

DEVELOPING A POLICY FRAMEWORK FOR MANAGING DIFFUSE DEER IMPACTS

Landwise Scotland for the Deer Commission for Scotland

Project RP35c

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1.0 Executive Summary

This study was commissioned by the Deer Commission for Scotland (DCS) in December 2004 amidst growing disquiet over the perceived increase in numbers and the spreading range of deer (chiefly red deer (*Cervus elaphus*)) in Scotland and over the adequacy or otherwise of policies and measures such as collaborative deer management to control these trends. DCS needed analysis of how competing public and private interests could be assessed and reconciled. In particular, the work was to focus on “diffuse impacts” of deer and to aim towards the “sustainable management of deer”. The aim of this report is not to recommend specific policies or measures. What has been emphasized to us is that what is required is a “**Think Piece**” to stimulate discussion about the situation and a “**language to aid discussion of the subject.**”

On the ground, the management of diffuse impacts of deer cannot be separated from the management of other impacts by deer and hence what follows applies broadly to deer management. Looking broadly across this report, the following general recommendations can be made:-

- 1) The expansion of red deer range is likely to produce increasing conflicts.
- 2) Concern over the perceived expansion in numbers of deer and their range, especially red deer, and their impacts, has to consider not so much what the situation is now, but what it might be in ten to twenty years if effective action is not taken and, for example red deer colonise the lowlands, or continued with strong impacts on parts of their current range.
- 3) The importance of emergent land uses and ensuing environmental legislation show that sustainable management of deer must be defined broadly in a manner that take the public interest and public goods in land into account,
- 4) These phenomena and major political changes such as devolution indicate that there is limited time for voluntary solutions and that, for those involved in deer forests or where deer are the dominant large herbivore, the core task is the renegotiation of a more acceptable contract with society.
- 5) If, as some evidence suggests, moderate to low grazing intensities provide advantages to the natural heritage and some landscape parameters, then pursuit of such grazing levels would be important.
- 6) The likely impacts of more than moderate grazing levels on general biodiversity, soils, and hydrology show that the best indicators of sustainable deer management are the condition of the vegetation and of general biodiversity, and impacts on ecological processes, not deer numbers, which seem not very useful indicators, although they are an important indicators of cull targets.
- 7) In general, DCS should perceive their task, in areas where deer are the dominant large herbivore, not as one of regulating populations to achieve a balance of land uses, but one of human ecosystem management in which a human and a “natural” system are coupled and knowledge of both is important.
- 8) The impacts of climate change are as yet uncertain but DCS may well have to take greater account of certain aspects such as slope stability, soil erosion within the riparian zone with resultant damage to fisheries and freshwater ecology, and changes in land use patterns.

- 9) Looked at as an extension programme, the DCS's strategy correctly makes an attempt to improve a whole system where it is addressing areas like red deer control in the Highlands and Islands. However it needs to do social research to establish links between the stated problem and the solutions to ensure its measures will be effective.
- 10) Regarding the problem faced by the DCS as one of natural resource management, the DCS correctly is developing DMGs as platforms of stakeholders to address problems at the local level and other bodies to address them at the national level. There needs to be appropriate functions for the platforms at the national level and at the DMG level and they must have the full range of stakeholders represented on them if they are to be effective.
- 11) Such platforms have to learn their way to solutions, but there is evidence on the nature of the major constraints on this that such learning will require changes in values, basic beliefs etc by key stakeholders and will take time.
- 12) Successful platforms need skilful facilitation and the DCS needs to consider how this should be provided.
- 13) Because of the problem of complexity in ecosystem management, management of deer populations has to be adaptive, with scientific research providing guidance but seldom totally reliable prediction of the impacts of management interventions in the situation.

1.0 Introduction

1.1 *The reasons for this study*

This study was commissioned by the Deer Commission for Scotland (DCS) in December 2004 amidst growing disquiet over the perceived increase in numbers and the spreading range of deer (chiefly red deer (*Cervus elaphus*)) in Scotland and over the adequacy or otherwise of policies and measures such as collaborative deer management to control these trends. DCS needed analysis of how competing public and private interests could be assessed and reconciled. In particular, the work was to focus on “diffuse impacts” of deer and to aim towards the “sustainable management of deer”. As can be seen from the objectives (Box 1), the aim of this report is not to recommend specific policies or measures. What has been emphasized to us is that what is required is a “**Think Piece**” to stimulate discussion about the situation and a “**language to aid discussion of the subject.**”

Deer can have both negative and positive impacts on their environment. The red deer stag for example, is iconic of the Highlands of Scotland and as such plays a significant part in the area’s attraction as a tourist resort, while recreational hunting of deer in one form or another has been part of highland life for centuries. Nonetheless, this report inevitably focuses mainly on the resolution of the perceived negative impacts, as these are the main reasons the present discussion taking place. The Deer Commission for Scotland’s own Long Term Vision and Long Term Strategy after all, are almost entirely focused on dealing with major problem areas in deer management and the authors of this report must address these.

1.2 *General structure of the report*

The report first of all presents a situation analysis of environmental and political backdrop to the present and the implications for sustainable management of deer. It then reviews knowledge about the impacts of deer, and next briefly reviews some likely implications of climate change for deer management. Thereafter, it examines DCS’s strategy and approach to deer management in the light of subject fields listed in Section 1.3 and finally makes recommendations for DCS’s future approach to the sustainable management of deer.

Major conclusions are entered in italics

1.2 Objectives of the study (Box 1)

The objectives of the study are laid out in Box 1

BOX 1

Objectives for the Study

- 1) Clarify the different meanings of terms such as diffuse impacts.
- 2) Review the scope and reliability of current knowledge about the extent of such impacts and their effects.
- 3) Explore the diversity of perspectives on this situation among stakeholders, with due regard to the sensitivities involved. Stakeholders in this situation includes those regarded as the "source" of any impacts, those receiving them, either as benefits or disbenefits, and agencies and others with power or influence to deal with the situation, normally at the policy level.
- 4) Discuss and analyse the above in terms and concepts that aid the development of a language and conceptual framework that permits an effective discussion by the DCS during its evolution of policies and measures.
- 5) To point towards and, where quality of evidence permits, assess options for management of diffuse impacts that should be considered by the DCS but **not** to recommend specific policies or measures.
- 6) Place the above discussion clearly within the framework of government polices such as biodiversity planning, under the Nature Conservation (Scotland) Act 2004 and the Water Environment and Services (Scotland) Act 2003, the Strategic Environmental Assessment Directive and any policies arising from climate change.
- 7) Recommend any actions, as "next steps" for the DCS in developing its policies and measures.

1.3 Guiding considerations in writing this report

In writing this report, we are guided by the following considerations as listed below.

- 1) Since this assessment takes place within the government's commitment to Sustainable Development, these effects must take into account environmental, social, and economic impacts and the interaction between these.
- 2) The terms "Diffuse Impacts" and "Sustainable Management of Deer" are not clearly defined. We have therefore developed working definitions in general terms (Section 2), and explored their implications in the rest of the report.
- 3) In so doing, we are aware that, since deer move freely over land whether it is part of a protected designated area or not, it is not possible in practice to separate management of diffuse impacts as we have defined them, from management of impacts within designated areas or woodlands or, for that matter, agricultural interests.
- 4) Particular areas of deer impacts in Scotland and their possible solutions that have been studied in depth under previous research commissioned by the DCS. These are road accidents through collision with deer (1) and the operation of Deer Management Groups (DMGs) (2). Where appropriate, we make use of these but do not attempt to re-explore them to the extent of reanalysing and reframing their conclusions. We concentrate on the larger picture.
- 5) The report draws on what has been learned about management in a range of subject areas that related to the present deer management situation. These include:-
 - extension approaches in agriculture and rural development
 - complex problems of natural resource management
 - social learning as an approach to natural resource management
 - deer management as an example of human ecosystem management.

Adopting concepts and/or lessons from these bodies of knowledge does not guarantee success, but it should at least point the way forward, help provide a language for discussing the subject, and provide a more useful framework for thinking about the situation.

- 6) Inevitably, given the present concerns by the public and a diversity of interest groups, the report focuses mainly though not exclusively on the management of red deer.
- 7) We have aimed to make recommendations that would deliver a better **praxis!** Praxis may be defined as a body of practice and skills on the ground that is informed by sound theory, often, as in this case, both sociological and scientific theory.
- 8) Two recent reports are particularly relevant to this report These are the study by Price and Thomson (3) on developing methods for monitoring red deer impacts and the other the commonly termed "Hunt Report"(4) on the tension between public and private interests through the impacts of deer.

