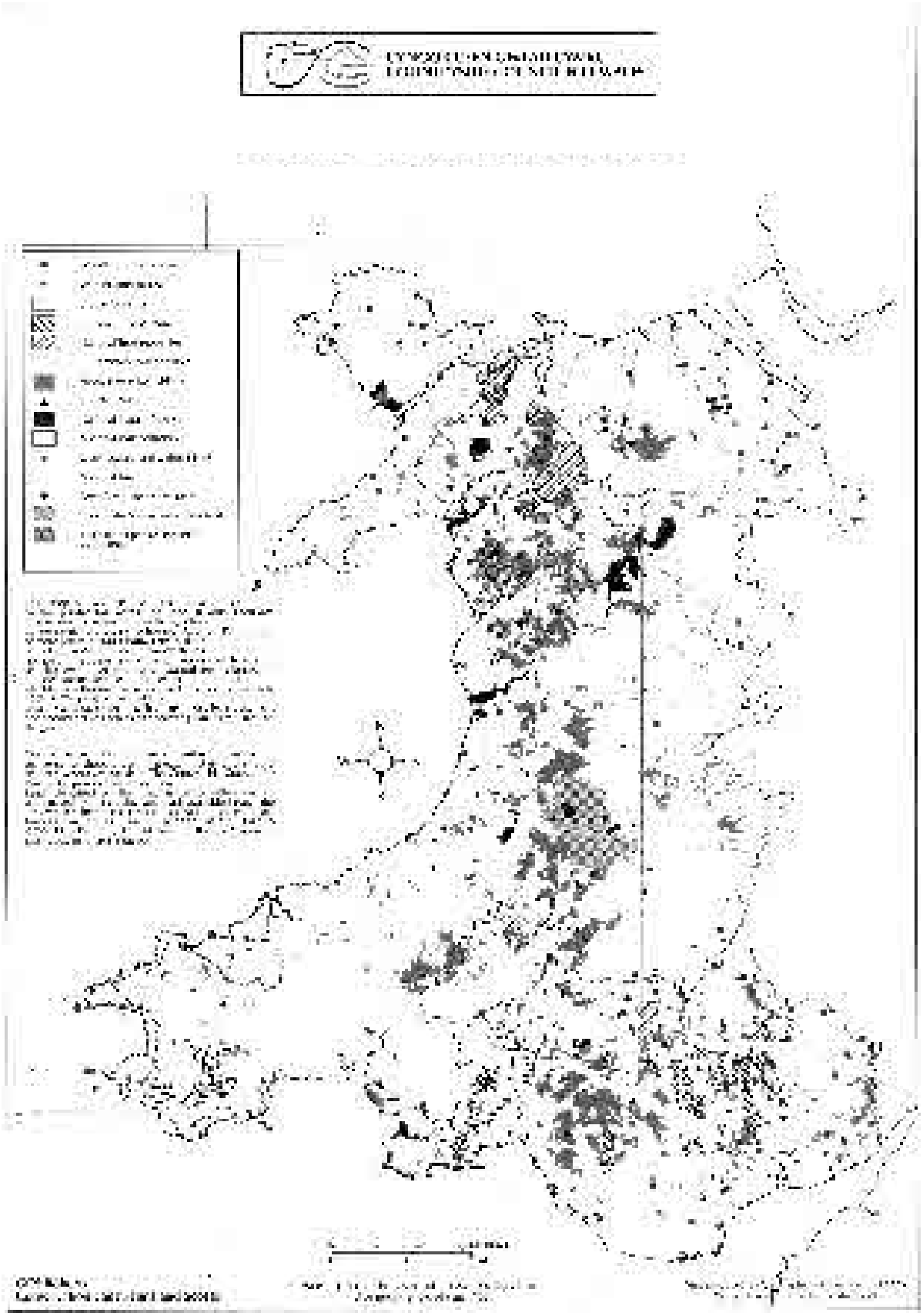


Figure 4 Nature conservation interest in Wales.