2.0 CLARIFICATION AND WORKING DEFINITIONS OF TERMS

2.1 Diffuse Deer Impacts

Like any large herbivore, deer interact with their environment, the ecosystem within which they function, in diverse ways. From the human point of view, these impacts may be viewed as positive or negative.

Within designated, protected areas, such as Special Areas of Conservation, National Nature Reserves, or Sites of Special Scientific Interest, there are specified habitats, species or ecological processes that are identified and protected in law. Deer may impact on these, but this does not count as a diffuse impact. Where such areas are threatened with serious damage, the DCS “priority site” procedure is invoked.

Across the broader countryside, and even within protected sites, deer may impact on aspects of land use, species, habitats or ecological processes that are not specifically identified as protected in law. Negative examples include grazing of young trees so that woodlands and forests do not regenerate, or “overgrazing” (however that is identified) of habitats in ways that damage its biodiversity or expose underlying soils to erosion. Deer grazing in private gardens is another example. Increased road accidents due to collisions with red deer in particular are another form of impact that may increase as deer numbers rise in an area, deer expand their range, or fencing layouts create accident blackspots with deer.

Such negative forms of damage are covered by the general term “Diffuse Damage.” It may occur on deer forests where deer stalking is a land use, or they may be “exported” to other areas as deer move within their range. The damage may be direct, as in the prevention of woodland regeneration, or indirect if, for example, the loss of birch or other woodlands over time removes an important landscape element and scenic quality may be lost. The damage might be to private interests in land, as in the case of damage to a private forest or a farm crop, or to public interests in land such as general biodiversity, hydrology or landscape.

There are “grey areas” in which damage from deer may not fall clearly within either of the above categories. For example, government agencies such as the Deer Commission for Scotland and the Forestry Commission Scotland are now required to take note of Local Biodiversity Action Plans in their actions. These specify habitats and species that should be protected and/or enhanced but not necessarily on specific sites or to such strict standards of protection as in Natura 2000 sites. Catchment Management Plans produced as locally based initiatives, or under River Basin Management Planning, which are likely to become more important under the Water Framework Directive, may also strongly influence land management. Across the broader countryside, including the uplands, river bank protection through control of grazing and protection of riparian trees and woodlands is becoming more important.

Diffuse impacts therefore cover diverse situations and seem to hold in common the fact they occur widely across the countryside, or potentially will, and are not specified as forms of damage to be controlled within the present law. On this basis, a definition is offered in Box 2.

Box 2

A Working Definition of Diffuse Impacts by Deer

Diffuse deer impacts are those positive and negative economic, social and environmental impacts on private or public interests in land, occurring broadly across the countryside, or with the potential to do so, and not covered by designations.

2.2 Sustainable deer management

DCS are charged with furthering the conservation, control and **sustainable management** of all species of wild deer in Scotland. The accepted general definition of sustainability is “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”.

Since sustainability as a concept covers environmental, economic and social aspects, this overall objective can be broken down into three basic objectives:

A healthy environment
A healthy society
A healthy economy

Hence, in defining sustainable management of deer, these three aspects must be taken into account.

Box 3

Definition of Sustainable Management of Deer

Sustainable management of deer is that which produces an optimum mix of environmental, social and economic benefits, with the focus of these attributes on the benefits to society broadly

These general parameters are examined more fully when reaching conclusions and recommendations for the management of deer.

3.0 METHODS

In preparing this report, we have done seven things:-

- 1) Conducted semi-structured interviews with twelve people involved in deer management including estate factors, foresters, stalkers' representative, woodland managers and deer cullers.
- 2) Participated in a conference The Role of Large Herbivores in Shaping the Upland Landscapes of Britain.
- 3) Organised and run a participative workshop of a diversity of stakeholders involved in deer management.
- 4) Reviewed the literature on deer management and their impacts.

- 5) Reviewed recent DCS annual reports and other relevant DCS literature.
- 6) Assessed relevant literature and publications in the fields of land tenure, natural resource and ecosystem management and rural and agricultural development to draw on relevant lessons.
- 7) Drawn on our own extensive field experience of the Scottish Highlands and in mountain and ecosystem management in various parts of the world.

4.0 SITUATION ANALYSIS – THE SHIFTING GROUND

In discussing deer management and control of their impacts, it is important to set the topic clearly in its current broad context, as forces and trends within that context are driving and shaping present concerns and actions. We do this below in terms of the significance of changes in deer populations in numbers and distribution, changes in patterns of landownership and tenure, the emergence of land uses focused on public goods in land, the very major changes in the political backdrop to the situation, the consequent major legal changes, and the relative importance of deer hunting in the rural economy, particularly in the Highlands and Islands.

4.1 *The significance of trends in deer population and distribution*

The DCS's publication specifying its Long Term Vision (5) for deer in Scotland, (Box 4), lists only sika (*C. nippon*) and red deer as causing concern through expansion of their range in Scotland.

Roe deer (*Capreola capreolus*) have, however, established themselves not only widely in the broader countryside, but also in urban parks and similar amenity areas. It is widely accepted that, over the whole of Scotland, the roe deer population is almost as large as the red deer population but this has caused concern in relation to woodland damage, loss of biodiversity and increased incidence of road traffic accidents.

Since the impacts of red deer have caused most of the public concern, this report largely focuses on that species.

Two major trends in red deer populations are highly relevant to this report. These are increase in their population density in some locales at least, and expansion in their range.

Counting deer populations is a difficult and much disputed subject, especially in woodland areas. Hunt (4), using DCS data, estimated that numbers had risen from 300,000 in 1989 to 454,000 in 2002. If these figures were correct, it would mean red deer numbers have tripled since 1962. Clutton-Brock et al. (6) calculated the increase has been significantly smaller and the rate of increase more gradual, perhaps to an estimate of about 350,000.

The expansion of red deer range is mapped in the DCS's Long-term Vision (6).

Despite such lack of agreement, there is a widely held view on three major points that are central to this report:-

- 1) *That red deer numbers have increased considerably, are continuing to do so, and total numbers are probably at record high levels.*
- 2) *That red deer have expanded their range and are continuing to do so.*
- 3) *That diffuse damage by red deer is causing concern.*

There is also considerable consensus that red deer population densities are increasing in some areas at least, and that sika deer are expanding their range.

The significance of point (1) is considered in Section 6. The significance of point (2) is considered in Section 4.2 below.

Box 4
Wild Deer in Scotland – A Long Term Vision
(Published by the DCS on 30th October 2000)

Species and Distribution

- Scotland will have the same four species of wild deer as at present (roe, red, sika and fallow). No significant colonisation by muntjac will have occurred.
- Roe deer will still be distributed throughout mainland Scotland.
- The expansion in the range of red deer will have largely ended. A growing proportion of the overall red deer population will live in woodlands or use woodlands for much of the year. The genetic integrity and viability of island populations of red deer will have been maintained.
- Sika will not have spread throughout mainland Scotland and they will generally be restricted to woodland populations, and excluded so far as possible from open range.
- There will have been little, if any, expansion in range of the localised populations of fallow deer, and in some cases a reduction.
- Deer will occupy land of a higher ecological value than at present. The process of improvement will be ongoing.

Populations and Management

- Deer populations will be managed locally so that their management is fully integrated with all local land uses and land use objectives.
- Deer management will be planned and decided locally on the basis of sound knowledge of all the factors involved and through a collaborative process involving those responsible for land management in cooperation with local communities and all other relevant interests.
- The management of local deer populations will ensure high standards of deer welfare and public safety, and play a constructive role in the long-term stewardship of natural heritage habitats.
- Local deer management will continue to deliver and will be further developing its positive contributions to the rural economy. Involvement with deer management will be seen as an attractive and worthwhile occupation associated with high standards of skills and employment practice.
- Overall, wild deer will be viewed as a valued asset that is managed on a sustainable basis to produce a wide range of economic, social and environmental benefits both locally and in the wider public interest.

4.2 The Significance of the Expansion of Red Deer Range

The DCS's Long-Term Vision for deer in Scotland (6) lists only sika deer and red deer as causing concern through expansion of their range in Scotland. As stated, attention is given here only to the expansion and potential expansion of red deer range since that is what has caused most public comment. This expansion is considered under the issues of expansion within the uplands, where it has occurred, and potential expansion into "lowland" Scotland.

4.2.1 Spread of red deer within the uplands

A map of this expansion of range is produced in DCS's publication on its Long-Term Vision (6). Given that this was published in Oct 2000, red deer range may have expanded beyond these boundaries. Observations by many people confirm this. The expansion has been mainly along the upland fringe where it abuts the lowlands. Several points arise here. This brings red deer into areas where plantations are unfenced against deer and have traditionally not carried that cost or the cost of red deer management. It brings the range increasingly into areas where deer stalking is not part of the estate economy, Deer Management Groups do not currently operate, and might be more difficult to organise and run given the more fragmented landownership pattern often typical of such areas.

Moreover, it tends to move the interface between deer management and agriculture from hill sheep farms to mixed upland farms, with their fertilised and more vulnerable and more nutritious crops accessible year round. This, along with better shelter, would not only enhance fecundity and size in red deer, but the scope for conflict through damage to crops will also become much greater.

Lastly, changing patterns of commuting to work in urban areas and increased housing in the countryside have increased the number of houses and gardens in such areas and with that traffic flows. This enhances the scope for conflict with red deer. In a few villages such as Braemar on Deeside and Lochranza on Arran, their presence may be accepted traditionally, albeit sometimes grudgingly, especially if they are seen as a local tourist attraction. However, the necessity for deer fencing around gardens and allotments etc imposes a significant cost on residents and would be unlikely to be accepted in other settlements.

It is reasonable to expect that red deer populations will tend to build up within this newly occupied range and with that growing problems from these interfaces and any other problems that arise from their occupation of what are more populated areas with more gardens, roads etc.

4.2.2 Potential spread of red deer in lowland Scotland

There seems no reason why the expansion of red deer range should stop at the uplands fringe.

It has been argued by some that the open lowlands of Scotland are not attractive habitat for red deer. Certainly Mitchell et al. (7) describe the red deer as basically a forest glade/woodland edge animal that does not continually inhabit flatland without forests, suggesting cover is very important to them. On this basis, it might be thought that the Scottish lowlands are unsuited to colonisation by red deer. However, against this must be remembered two relatively new features of the Scottish lowlands.

Firstly the Scottish lowlands are interspersed by ranges of “block mountains” such as the Campsie, Ochills, and Kilpatrick, which contain not only expansive open grazing but are now dotted with sizeable forestry plantations with no deer fences and which would give excellent deer cover. Secondly, till recently, extensive woodland cover was largely absent from the Scottish lowlands. Now, woodland grant schemes aimed at farmers and other schemes, including the Central Scotland Forest, Grampian Forest, the Broadleaved Woodland Scheme, and riparian planting schemes, to name obvious examples, are steadily providing the essential cover. Over increasing areas of the lowlands, there is a substantial scattering of small to medium sized broadleaved woodlands. This has made lowland arable farming areas much more attractive for red deer colonisation. This would take place in an environment with a milder climate, good shelter, and almost year round access for deer to crops with a raised nutritional value in energy and protein content through fertiliser application. The impacts on fecundity and raised mature bodyweight of deer would be considerable.

Potentially, one could foresee much greater and more widely dispersed conflicts arising as deer impact gardens, amenity areas and agricultural crops and attempt crossings of busy motorways. This possibility does not seem to have been given the attention it deserves.

4.2.3 Implications of red deer expansion for control of populations

The concern that arises from this consideration is not so much the situation as it is now, but what it will be in ten to twenty years time if intervention is not effective and the results of continued expansion unacceptable.

It is well established that red deer hinds are hefted to their home ranges, at least on open ground (7,8,9) though stags may range much more freely. Practical experience of heavy culling of red deer in an area like the Creag Meaghaidh NNR and Inschriach supports this and indicated strongly that migration of red deer into new range from open ground, as opposed to diurnal or seasonal movements, is usually the result of pressure caused by high populations within the home range. There are alternative views which are that deer move into areas where sheep have been removed or where the density of deer has been decreased.

If the first assertion is correct, for policy on deer population controls. It would mean that problems arising from red deer in the areas into which they expand are essentially an exported cost of the failure to maintain optimum population densities in deer forests and other parts of the home range. This would present a further strong argument for effective management of deer populations within their current home range.

4.3 Scale of sporting estates and changes Highland landownership

The Sporting Estate is essentially a social construct created to access the benefits of recreational hunting and landownership for the landowner. Its evolution and sociology have been analysed critically by various authors such as Lorimer (10), Wightman et al. (11) and Wightman (12). From inception, it has been a controversial creation. This report does not discuss that controversy, but analyses and comments on the sporting estate as a social construct only in so far as that affects the management of deer or, more importantly, innovation in the management of deer.

Wightman et al. (11) describe how, although, in 1811, there were only six or seven deer forests which were actively managed for hunting, by 1873, this had risen to 79 and by end of 19th century there were 130 –150 covering 2.5 million acres. They refer to Orr's

estimate in his book “Deer Forests and Landlord” in 1957 that there were 183 deer forest in the Scottish Highlands and Islands covering 2.8 million acres. They regard this as the last date for which accurate figures are available. They estimate there are around 304 sporting estates in Highlands and Islands, covering around 5.2 million acres – about 30% of private land in Scotland with over 50% of that in Highlands and Islands. Only a part of that total will be deer forests which are now estimated to occupy some 10,000 square kilometres (3860 square miles) of the Highlands and Islands, and deer management is important on a much larger area, perhaps double that, bringing the scale to about half the size of Belgium.

Wightman et al (11) conclude that, “The classic Highland Sporting Estate is around 30,000 acres and typically owned by a man from a family with substantial financial or business interests. The owner(s) will visit infrequently and will often employ a professional estate agency firm to administer and manage the estate.”

Certain trends in landholding in deer forests are relevant to this report in that they may make deer management more difficult. Firstly, there has been a fragmentation of many of the larger estates into smaller landholdings. Deer ranges thus tend to be spread over more landholdings than previously, making cooperation between such groupings more important. Secondly, the nature of estate owners may have diversified, and often the owners, as key decision makers, are overseas and less aware of situation on the ground. There is also a more rapid turnover in ownership, making the consistency of long-term policies that are often essential in the management of such areas more difficult to maintain.

Studies by Higgins et al (13) support these last two points. They concluded that, of a sample of 218 estates in the Highlands and Islands,

- 1) “39% of legal title are held in the name of an individual or individuals;
- 2) 23% are held by trusts;
- 3) 21% by companies registered in the UK
- 4) 16% by companies registered offshore.

- 5) 50% have been owned by the current owner or their family for 25 years or less;
- 6) 20% have been owned by the current owner or their family for 26-50 years;
- 7) 30% have been owned by the current owner or their family for over 50 years.

- 8) 66% are owned by absentee-owners (defined by principle place of residence).

- 9) 39% of estates were obtained by inheritance;

- 10) 61% of estates were purchased.”

Lastly, the traditional sporting let of a client taking the let of the deer stalking for a whole season, has changed to one of short term lets of one or two weeks, during which clients expect to shoot a reasonable number of stags. To ensure this happens within the brief period of the let, there is a pressure to maintain higher numbers of stags on the land.

Thus, red deer management in the Scottish Highlands and Islands takes place over a massive scale, but fragmentation of holdings, changes in the kind of estate owners to include for example non-government organisations, overseas owners and local communities. Increased turnover of ownership makes long-term consistency in management and policy more difficult, and changes in sporting lets towards short term lets and more importantly changes in the policy of owners make effective deer management more difficult.

4.4 Emergent land uses – public versus private goods

A major trend that it is important to consider in the general discussion on deer management is that of *Emergent and Re-Emergent Land Uses* which is linked in turn to the social phenomena of *Emergent Values* in society. This is a global phenomenon that has underlain much that has happened in environmental and land use conflicts in the 20th and into the 21st century. In some cases, the emergence largely reflects the emergence of a social value. This is the case with the development of sporting estates as a phenomenon through the 19th century through re-evaluation of the highland scene and the development of mountaineering through the re-evaluation of the mountain scene. In other cases such as water catchments, it reflects the pressure of trends like agricultural intensification on “ecological services” which had previously been accepted as a “given” by land. In the context of this report, it can most usefully be considered in the light of the dominance of sporting estates as outlined in Section 4.2. This describes essentially a movement that focused on the dominance of the use of land for the delivery of “private goods” – in this case the enjoyment of recreational hunting by the landowner, clients or guests.