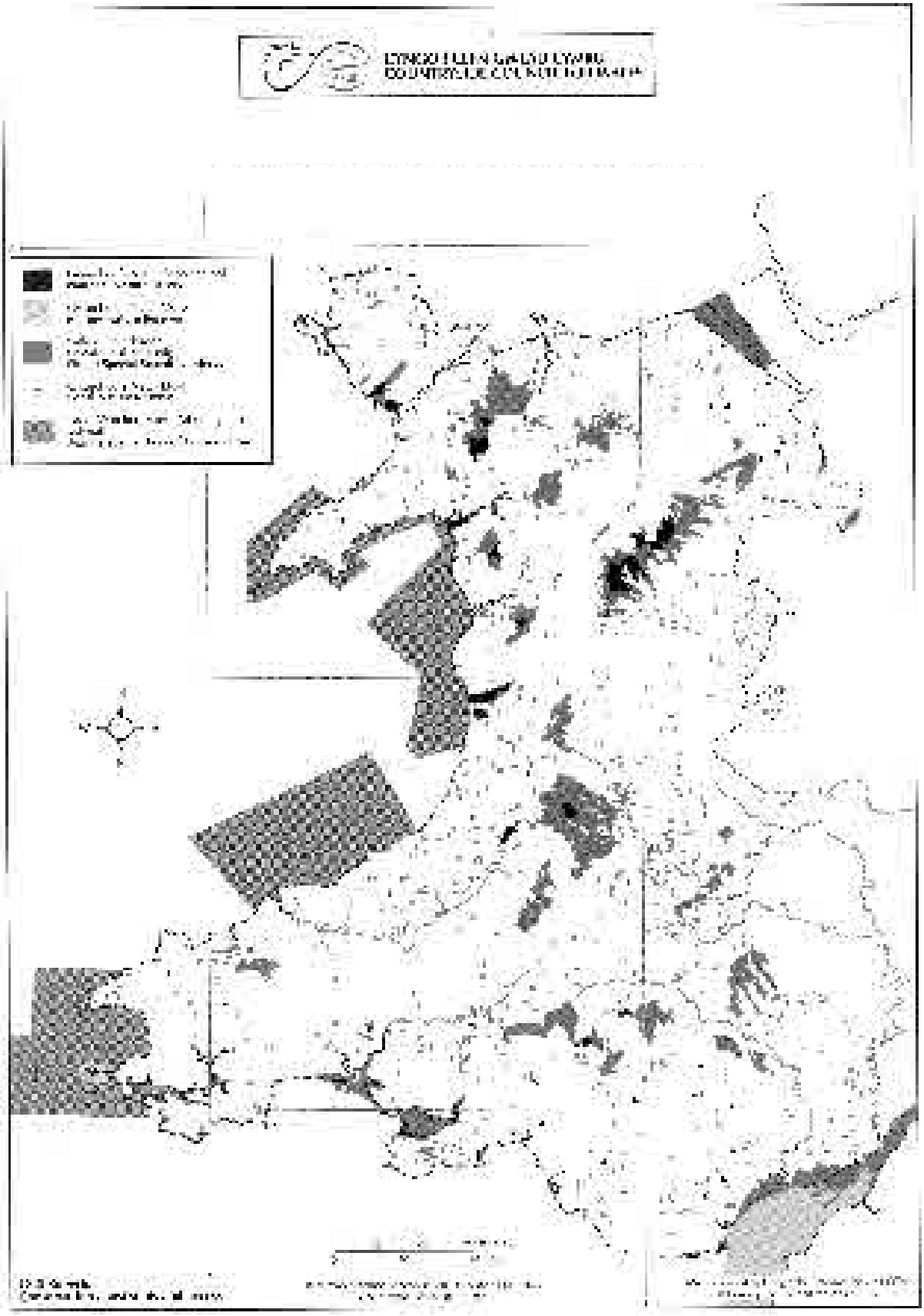


Figure 5 (a) Location of the Berwyn.