Counter to this, a series of land uses have come to the fore that are essentially about the delivery or protection of “public goods” in land. An example is a land use such as recreation on foot and which, in various forms, has become important to the Highland economy. But it particularly includes those land uses that are often termed “ecosystem services.” Thus the protection of biodiversity covering the protection of species, habitats, and genetic resources increasingly figures in public debate. As stated, water catchments are another example that is now receiving increased attention, particularly in the light of activities like pollution and flood control and freshwater fisheries protection.

How a society divides land uses and associated yields between public and private goods is partly decided by the nature of that land use, and partly by the cultural and political situation within that society. Thus, the post war construction of hydro schemes and the associated acquisition of land by compulsory purchase was perhaps a dramatic assertion of the claim of public goods in land, but this was largely reversed through privatisation of power generating companies. On the other hand, the firm rejection by people in Scotland of privatisation of water catchments for domestic and industrial use, as occurred in England, was clearly a cultural and political assertion that classified this as public goods. Notwithstanding such cultural influences, certain land uses, such as the enjoyment of landscape underlying the tourist industry are, by their very nature, are almost invariably classed as public goods. Biodiversity, across the broader landscape, is emerging as another example of “public goods in land.”

This powerful trend is undoubtedly asserting an important pressure on deer forest owners and those others with a responsibility for deer management just as it is on those in agriculture and forestry. There are at least five implications from it.

- a) The trend will continue with further such land uses “emerging.” They seem to emerge at the rate of one per decade. The most recent examples are carbon fixation, a particularly important property of Scottish soils, and, more recently, albedo. Both are related to climate change and its limitation.
- b) Such emergent land uses will largely reflect public goods in land and hence impacts from private land uses that may damage them will become increasingly controversial and less tolerated. At the centre of the tension is a disjunction

between legal and other theory and underlying systems of land tenure emphasizing private goods in land and ecological realities.

- c) Alongside these trends and supporting them are broad social trends that reinforce the situation. Bryden (14) included in these the change in social attitudes towards a more favourable view of “rurality,” the resultant increased flow to many rural areas of in-migrants with differing attitudes to rural issues, the fact that rural people becoming more politically organised, and the recent rise of the environmental movement.
- d) The conflict between a private land use such as deer hunting and public land uses is drawing powerful voluntary organisations of various kinds including rural development groups, outdoor recreational groups and environmental groups increasingly into the debate on deer management

Overall, emergent land uses focused on public goods in land are increasingly circumscribing land management for private goods in land. Further emergent land uses are continuing to arise. Broad social trends in “rurality” are also influencing land use. These trends are drawing a diversity of interested parties into issues such as deer management.

4.5 The legal trend and background

Two broad trends are clearly relevant to the issue of deer management. They reflect wide shifts in the political organisation of the UK and the implications of the emergent land uses discussed in Section 4.4.

Broadly, devolution has led to the emergence of a renewed focus and policy agenda on rural development including land tenure and management, which had been neglected at the UK level owing largely to a shortage of parliamentary time. The resultant Land Reform (Scotland) Act 2003, for example, not only produced community buyout as a significant long-term trend. The enshrinement of broad powers of public access was an assertion of the public right in land that subtly shifted the power relationships between landowners and managers on the one hand and the general public on the other. Devolution also swept away the role of the House of Lords and what Wightman et al (11) call “the vested interests of the many landowning members of the House of Lords”

More specifically, extensive legislation and initiatives aimed at the protection of public goods in land and framed at the global, European Union, Scottish and local government level have already emerged and continues to do so. Almost certainly, they will continue to emanate from government and will likely become more prescriptive and overarching in their reach. The lesson from other problems of resource management is that parties, which can resolve private versus public goods conflicts on a voluntary basis are less likely to be impacted by such legislation.

In addition to the designation of SACs and SPAs under the Natura 2000 programme, there are several pieces of legislation at the Scottish level that have important implications for management of deer populations and with *protection of biodiversity* as a significant theme running through several of them. Thus the Section 1 of the Nature Conservation (Scotland) Act 2004 states that “It is the duty of every public body and office holder, in exercising any functions, to further the conservation of biodiversity so far as is consistent with the proper exercise of these functions. The official publication “Scotland’s Biodiversity: Its in Your Hands” (15) even specifies tasks for the DCS. The

combined significance of the above Act and this document is considerable and the most significant aspects of both are therefore combined in Annex 1.

The Scottish Biodiversity Strategy(16) identifies native pinewoods and oakwoods and, to a lesser, extent birchwoods, and a range of upland habitats and species in need of protection and restoration. Price and Thomson (3) review fully the range of species and habitats identified as being impacted upon by deer. Such priorities are in turn reflected in Local Biodiversity Action Plans being furthered by Local Authorities. These authors' review showed that deer impacts were addressed in every Local Biodiversity Action Plan covering the Highlands and Islands except Argyll and Bute, and in several covering areas outwith them.

Price and Thomson (3) also detail the extent of concerns about deer impacts outlined in Scottish Natural Heritage's "Natural Futures" programme. In this, native deer are defined as a natural and desirable feature of many Scottish habitats, but deer impacts are described as a concern in four out of the six main thematic kinds of area, namely Farmland, Forests and Woodlands, Fresh Waters, and Hills and Moors.

The Water Services and Water Environment (Scotland) Bill 2003, produced in response to the EU Water Framework Directive, is a far-reaching piece of legislation. It tackles the maintenance and, where necessary, restoration of both the purity and ecological standing of freshwater and coastal systems. This could have significant implications for land management where it affects water flows or quality or the ecology of groundwater or surface water bodies. This could be particularly the case where large river systems have been designated Special Areas of Conservation under the Habitats Directive, such as the Rivers Spey and the Dee, as the stricter standards of ecological protection and management of the SAC designation that apply under Natura 2000 apply rather than those under the Water Framework Directive.

At the EU level, under the Strategic Environmental Assessment Directive, the resultant Environmental Assessment of Plans and Programmes (Scotland) Regulations 2004 require agencies like the DCS and landowning agencies like FCS to assess the environmental impact of their public sector strategies. Maintaining as well as enhancing and restoring biodiversity and ensuring the sustainable management of key wildlife sites will almost certainly be required of the strategies and policies of such agencies with regard to all positive and negative impacts of deer management.

That this legal trend will continue is clearly signalled by the forthcoming Soils Directive from the EU and the recent launch by the Scottish Executive of the New UK Framework and Scottish Strategy for Sustainable Development with the Scottish element of this to be developed during 2005. It is relevant and significant that this last approach makes clear links between environmental management and social justice. This will impinge on the approach to the management of all natural resources, particularly common property resources such as the public goods in land (Section 4.2) and hence how issues like sustainable management of deer are defined.

It is clear that a devolved parliament is taking a closer and more active interest in rural and land use policy than the Westminster-based parliament and initiatives at the global, EU and Scottish level are resulting in legislation and policies that increasingly focus on protecting the public interest in land.

4.6 Renegotiation of social contracts

Fundamentally, what is happening is that the underlying realities of ecology and changes in societal values are forcing a move, across the board, from a land use and ownership model of single land use and rights focused on single landownership and private rights in land, to rights of multiple land uses, including public land uses, and hence multiple landownership. Agriculture and forestry for example, are finding themselves undergoing a similar process. The interest group concerned undergoes a similar process. It has to “*renegotiate its contract with society.*” The public access arrangements contained in the new Scottish Outdoor Access Code under the Land Reform(Scotland) Act 2003 are a classical example of the renegotiation of such a contract.

Post-war agriculture had simple terms of reference with a society that had seen hunger and starvation as a possibility, and which indeed in continental Europe had experienced it. The contract could be summarised as “provide us with a stable market and income, and we will provide the food.” The emergence of agricultural pollution, loss of wildlife, loss of cultural landscapes and other impacts on emergent land uses through intensification lead to very changed terms of reference being demanded to take account of these “public goods.” The emerging contract looks to delivery of environmental public goods.

With forestry, in the light of experience of a u-boat attack in the First World War, the original contract with society was for delivery of strategically vital timber supplies in return for public financial and political support, but the renegotiated contract, under the Scottish Forestry Strategy, considers also landscape, water catchments, biodiversity and outdoor recreation.

Where land is mainly used for sporting purposes, and with particular regard to this report, deer forest owners are now facing the same challenge. With both forestry and agriculture, as primary land uses, the original contract promised delivery of a key public need – food and timber – but a land use like deer forestry is in a more difficult negotiating situation. It cannot directly point to delivery of a key public need other than the sustainable management of deer in a manner that considers the public interest.

4.7 The economy of upland Scotland and public land uses

Within the uplands much of the focus, and indeed evidence, is on the Highlands and Islands. When considering deer management, the relative economics of private and emergent public land uses in the Highlands and Islands must be remembered. Jones Economics Ltd and co-workers(17), in their study of the economic impacts of hillwalking and mountaineering in the Highlands and Islands, summarised incomes and employment from a number of sources. Some are detailed in Table 1. The figure for Hillwalking and Mountaineering does not include income and jobs from ramblers and general short distance walkers. Also, it should be noted that the figures of shooting and fishing are for the whole of Scotland, including large areas like the Borders and Dumfries and Galloway and fishing in large rivers like the Tweed. The relevant figures for the Highlands and Islands would therefore be considerably less. Thus, within the Highlands and Islands, the gap between figures for mountaineering and hillwalking on the one hand, and sporting activities on the other would be considerably greater than the figures in Table 1 indicate.

Jarvie (18) assessed the number of full time equivalent jobs from direct involvement in red deer to be 315 in 1978/79. This number seems unlikely to have risen since then. The Association of Deer Management Groups (19) claims that the number of full time jobs created by red deer management is 320 full time and 460 part time stalker jobs. Even

allowing for extra jobs activities like roe deer control, it is difficult to bridge the gap between these two figures.

<i>Activity</i>	<i>Participant Expenditure (£)</i>	<i>Employment (FTEs)</i>
Hillwalking and Mountaineering	163.7	6,100
Sport Shooting in Scotland	35.00	2,171
Salmon fishing in Scotland	33.6	3,400

Table 1 Comparative Economic Impacts of Activities in the Highlands and Islands. Source – The Economic Impacts of Hillwalking, Mountaineering and Associated Activities in the Highlands and Islands of Scotland. Report to Highlands and Islands Enterprise by John Jones Economics Ltd, Landwise Scotland, and Scotiform Ltd. Nov 1995.

Considering direct employment impact of people involved in environmental protection, a report by Independent Northern Consultants (20) estimated in 1995 that this supported the equivalent of 1,356 FTEs, about 1.0% of the employment in the Highlands and Islands. This number will have since grown.

Much more importantly, the total income from Tourism in the Highlands and Islands is currently estimated at £606m with an additional £317m from day trips. The visitor attitude surveys of 1999/2001 (21) demonstrate that 90% of tourists place the landscape as the key reason for their visit.

The point that emerges from this analysis is that, over the broader landscape of the Highlands and Islands, while it is the interests of private goods in land that dominate land management, it is the value of the public goods in land that dominates the land-based economy. This provides a strong reason for heeding the public interest where it is impacted by deer management.

4.8 General conclusion of the situation analysis

Broadly therefore, there are major social and legal trends that are exerting pressure on landowners and others involved in red deer management to define their objectives in a manner that takes account of sustainable deer management that takes fuller account of the public interest. There is a need for them to negotiate those objectives with interested parties even they may not start from a strong negotiating position.

The significance of this developing situation for policy is strongly indicated by the recent policy document presented to the SNH Board of March 2005, concluding that if partnership working did not create the necessary improvements of deer range management within three years, then further legislation should be sought. The law is intervening increasingly in situations of natural resource management, and the scope for non-coercive solutions to the problems is running out of time.

5.0 The Impacts of Deer and their Significance

This is considered under the three broad headings of ecological, economic and social impacts, although these are in practise difficult to disentangle. While roe and other species have significant impacts, it is the impacts of red deer that are focused on here as this is where the main concern currently lies.

5.1 The Significance of Ecological Impacts Within the Home Range of Red Deer

This is not a well researched area of work and many uncertainties remain. Also, over much of their range, the impacts of red deer are confounded with the impacts of sheep. Grazing habits of deer and sheep differ but, broadly, have similar impacts and some generalisations are made on this basis. It must also be remembered that grazing impacts are also confounded with those of muirburn. The following considerations are relevant where deer are the main grazing influence, especially on deer forests.

5.1.1 Impacts on Vegetation

Milne et al (22) thoroughly reviewed information on the impact of vertebrate herbivores on the natural heritage of the Scottish uplands in 1997 and reached some important general conclusions. They concluded that, "In general terms, therefore, increasing grazing pressure tends to result in the following sequence of vegetation change: from tree/scrub dominated (under light/no grazing) through dwarf-shrub dominance, to grass dominance under heavy grazing pressures." Deer did not establish the deforested landscape that today typifies much of the Highlands and Islands, but their grazing and muirburn maintain it at that ecological stage which has become the traditional landscape pictured by people the world over of the Scottish Highlands, and the iconic landscape at the heart of the tourist industry.

This suppression of forest and woodland, the further stage of ecological suppression resulting in grass dominated landscapes, and the possible further stage leading to soil erosion, have important implications for deer management, landscape, biodiversity, and ecological processes.

Milne et al (22) also concluded that, "In general terms, high, very low, or no grazing pressures by large herbivores leads to a reduction in natural heritage value whilst moderate and low grazing pressures benefit the natural heritage by giving maximum plant and animal diversity." For reasons given in Section 5.3, maximising of biodiversity would probably also provide a more diverse and attractive landscape. This conclusion therefore has important implications. It indicates that there may well be population densities of deer, which could meet the requirements of deer stalking, biodiversity and landscape, in a situation where deer are important in maintaining these public interests.

At present population densities of red deer in many areas, Staines and Balharry (23), considering the impacts of red deer in the Cairngorms, state that the main issues are lack of regeneration of native woodlands and the impact of red deer on other plant and animal communities. As particular examples, they refer to information from Glen Feshie and Glen Lui showing the loss of heather cover to grass due to the impacts of deer grazing. Hester (24) states that "Many scrub types in Scotland are now scarce and highly fragmented." She identifies sheep and deer grazing as the main causes of this.

Nolan and his co-workers at the Macaulay Institute are producing the most extensive assessment of deer impacts within deer forests, using a GIS based system of mapping impacts on different vegetation types over the land area of 12 Deer Management Groups. A brief description of their work is given in Box 5. It confirms that high and medium impacts on vegetation from deer grazing and browsing occur widely on a diversity of habitats. The observations of those we have interviewed on the condition of sites they have visited, such as Glen Shirra support this. Indeed simple observation shows that, over very large areas, some species such as holly and aspen have been reduced to scattered ageing individual specimens, or survivors clinging to a few cliff areas beyond the reach of grazing.

The effectiveness of deer grazing alone in sustaining grassier vegetation cover is clearly demonstrated within very recent deer exclosures in places like the Knoydart area. What is striking within exclosures is not just the tree regeneration, but the speed of other vegetational changes such as the revival of heather as a more dominant groundcover and the relative retreat of grassier groundcover creating a more visually and biologically diverse terrain.

A matter of concern for which there is some evidence is that some of the major impacts are governed by positive feedback cycles; that is they have a self-accelerating tendency under the impact of heavy grazing. Once bare ground is established on hillslopes, the tendency for it to expand in a self-accelerating way, for example through eroded soil burying downslope vegetation, is well known, but the processes can be more subtle. Nolan (personal communication) has pointed out how, once grass establishes within a heather cover, deer graze it preferentially. In so doing they graze heather on the perimeter of grass patches strongly. This causes its gradual elimination, permitting the grass to replace it, expanding the grass patches. Sensitive montane habitats that may be subjected to such self-accelerating processes are *Racomitrium* heaths and montane blanket bog. Deer may enter pine or birch forest fragments for shelter in poor weather and graze out seedlings, thus preventing tree regeneration. Over the longer term, this reduces the area of forest for cover, resulting in higher densities in the reduced fragments, and hence more intensive grazing of tree seedlings. Indeed, Mitchell et al (7) point out that much of the movement of deer is due to a search for shelter over landscapes with such fragmented woodlands.