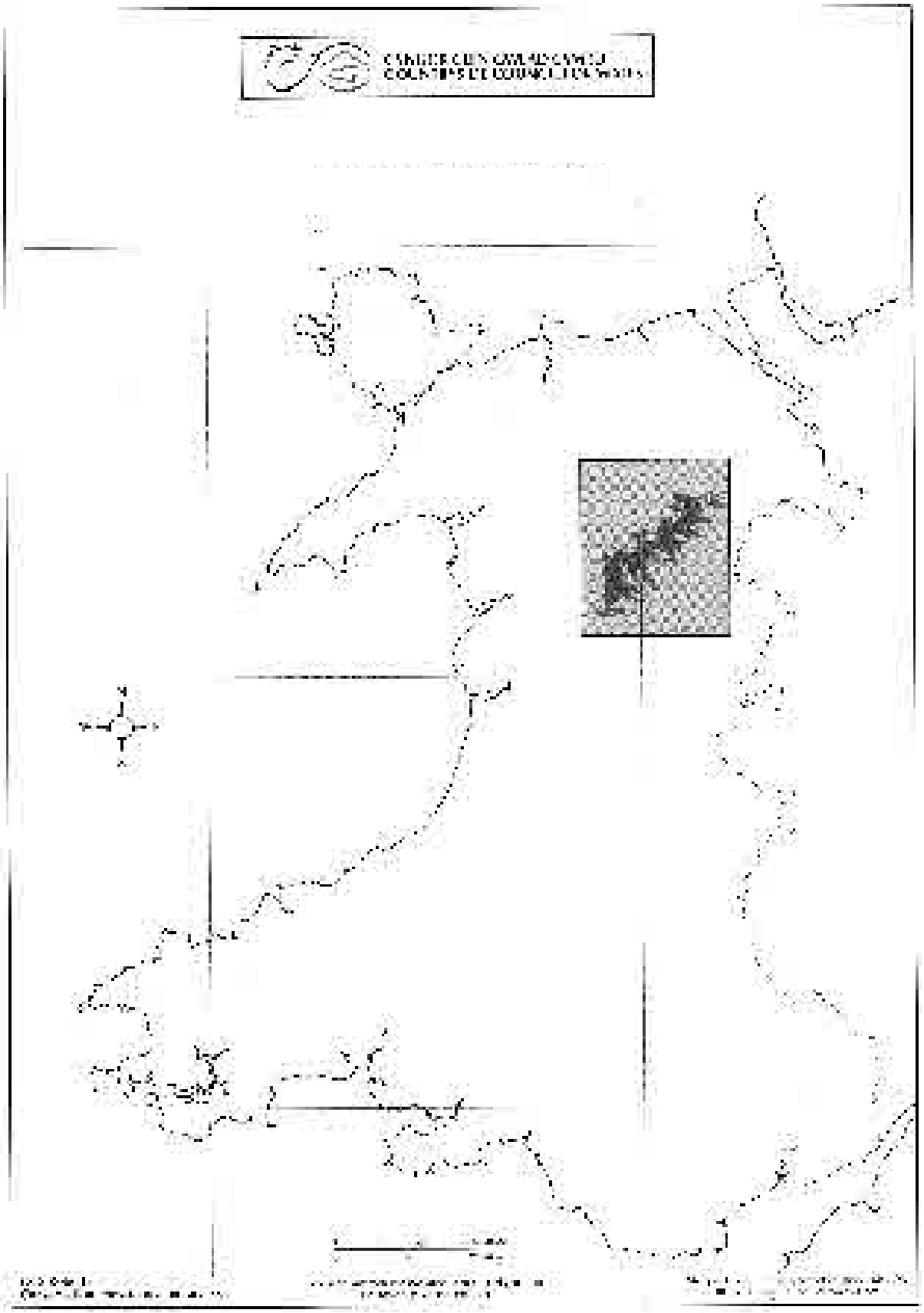
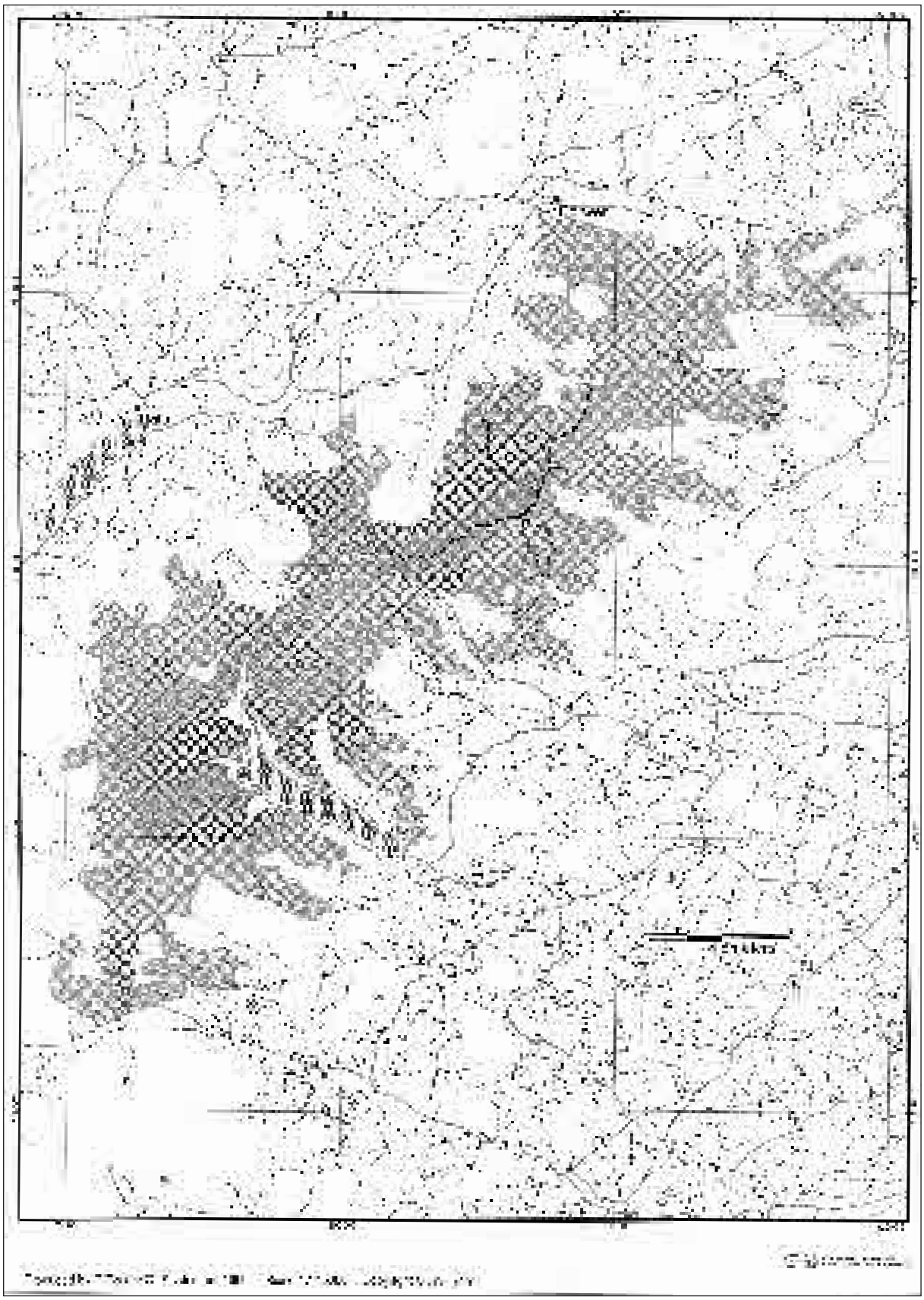


Figure 5 (b) Conservation interest and access in the Berwyn.