5.1.2 Impacts on Other Lifeforms

The general focus of research and comment in the debate on the impacts of red deer, has been strongly on impacts on vegetation, or habitats characterised by particular forms of vegetation. But the loss of a plant species or habitat, or its reduction to comparative rarity by heavy grazing or burning, clearly has implications beyond that species and far beyond impacts on vegetation. Such broader aspects have been comparatively neglected, but are almost certainly of equal or greater importance. For example, recent investigations (25) into the dwarf willows of the Scottish uplands were initiated because they had been reduced by grazing and burning to small fragmented populations. This raised fears that their genetic diversity had been reduced to the point where the survival of such species was endangered. The investigations also identified twenty mycorrhizal fungal species that the willow supported, plus other macrofungal species growing in association with them. Many of the species identified were found nowhere else in the UK!

This points the way to the wider insight that the impacts of grazing go far beyond those on vegetation and which seems to have been comparatively neglected. Thompson and Brown (26) begin to explore this when they list the main impacts of heavy grazing by sheep and deer as being:-

Box 5

REDEVELOPMENT OF A DEER MANAGEMENT GROUP

Initially, the Deer Commission for Scotland approached the Forest Enterprise District Officer, Mr Kevin Peace, to revitalise Sub-area 3 of the Eastern Cairngorms Management Group. He undertook this task about 2002.

At first, not many people attended the meetings of the Group, but gradually attendance built up until all the estates involved were participating. The group:-

- a) Shared information on deer culls.
- b) Discovered how much participants had in common – they all had similar mixes of land uses.

Several outdoor meetings were also held.

The group then decided to draw up a deer management plan, a task, which took two years. The now participants keep in touch throughout the season, exchanging information on how they are progressing with culls. Some of the estates are now organising cooperative culls. All parties have agreed there are too many deer and set an annual cull rate that should reduce deer numbers. All have met this aim and some have exceeded it.

There is monitoring of broadleaved and coniferous regeneration and other activities such as through the Capercaillie Life Project. The roe deer cull is much larger than the red deer cull.

Notes Regarding This Successful Management Group :-

- 1) All four estates involved shared compatible and often shared land use aims and none had a heavy dependence on deer stalking.
- 2) The Forestry Commission District Officer adopted a facilitating role.
- 3) Under these two conditions, the process was self-accelerating – Most estates send stalkers and land agents. Twenty people attended the last meeting

- “Extensive mosaics of near-natural vegetation are deteriorating into more uniform stretches of less diverse habitats
- 2) The potential value of these near-natural communities for wide-scale monitoring of ecological consequences of climate change and acidic deposition is becoming more limited.
 - 3) Birds and invertebrates dependent on the near-natural communities will be at risk of decline and range fragmentation.”

They state there is good evidence for the local extinction of ptarmigan by this and point out that dotterel have now virtually disappeared from south of the Highlands line. Milne et al (22) state, “However, in general, the requirements of the majority of bird and mammal species are more likely to be met by light to moderate grazing pressures than by heavy grazing pressures. Of the bird species currently present in the Scottish uplands, high herbivore levels over the last 20 years are considered to have decreased the populations of five species, viz red grouse, black grouse, merlin, hen harrier, and ring ouzel.”

Dr Adam Watson (personal communication), from long observation, has concluded that heavy grazing by red deer, through its impact on vegetation, is reducing populations of red and black grouse and ptarmigan.

Despite a lack of well researched evidence, simple observations support the point that heavy grazing reduces general biodiversity and an example of such an observation is given in Box 6.

Looking more widely, basic ecology and considerable research tells us that not only changing the plant species mix of upland vegetation, say from heather to grass, but even altering the physical stature of a dominant species like heather, will probably alter both soils and hydrology, with a probable strong interaction between these last two factors.

To take a simple example, some Biodiversity Plans note the impact of deer and sheep grazing result in the loss of riparian edge scrub and woodland. The importance of this for the sustainable management of fisheries through control of bank erosion, provision of food, nutrients and shade to waterways is being increasingly appreciated by fisheries experts, the angling community and downstream riparian owners. Scottish Natural Heritage’s Freshwaters document under its Natural Heritage Futures (27) specifically draws attention to deer browsing as a factor in the loss of wetland and riparian zones and proposes a reduction in these impacts. The document also connects the impacts of deer and sheep grazing as a factor in more rapid runoff and soil erosion to impacts on freshwater fisheries. This issue may be brought into greater prominence within River Basin Management Plans under the Water Services and Water Environment (Scotland) Act 2003, particularly as thinking on flood control moves from hard “concrete based” approaches to “softer” more ecologically focused approaches based on catchment storage capacity and land management methods.

There has been no work exclusively on the impacts of heavy deer grazing on wider ecosystem processes but significant work on sheep grazing which provides relevant insight. As stated in Section 5.1, red deer and sheep have different grazing habits, but most of the broad impacts of heavy grazing would be similar. Indeed DCS acknowledge the difficulty in distinguishing between the impacts of deer and sheep grazing on vegetation.

Evans has studied the effects of grazing by sheep and other large herbivores extensively. Studying the impacts of sheep grazing on a small catchment in the Peak

Box 6

**OBSERVATION ON BIODIVERSITY ON A RECENT VISIT TO AN
EIGHT-ACRE EXCLOSURE IN GLEN EY, DEESIDE.**

APRIL 2005

Glen Ey is grazed by deer, almost entirely red deer, and not by sheep or cattle.

A recent walk by one of the authors up the fertile Glen Ey in the southern Cairngorms to visit an eight acre enclosure around ageing birch revealed surprisingly little wildlife over several miles of heavily grazed swards of bottom land. Few curlews, peewees, or other expected species were observed and no hares or amphibians.

On steep slopes above the enclosure, much tracking across the contours and heavy grazing impacts on vegetation could be observed, to the point where soil erosion was clearly initiated.

Inside the enclosure, apart from birch regeneration, rowan and pine had colonised over a very considerable distance from the nearest seed sources, willows had appeared along ditches and a ground vegetation diverse in its species mix and physical structure had established.

Within twenty minutes of inspecting ground inside this small enclosure, the animal list spotted included two common lizards, one adder, one snipe, one rabbit, one stoat, and moth caterpillars. Nests of small birds were visible in the growing trees and other signs of plentiful animal life detectable. The contrast in species richness with the ground outside was striking. There were abundant signs of smaller mammals present.

District of England (28), he points out that the vegetation reinvaded bare soil rapidly but that:-

“It took two decades before vegetation began to invade the bare soil on the higher slopes. There, it was not until all the peat and underlying leached (Ea) soil horizon was stripped off that was vegetation re-established.”

and,

“There is an important implication arising from this finding. Thus, erosion of peat, once started, is likely to continue until the peat and the underlying infertile Ea or Eag horizon is stripped off. It is likely that such findings also apply to where unstable subsoil is close to the surface, such as shallow (300mm) ranker or rendzina soils over scree. In localities

with peat or ranker soils or other shallow soils over scree therefore, grazing pressures should not be allowed to cross the erosion threshold, likely to be a summer grazing intensity of c. 1 sheep per 0.2 ha.

To avoid crossing this threshold, vulnerable slopes need to be monitored to assess grazing pressure and to look for signs of the onset of erosion.”

Whilst peat erosion is not necessarily associated with grazing, Birnie (29), working on erosion of blanket bogs in Shetland, noted that 1- 4cm of peat on hilltops eroded per year. He observed that “Erosional features in peat in Shetland, once started, tend to be persistent. Stock may accelerate erosion by trampling but maybe be preventing re-colonisation.”

In short, once erosion of peat is initiated, it tends to persist.

In this, the conclusion of Milne et al (22) is highly relevant. They state, “Available evidence suggests that grazing and trampling can be important factors in soil erosion in upland Scotland. The impact of trampling may be especially important in steeply sloping terrain.” They conclude, “The information available suggests that there are threshold grazing intensities at which soil erosion occurs, often slightly greater than the grazing intensities at which substantial vegetation changes can be expected.”