The Norwegian Experience

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Introduction

Firstly, I want to make it clear that when I talk about Public Enjoyment of the Outdoors, I include hunting in this concept. This is probably an important difference from Scotland. I will explain it later on.

I am going to talk about how we in Norway integrate hunting activities and the more general recreational activities. I also intend to say, briefly, something about how we deal with the Multiple Use issues connected to farming and forestry.

When I use the word hunting, it is in the Norwegian way of using the word. In Norway hunting is a common concept for different ways of shooting animals; it can be with or without a dog, it can be shooting smaller game or deer species. It also includes your word "stalking". Shooting wild reindeer is a similar type of hunting to your deer stalking.

I will give you the cultural background of hunting and outdoor recreation in Norway, because that is necessary to understand how and why we have chosen our solutions.

Area Categories

Firstly, some figures to tell you what the scale is of the areas we are talking about:

- Cultivated land, less than 3%;
- Productive forest, about 18%;
- Areas above timber line, about 50%;
- Areas above 900 meters above sea level, about 20%.

These figures clearly indicate that most of the land in Norway is relevant to the issues we have been discussing here these past two days.

Outdoor Recreation

As many of you may know already, in Norway we have a general right of access on foot, on uncultivated land all the year round, when this is done considerately and with due care. There are, of course, some more detailed regulations of the rights, but for this purpose it is sufficient to keep to the general right of access. We call it the "Allemannsrett". Picking berries and mushrooms is also part of the Allemannsrett, with some exceptions.

The right of access is based on old rights of the commons. I think this right of the commons originally developed from the fact that every man, from time to time, had the need for free passage on another man's land, and therefore everybody benefited from it.

The right of access is strongly rooted in the population. The Non Government Organisations [NGOs] are important spokesmen in defending this right, but politically there have not been any serious discussions on reducing this right.

But of course there are, in Norway as in other countries, attempts and wishes to withdraw some of the rights. I will divide the threats into two categories:

1. The farmers/landowners;
2. The tourist industry.

1. The farmers' wish to withdraw these rights has become more focused recently with the increasing pressure to find supplementary income from their uncultivated land.

   Still, as a result, the farmers have not yet made serious attempts on attacking the Allemannsrett. But what we see is the building of rental summer houses, construction of roads and pressure from motorised traffic (which is prohibited) – all taking place on what we might call the "wild land". And this is against the national policy of keeping the wild land free from such encroachments and it is conflicting with outdoor recreational interests. I'll come back to this.

   The possibility of enjoying the outdoors in Norway through the Allemannsrett is an important attraction in itself. The landowners also realise that. If they rent out a summer house, they benefit from the fact that the lodger also has access to the neighbour's land. The average private property in Norway is not very big!

   There is also a connection between the goodwill the farmers get from a more and more urban population and the way they treat people on their land. Because agriculture is quite a subsidised sector, the landowners are getting increasingly aware of their "contract" with the national society. So, in my opinion, we should be able to sort out the possible conflicts with the farmers reasonably well. After all, we have a culture for reaching consensus. We cannot solve all conflicts by recourse to the law, but we have developed a mutual respect for different interests and find solutions when necessary.

2. Nowadays the tourist industry is the most serious threat to the wild land and the Allemannsrett. Here are two examples:

   - The Nordkapp Plateau (the northern-most point of Norway) has been bought by a private company, which has built quite a big tourist development, comprising a visitor centre, restaurant etc. – quite advanced for Norway. The company wants to make as much money from it as possible, and is now charging people for entrance to the plateau, when in former times they enjoyed free access. This is most probably illegal and not in accordance with the Outdoor Recreation Act. They may very well be able to charge for parking, for entrance to the centre, etc., but not for the enjoyment of nature. This is a touchy subject for the authorities, because it has to do with local jobs. The case is not finished yet;
   - The owner of an hotel wanted people to pay for the use of the ski tracks he grooms. The resistance from the locals was so strong that he had to back down before it really became an official "case". The reason for the resistance was that the local people had always used the tracks, with or without grooming. They did not demand this grooming, even if they enjoyed it and benefited from it, and they definitely would not accept the hotel owner privatising the land and commercialising its use in this way.

These kinds of threats are the ones most recognised today. There is a discussion on these threats going on in the papers just now, because the Ministry of Environment is preparing a report to the Storting (the Parliament) on outdoor recreation issues. I believe we will have to stand up again for the Allemannsrett in the coming years.

Hunting and Outdoor Recreation

The cultural context:

It is essential for the understanding of this presentation to emphasise that both fishing and hunting in Norway are regarded as part of the Outdoor Recreational interests. Still, most of the rural population feels that enjoying the outdoors has to include some utilitarian value. I think we can describe the Norwegians as a people of hunters and collectors. They bring a fishing rod, a gun or a berry pail when walking in the forests or on the mountains. Actually it isn't really important if they take anything home. They are just not comfortable with a "useless" stroll in the outdoors. But I think they enjoy the outdoors in just the same way as the more urban people do. In a cultural context this is important, because the modern way of enjoying the outdoors in Norway has its origin in the harvesting culture. For Norwegians hunting, or even harvesting, is a more natural concept than Field Sports.

First a few words about "**Who owns Norway**". This is important in order to understand why hunting plays such an important role in the Outdoor Recreation concept. This is also a question of access to the public:

- The State owns about 25% – most of it in the northern part of the country;
- We have two kinds of Common land, the State Common Land and the Local Common Land;
- The Norwegian "Forestry Commission" is the manager of about ⅓ of the land surface;
- Some municipalities are also important landowners;
- On the local common land, the locals might have certain rights, for instance to hunt.

I'll come back to the importance of the state owned land later on.

Wildlife and Hunting

Wildlife is, in principle, in common ownership, but the right to hunt is connected to the ownership of the land. We generally differentiate between hunting of the deer species and hunting of the smaller game species.

Traditionally, shooting of the deer species is done by the landowners themselves. It is often a social event as well. During the first two weeks of the hunting season you might find it difficult to get in touch with the adult, male part of the rural population, because they are off hunting. This is most typical for moose hunting and reindeer stalking. In addition, the landowners can rent out hunting rights to those who want to pay. This is done especially for reindeer, but also for moose hunting. The public do not have easy access to this part of the hunting.

Hunting of the smaller game species, like hare, ptarmigan, willow grouse, capercaillie, black grouse etc., is much more an activity for the public, especially ptarmigan and willow grouse.

There are regional differences in the possibilities for the public to get hunting access to the smaller game. In many parts of the country the State-owned land or the State Common Land is important for the public, because the State does not practise discrimination against non-locals when distributing licences, and the price is reasonable. This is an important part of the discussion, when from time to time, there are proposals to privatise the State owned land. The public are afraid of loosing the opportunity to hunt for a price they are able to pay.

I quote one example from Buskerud County:

A mountain municipality owns some valuable land with lakes for fishing and terrain for hunting small game. In this district there are lots of large, private properties where the prices are so high that in practice local people do not have access to hunting or fishing. The municipality's land is rented to the local hunting and fishing NGO, which for years has done a very good job of managing the land, and the locals are able to buy licences for hunting and fishing at a reasonable price.

A local politician raised the principle in a discussion on selling the municipality land, because he could not understand why the municipality should "subsidise" the locals when the market was obviously willing to pay more for the rights to hunt. This caused a huge local debate. For weeks the local newspaper was full of protests against the proposal. Finally the local council decided to keep the property in public ownership. The mayor, who belongs to the same political party as the proposer and who is a very brave man, was very unhappy about the proposal. He was very content to have found a good solution before the local elections two weeks ago.

I think they realised that the opportunity to fish and hunt is essential to the locals. Actually the opportunity to hunt, fish and ramble is one of the best comparative advantages the rural communities have to recruit workers, especially highly educated people.

This story says a lot about how deeply rooted the importance of access to hunting and fishing is amongst the Norwegians. It also shows that, when really threatened, access to hunting and fishing as well as access to land is an important part of the discussion on the distribution of welfare goods in Norway. And to many people, especially men, this is the very reason why they choose to live in the rural communities.

In my opinion, one of the benefits from all this commitment to hunting, is that a rather large part of the population is concerned about nature management, and they are also reasonably skilled in the management issues.

Principles for Integrating Hunting and Outdoor Recreation

This presentation attempts to give a perspective on conflicting interests. Are hunting and rambling conflicting interests? To what degree is the acceptance of hunting a rural phenomenon? It is partly, but I would say that most Norwegians still have relatives or friends who hunt, and as such they are in some way or other familiar with hunting activities.

The Norwegian population is still more or less rural, but at the turn of this century we now see changes towards a more genuine urban population, and we still do not know what the implications are on the aspects I am discussing now. But today, we still find a high degree of acceptance of hunting in the population. Hunting and fishing are really still regarded as part of the outdoor recreation activities. Some recent research on NGOs in Norway showed that, Greenpeace for instance, has never succeeded in getting a real platform in Norway, and the scientists explained that this was due to the generally high level of acceptance of harvesting the natural resources. Typically, there is no strong opposition against catching the smaller whales or seals in Norway, even if the rest of the world is against it!

Hunting, together with the most frequent outdoor recreational activity like rambling can be regarded as concurring activities. But we follow the principle that these activities are supposed to be integrated; we want

the concept of multiple-use to become accepted. That means we do not impose any restrictions on walking activities, berry-picking, fishing, etc., in order to facilitate hunting. The hunters or landowners are not allowed to obstruct people's freedom to roam.