Considering possible impacts on general hydrology, Evans (30), reviewing the work of many authors and looking at the situation within the British Isles, states that:-

“In Britain and Ireland grazing appears, from field observations, to cause the decline of peat on moorlands and the decline of rainfall absorbing Sphagnum spp. mosses. This was the explanation for the greater runoff in grazed moorland catchment, compared to an ungrazed moorland catchment, in North Wales, and to the increase in runoff in the Derwent catchment in the southern Pennines in England between 1945 and 1975; and may partly explain the more flashy flooding and erosion of upland riverbanks in England“

Looking more broadly, he concludes:-

“Many plot and catchment studies in both semi-arid and temperate locations show that heavily grazed range produces more runoff and runoff events and sediment than less heavily grazed ranges.”

He continues:-

“The greater runoff is related to a number of factors: on heavily grazed rangelands there is less vegetation biomass and cover, both live and dead, which use less water so the topsoil is moister; an increasing amount of bare soil of decreased aggregate stability; an often denser, less porous topsoil with a platy structure, and lower infiltration rates.”

Reid (31), reviewing cumulative watershed effects widely, similarly concludes that trampling by animals and people compacted soil and altered its hydrological properties, stating that:-

“Heavy grazing was generally found to reduce infiltration rates on porous soils by about 50%, while light and moderate grazing decreased rates to about 75% of their original values.”

It has long been understood that the aerodynamic roughness of the canopy of vegetation influences hydrology. Eddyding caused by an aerodynamically uneven canopy transfers

energy to the canopy and moisture sitting on, evaporating much of it. Twenty percent of precipitation may be lost from a forest canopy in wetter areas of the Highlands this way, but even alteration of h Ward and Ronison's basic text (32) hydrological text states, "

"Research by the Institute of Hydrology (Hall, 1985, 1987; Wallace et al, 1982) showed that the aerodynamic resistance for heather is lower than for grass. Therefore, during wet periods interception losses from heather are likely to be much higher than those for grass. However in dry periods transpiration losses from heather are significantly lower than those from grass, so that in regions of moderate annual rainfall (approx 1500 mm) the increased interception losses are likely to counterbalance the reduction in transpiration. In high rainfall areas interception losses will dominate and in drier areas the converse will be true."

This has obvious implications for the vegetations changes under heavy grazing outlined by Milne et al (22) from tree/scrub to dwarf shrub to grass dominance. Overall, the implications of vegetation changes induced by heavy grazing for hydrology are highly likely to be significant.

5.2 General Conclusions About Ecological Impacts

Even within our limited knowledge, this consideration of the impacts of deer grazing on their home range has important implications for the sustainable management of deer. Grazing pressures by large herbivores result in the sequence of vegetation change: from tree/scrub dominance (under light/no grazing) through dwarf-shrub dominance, to grass dominance under heavy grazing pressure. Red deer thus sustain the iconic deforested landscape of the Highlands but this deforestation has reached the point where some tree and shrub species are either extinct over large areas or reduced to scattered ageing individuals or small stands.

High, very low, or no grazing pressures usually reduce natural heritage value, but moderate and low grazing pressures benefit it by giving maximum plant and animal diversity. This may indicate a middle ground where the needs of deer forestry, the natural heritage and landscape could be better accommodated. Recent work surveying deer forest terrain has shown significant if localised areas with strong grazing impacts.

There is evidence that, under heavy grazing pressures at least, some of the impacts on vegetation and hence on habitats, are influenced by positive feedback cycles and may be self accelerating.

Grazing, particularly heavy grazing, leads to important impacts on vertebrates, invertebrates and other lifeforms, and also on hydrology and soils and the differences in such grazing pressures between those that cause substantial vegetation changes and those that cause soil erosion may be small.

Our knowledge of these processes is limited, not only in terms of impacts that have received considerable attention such as on vegetation and tree regeneration, where it is at least substantial, but also much more so on impacts on soils and hydrology. These have not been little investigated but seem likely to be significant. Research has been heavily skewed towards impacts on vegetation and associated interactions while other equally important ecological impacts connected with it have been neglected.

As with the question of the expansion of red deer range, the important question is not what the situation is now, but what it will be in future - in say ten or twenty years, if the present impacts continue or worsen. We have little information on trends in impacts.

Historically, it was not possible to map accurately the impacts of longterm grazing by sheep, cattle and, before that, large numbers of goats in a densely populated Highlands in creating the largely deforested scene on which red deer stalking was founded. In the shorter term, problems like the turnover of staff on estates and lack of observational skills on ecological processes among estate staff make assessing recent trends difficult.

In general, DCS has interpreted its task in terms of achieving a balance of land uses through management of deer populations. Its Long Term Vision for example (6) states, “Deer populations will be managed locally so that their management is fully integrated with local land uses and land use objectives.” From the analysis above however, this does not seem to adequately grasp the nature of the Commission’s task. Over much of their range in Scotland, the red deer is the dominant large herbivore, indeed in many situations the only large herbivore. Manipulation of such populations is not simply an exercise in land use. *It is a fundamental intervention in the ecosystem that has implications for a wide range of plant species, vertebrate and invertebrate animal species and other lifeforms, soil development and hydrology, and possibly other effects unidentified!* This after all is an accepted view where populations of large herbivores are being managed whether it is elephants in the Serengeti National Park to buffalo in Yellowstone National Park in the USA

The management of deer has to be achieved through the actions of estate staff and cooperation between various agencies and other organisations and groups – indeed a diversity of stakeholders. Hence the operation couples a human and an ecological system. What the DCS and its partners are therefore involved in over much of the area is human ecosystem management and, given the extent of ground covered by deer forest, as mentioned in Section 4.3, human ecosystem management on a substantial scale. This is considered further in Section 7.0.

5.3 Impacts of Deer on Landscape

Wildlife is a major part of the attraction of Scotland for both tourists and residents and deer as an important and natural constituent of that wildlife are, in a sense, part of the landscape. Red deer in particular are probably the most striking terrestrial wildlife experienced by tourists and hence an important resource to the industry.

From the landscape point of view, the most important impact of red deer is that, over large areas of the broader Highland landscape, red deer and management for them, maintain an open, deforested landscape. Laying aside the debate as to whether this landscape should be fundamentally altered, this landscape has attractive features. While there is considerable debate over the desirability of this condition, or at least the extent of it, the resultant landscape is now globally iconic of the Scottish Highlands and features prominently in its attraction as a tourist resort. Various authors have commented on the qualities of that landscape.

The patchwork of rocks, heather, bracken, grassy flushes or other vegetation produces a subtle and every varying carpet of textures and hues that bring a detailed diversity to the landscape that more spectacular mountains like the Alps lack. Scotland is geologically very diverse and this in turn produces a wide diversity of hill and mountain ranges. There are few if any areas in the world than can equal that quality of “compact diversity” that the Highlands and Islands produce. Whether it is the cleanline curves of the Eastern Highlands or the more rugged ranges of the northwest Highlands, the deforested landscape reveals this diversity in both its detail and in its macro differences. Watson (33) considering this whole scene, states,

“This effect is enhanced by the pale northern light, with the long dawns, lingering sunsets, and afterglow of long evenings. The constant variation in visibility, induced by the humidity, and the drifting mists, and the above light effects ensure the scene is ever changing, like a kaleidoscope of colours, shapes and textures that never repeats itself. It is further enhanced by one other characteristic which I have come to appreciate about the Scottish scenery. We sometimes forget that the other half of any scene is the sky. As I have grown older I have come to appreciate the upper half more. I have a growing suspicion that Scotland may have the best skies in the world for the sheer diversity of colour and texture and panoramic quality in its cloud cover.”

The deforested state of the landscape also strongly effects that much debated question of wildness in the Scottish Highlands and Islands. Watson (34), commenting on this, states,

“The Scottish wilderness areas have been heavily modified by man. Most importantly, they are largely deforested and are lacking major carnivores and other species, leading to the development for example of moorland, a semi-natural habitat. They would not qualify as wilderness by North American definitions but would by Scottish concepts.

Wilderness experience tends to be a combination of a close relationship with nature, along with a parallel experience of the adventure and risks that close exposure to natural forces usually brings, often combined with adventure activities that involve additional risk such as rock climbing. Deforestation produces an open landscape that develops its own wilderness experience, providing a landscape of expansive vistas and open skies that become a major and ever changing component of those treeless panoramas. In a deforested landscape, the unstable and often hostile oceanic climate of the Scottish Highlands increases the sense of exposure to natural forces and indeed increases vulnerability to natural hazards such as cold exposure. It is something of an irony that a major human impact such as deforestation can this increase certain wilderness qualities.”