To obtain this multiple-use, all new hunters have to pass an examination focusing on different issues, including the acceptance of other peoples' right to be on the land.

In very special cases we have hunting restrictions because of other Outdoor Recreation. In Oslo and the surrounding Municipalities hunting is not allowed on Saturdays and Sundays, because it creates conflicts with all the people going for walks. The autumn season is just great for walks and berry/mushroom-picking in the woodlands. With such large numbers of people in the woodlands it just would not be possible to carry out hunting safely and I don't think the hunting would be very successful either. In other municipalities the roe deer and moose hunt are carried out on alternate days – in that way giving the other part of the population a chance to pick berries.

The possibility to go for walks in the woodlands is regarded as such an important part of the welfare for the citizens of the capital that they have been given priority over the relatively small number of people who would have been hunting there.

Then How Does this Work in Practice?

I do not want to give you a picture of total harmony. We have discussions, we have conflicting interests, but I do not think we have any really heavy conflicts.

Sometimes the hunters are quite good at making people feel they are not welcome on the land. I have experienced this myself. We do not have any figures on how many people actually stay away from the woodlands and mountain areas because they are afraid of the hunting going on but it is probably quite a lot. It seems, for instance, that the wives of the moose hunters stay at home during the hunting period, even if they quite often are keen berry-pickers. But these conflicting interests have never been focused upon very much. Perhaps people find alternatives for their recreational activities. After all, we have a lot of space in Norway.

I think the closest we come to a real conflict is when reindeer hunting takes place in some mountain areas.

In one such area, the Hardangervidda, we face a huge challenge in shooting enough reindeer. The available food resources over the winter is a critical factor. The population easily increases beyond the carrying capacity, mostly because their natural enemies, the big carnivores, are not present anymore. In addition it is difficult to establish an effective management scheme. In this area, part of which is a National Park, the hunters are allowed to use more motorised transport than the legal framework actually approves of, because we have to facilitate the hunting. The distances are vast: it is far to walk in, and far to carry out the meat. The pattern of hunting has also changed radically over the last decades. In the earlier days (not more than 10-20 years ago) people tended to stay in the mountains for weeks during the hunting season. Now their stay is limited to week-ends, which means a greater need of transport in and out of the mountain zones. Of course, this motorised transport is a nuisance for the people who have sought the mountains because they wish peace and quiet or have a desire to experience the wild land. It also damages a vulnerable mountain ecosystem. Even so, we have chosen to allow it because of the need for the proper management of the

reindeer population; not because of the interests of the hunters alone. However, to compensate for the damage and the nuisance, we demand strict co-ordination of transport, in order to minimise the conflicts. I have to add that this solution is the result of negotiations with the local communities in order to meet their need for a "modern" way of carrying out their hunting traditions.

In a couple of mountain areas, the landowners have accepted the building of self-service cottages by the Norwegian Mountain Touring Association on condition that they are closed during the period of reindeer hunting. In this way the landowners effectively keep most of the ramblers out of the mountains during the hunting season.

There is also a possibility, in accordance with the Outdoor Recreation Act, to regulate camping which may inconvenience reindeer hunting. This has been done by the Directorate for Nature Management in 3 municipalities on the western part of the Hardangervidda. But mostly we are very careful not to put limitations on the Allemannsrett in Norway, and the right of access cannot be touched, even by reindeer hunting.

Restrictions on the Allemannsrett Out of Consideration for the Wildlife

But to protect the wildlife we can regulate people's access both in accordance with the Wildlife Act and the Nature Conservation Act. Then, regulation is implemented in order to protect wildlife and not the interests of the hunters. These kinds of regulations can, for instance, comprise: prohibited access during the breeding season for birds, prohibited access during the calving period for reindeer, or an intermediate alteration of skiing-routes when they are in conflict with the reindeers' temporary use of an area. I am sure you have these kinds of regulations in Scotland as well. My opinion is that in general, we have a high level of understanding of these kinds of regulations in Norway.

The Multiple Use Principle in the Forestry and Farming Sector

As a result of the Brundtland Commission in 1987, we have established the principle that every sector in society is responsible for the Environmental Impacts and Benefits they create. Thus, both the Forestry and Agriculture sectors are, through legislation, obliged to deliver environmental benefits. This means these sectors have to secure the biodiversity, the cultural heritage, the outdoor recreation and landscape values within their ordinary land use. This is part of the basic conditions for the sectors. As I said at the beginning, The Multiple Use principle is carried through.

Forestry

We have two ongoing debates on the Multiple Use principle in the forestry sector. One is regarding the conflicts between forestry and outdoor recreation, mainly focused on the building of roads (which has often affected old footpaths) and the consequences of felling large areas, affecting the natural scenery. The other debate is about how the sector is reaching the objective of securing biodiversity in the forests.

As far as the first discussion is concerned, I think we have seen some improvements in the forestry sector in recent years, at least as far as felling practice is concerned. However, even if the Environmental Authorities give their advice to applications for road building, that advice is seldom followed. In some ways we have given up the fight, because at the moment there is no political will to change the practice.

Overall we have a long tradition of a voluntary approach to these issues in Norway. "Freedom subject to the consequences of the law" is a basic statement for the regulation of the forestry sector. I won't hide the fact that there are intense discussions going on, both politically and professionally, about how effective this approach is considered to be. Even if the forested areas are increasing, and the cubic volume of timber produced is increasing, it does not mean that the biodiversity is in good condition. The biotopes connected to the really old forests are especially threatened, and it is difficult to get the landowners to accept that some areas should just be kept untouched.

In Norway the outdoor recreation groups are also concerned about biodiversity, as biodiversity is related to rich experiences in the outdoors. I have been working with these issues for more than 20 years, and I still feel there are many nice "non-committing" words hanging around. The most interesting process going on now is within a forum with the landowners and the NGOs on Nature Conservation. They have agreed on a Statement of Environmental Standards for Forestry. But again, part of the problem is the totally voluntary approach as a principle. The Government put a motion on by-laws on environmental adaptation in the forestry sector before the Storting this year, but the majority of parliamentarians wanted to continue the voluntary approach.

Farming

Agriculture also has a sectorial responsibility for environmental impacts **and** benefits. In order to meet the problem of over-production, and to meet the requirement from the World Trade Organisation [WTO], we have started the process of changing the subsidies towards non-productivity criteria. We call it a "cultural landscape subsidy". This means we have had the opportunity to insist on some environmental conditions for the subsidies.

Two examples are:

1. The farmers can get small amounts of money for facilitating peoples' access to the cultural landscape by opening up footpaths through the landscape. As I have said before, we think that by getting access to the cultural landscape, people also become fond of it and an alliance is developed;

2. To receive the standard subsidy, the farmers are not allowed to remove important biotopes like wetlands or small parts of woodland, or stonehedges for example. These elements are important for biodiversity, but they are important for the scenery as well.

Conclusion

I think that on Multiple Use in the cultural landscape, we can simplify the challenges to two aspects:

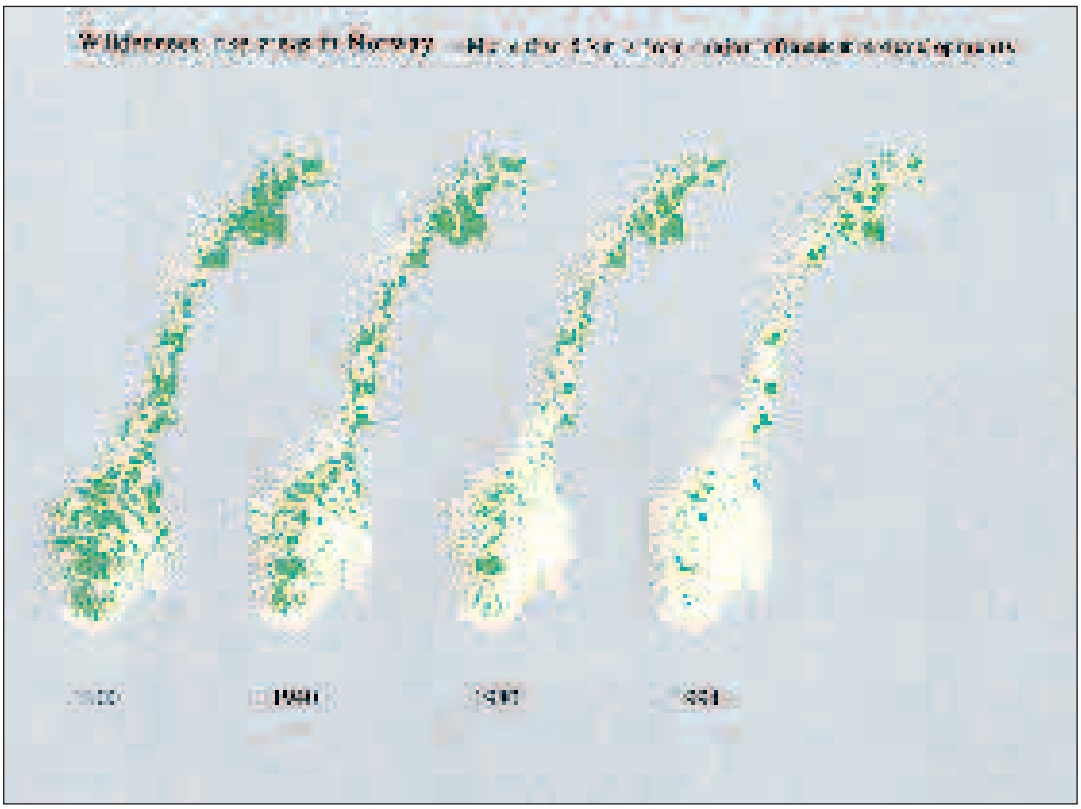
1. We need to open up the landscape for the public, but in a way which does not create troubles for the landowners;

2. What is good for the biodiversity is good for the scenery as well.

Maps on Wild Land

Figure 1 The "wild land" in Norway in 1994. The reduction of the wild land is mainly due to the forestry sector.

Figure 2 The reduction of wild land from 1900 to 1994, mainly due to: Watercourse regulations, Electricity transmission lines, Tractor tracks.



Integrated Upland Management for Wildlife, Field Sports, Agriculture and Public Enjoyment

Summary Day 2

Professor Jeff Maxwell
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In summarising the day's proceedings I do not intend to repeat what everybody else has already said but rather to highlight what has made the day a successful one. I will try to provide a framework upon which we can continue to develop our thinking and which may lead ultimately to a programme of action.

When we attend conferences we all tend to come with our own personal agendas and expectations. In assessing the success of a conference I think that there are three rather crucial questions to be asked. Have the presentations encouraged us to think about change? Have they encouraged us to think differently? Have they given us a clearer basis on which to formulate future decisions? If they have done any one or all of these things, then I believe the conference has succeeded. I have to say unequivocally that as far as I am concerned the conference has met all of these criteria and I thank The Heather Trust, SNH, Bidwells and all the speakers for making it so successful

We have had some quite excellent presentations. They have been informative, creative, constructive and visionary. They have provided us with ideas as to how we might do things better. They have provided us with wider perspectives from other parts of the world.

I hope that none of the audience came seeking total solutions. That is not what a conference like this is about. It is about providing insight into how solutions might be achieved. I believe the speakers today have risen to that challenge admirably. The aim of the conference has been about the **integration** of upland management for wildlife, field sports, agriculture and public enjoyment. But what are the big questions or drivers of change that are going to influence our ability to integrate these activities? Let me try and identify what I consider to be the six big issues that have been identified for us today.

1. **Our ability to influence CAP reform and the development of Agenda 2000** in directing a greater proportion of the financial support that is going into the hills and uplands towards the environment and social objectives.

2. **The need to take much more account of the public perception of what the countryside is expected to deliver and what the public are prepared to support as taxpayers in developing the rural economy.** There is a climate for change and there are expectations. These cannot be ignored or dismissed as being irrelevant or not in the self-perceived interests of country people.

3. **There is an urgent need to identify and achieve practical, more pervasive 'win-win' solutions** that provide viable agricultural and forestry activity along with high quality wildlife, sporting, recreational and natural heritage management. This will require a radical change in the entrenched 'mind sets' of sectoral interests. It will require imagination, co-operation, successful partnerships, a mutual understanding of objectives, an appropriate policy framework with respect to the CAP, Agenda 2000, Land Reform legislation and access. It will require time, tolerance and tact.

4. **There is a need to have a clear appreciation and understanding of the value of non-market benefits as well as market benefits.** The future of our countryside and the rural economy will depend on weighting the non-financial value of biodiversity, landscape, clean water and clean air appropriately and recognising their central importance in determining our quality of life, as well as realising the tourist and sporting potential of our uplands.

5. **The need to improve and simplify the process of government and the implementation of policy.** Since the Second World War and then following our joining of the European Union we have progressively added layer upon layer of bureaucracy in implementing agricultural and environmental policies and in providing financial support. That the latter is needed and that it should not be distributed without appropriate accountability is not in doubt nor is it being questioned, but a greater integration of policy also has the real potential to lead to administrative simplification.

6. **Finally, there will be an explicit need to have a clear understanding about the trade-offs between achieving economic, social and environmental objectives.** These should not be fudged. They operate at a national, regional, district and estate/farm level and they are fundamental in determining what is achievable and sustainable.

I believe that the concept of sustainable development provides the framework within which the integration of upland management for wildlife, field sports and public enjoyment can be achieved. At the European and national level it depends upon having a successful macro-economic performance from which disposable national income can be directed towards the support of our less favoured areas and the conservation and protection of the environment. At the regional and district level it requires that a balance needs to be struck between supporting rural industries and other economic developments and opportunities, in relation to also achieving environmental and social objectives. At the level of the farm and estate, similar considerations have to be considered within the context of the policy frameworks set out at the national and regional level and the need to achieve financial viability. But the fundamental issue at the regional, district and local levels is to have a legislative framework that reflects the concept of sustainable development and with which people have empathy and belief.

This framework must provide guiding principles that are realistic, practical and feasible. It must be imaginative, innovative and have a long-term strategic focus with well-defined short and medium term objectives and schemes that are simple to administer and that deliver what is wanted. It requires to be unequivocal about accountability, responsibilities and rights; the responsibilities of the public as users of the land, as well as those who manage and make their living from it. It requires also to secure fairness in relation to the rights and investments of the different stakeholders, which include the public as taxpayers. It must be a framework that is responsive and adaptive to the changing aspirations and goal-seeking behaviour of all sectors of society.

Two final points need to be made. First let us recognise that, over the last 10-20 years we have done much to create the possibility, as Stuart Housden said, of 'joined-up-thinking'. Let us not, as he said, destroy the possibility of that progressing further by 'arguing at the margins' and taking up entrenched positions that take us nowhere. Secondly, let us also recognise that the Scottish Parliament does provide the opportunity and possibility of bringing about constructive change and integrating the activities of the rural economy and bringing to the countryside of Scotland a new vitality and a sustainable future. Let us grasp this opportunity and possibility.