Regarding the impacts of deforestation, he states,

“Deforestation has had other impacts on recreational experience offered by such areas. Wildlife is an important component of the recreational experience of people like hillwalkers and also of the general tourists where they can see it. In the forested mountain areas of other parts of the world, considerable wildlife is present, but not often seen within its cover. In the deforested landscape of the Scottish highlands, the wildlife is highly visible. This applies not only to the larger animals such as the red deer, but to the smaller mammals such as mountain hares, and to bird life which, on the more fertile hills such a Morven between Deeside and Donside, can be almost prolific.

One other feature of the deforested landscape should also be mentioned. The landscapes shaped by glaciers and their meltstreams during the dominance of the ice and its retreat, are highly distinctive and are totally exposed in the deforested land. They encompass the ribbed hillslopes slit by parallel shallow gullies, the innumerable breast-like curves of glacial moraines, and easy graceful swing of the rivers and burns. On the open land, these are picked out in detail by the slanting rays of the sun and are collectively a major feature of the highland scene.”

However, over much of the Highlands and Islands, this deforestation has been carried to extremes, with impacts on tree and shrub cover that have been described in Section 5.1.1. Milne et al (22) review several studies that show that people are attracted to landscapes with partial but not dense woodland cover. Even scattered trees, as in parts

of the slopes above lower Glen Nevis can add qualities and diversity to a landscape without obscuring underlying features revealed by deforestation. In addition the trend towards grass-dominated vegetation produced by heavy grazing tends to erase the diversity of texture and hues of a more mixed vegetation, and hence undermine a key attractive feature of the Highland landscape. Such a vegetation pattern would also have greater general wildlife value which is again attractive to tourists.

As Milne et al (22) conclude, "There is a need, therefore, for landscape management to strike a balance between wild herbivore presence and visually diverse vegetation in the uplands. This requires not only increased understanding of the effects of herbivores on vegetation, but also increased understanding of public perceptions of both floral and faunal landscape components."

In general, although red deer grazing and muirburn maintain an iconic deforested, wild landscape that has important values for the highland economy, light to moderate levels of grazing would seem more suited to enhancing this landscape's values in terms of a diversity of vegetation and wildlife and of the presence of a significant woodland and scrub component.

5.4 Costs and Impacts of Deer Fencing

The effects of deer on young trees have necessitated the use of deer fences for the protection of young planted or regenerating forests and woodlands. Ratcliffe (35) commented on the limited effectiveness of deer fencing. He stated that deer would break through deer fencing because the incentive for them to do so was so strong and that snowdrifts sometimes covered them. He concluded that fences simply delayed colonisation of forests by deer and that "Within their existing range, it is not realistic to maintain large forests free of deer."

The deer fencing in turn creates problems such as the death of woodland grouse, especially capercaillie, flying into such fences, overgrowth of vegetation within the plantations, landscape impacts and restrictions on access for walkers.

The public cost of deer fencing is now well recorded, and available on request from FCS. Since the inception of the Scottish Forestry Grant Scheme on June 16th 2003, until 11 March 2005 the total fencing grant (establishment) paid has been as follows:

FCS conservancy area	Fencing grant aided (m)	Grant paid (£)
Highland	29,206	172,974
Grampian	9,213	43,280
Central Scotland	2,000	8,970
Perth & Argyll	8,688	46,011
South Scotland	10,020	41,381
TOTAL	59,127	312,616

These figures cover a period of nearly two years, and at the start of a new grant scheme, so they should be compared with other figures with due care.

A grant may also be given for the removal of deer fencing, and disposal of it to landfill. At about £1.98/m grant aid for this, the total public cost of removing the fencing described in the table above would be some £117,070.

A proposed SFGS application is only eligible if it allows for the sustainable management of deer, and fencing is approved only under certain conditions. Moreover, the Joint Agency Statement and Guidance on Deer Fencing (36) is clear that approval or financial support for fencing will be dependent on adverse effects being mitigated, and that impacts on the wider deer range, particularly adjacent properties and communities, has to be considered. In terms of reconciling public and private interests, the Joint Agency approach is clearly a way forward; although where fencing is entirely privately funded the non-priced public costs may not be considered.

Given the number of years that the Forestry Commission Scotland have been paying such grant aid, the cumulated cost to the taxpayer must be, to say the least, considerable. There are two points that seem to merit further consideration. One is that, if a considerable proportion of the public money available to support forestry is spent on deer fencing, then it cannot be spent on other silvicultural measures to support the production of quality timber or woodland habitat. Secondly, there is a curious anomaly here in that, boundary fencing costs between farms or neighbouring landowners are normally legally required to be shared between the two respective parties. In this case the whole cost is laid upon the one party, who is in turn financed by the taxpayer. In many situations, these, arguably, are exported costs of deer management on neighbouring land.

5.5 Road Traffic Accidents

Road Traffic Accidents (RTA's) involving deer may be partly the result of management regimes designed to achieve private objectives (density), public objectives (fencing to protect woodland) or, as seems likely, a mix of the two. There is no accurate historical data giving the number of accidents involving deer in Scotland. Estimates vary between 2,000 and 13,000 per annum. (37) The value of preventing accidents has been estimated by the Highways Agency as in Table 2.

Accident severity	Lost Output	Medical and ambulance	Human costs	Police cost	Insurance and admin	Damage to property	TOTAL £ June 2002
Fatal	479,750	5,400	952,100	1,460	230	8,550	1,447,490
Serious	19,520	11,700	132,820	200	140	3,890	168,260
Slight	2,320	980	11,030	40	90	2,300	16,750
All injury	11,410	2,520	41,050	90	100	2,600	57,760
Damage only					40	1,450	1,490

Table 2 Average value of prevention per accident by severity and element of cost

Source: Highways Economic Note 1 2002

NB –The Human Cost element in this table is estimated using the “willingness to pay” method, which can be inconsistent.

Even if one removes the “human cost” element from the table, the cost to society in general and to those directly involved is considerable. At least, the value of prevention of a non-injury accident in a rural location has been estimated at £2,060, more if the deer needs to be subsequently killed and the carcass destroyed. These accidents are not purely due to deer numbers but are caused, like all accidents, by a chain of events. Vehicle speed, changes in deer movement patterns related to fencing, reseeded verges

and overall deer density are all potential elements in the chain, and the question is where best to break it, given the balance of public and private costs involved. Certainly road traffic accidents are a negative diffuse deer impact, in all senses of the word, and the framework for managing them is already developing with the introduction of accurate record keeping (38), the identification of blackspots and consideration of appropriate education and signage for the drivers themselves.

Sustainable management of deer must consider such economic and social costs, which are considerable, and quantifiable in this case. Conclusions about the management of this situation are contained in the summary of research on this topic in the DCS's Annual Report of 2000-01 and we have nothing to add to the recommendations there.

6. CLIMATE CHANGE AND ITS IMPLICATIONS FOR THE MANAGEMENT OF DEER

6.1 General Comments

Any comments on this subject are presaged by two points:-

- 1) There remain scientific and other uncertainties about the full scale and nature of climate change, although there is an increasing consensus that it will involve raised temperatures with milder winters, and a considerable but slightly lower consensus that there will be an increased frequency and intensity of more extreme climatic events such as periods of sustained heavy rain. Such uncertainties, however, maybe reduced with further research and experience of real events. However uncertainty will not of itself remove the need for action.
- 2) If there is uncertainty as to the full nature of climate change, there is even more regarding the range and extent of ecological responses.

What is discussed below is simply some of the more obvious examples of impacts of climate change that do or will interact with deer management.

6.2 Some Implications of Climate Change for Sustainable Management of Deer

6.2.1 Soils

An important feature of Scottish soils is that they contain relatively high organic matter and hence fix large amounts of carbon dioxide. Peat, being almost entirely organic, fixes large amounts of carbon dioxide and hence the concerns raised in Section 5.1.3 about grazing induced peat erosion are particularly relevant to climate change.

6.2.2 Forestry and Woodlands

The capacity of forests to fix carbon dioxide is becoming a rationale for developing and maintaining forests and woodlands. The indirect but possibly important implication of this is that deer forests are maintained in deforested state and measures to increase carbon

fixation through forest and woodland expansion may well provide political pressures to reduce the extent of deforested land in this form.

6.2.3 Pests and Diseases

While there is at present little systematic research in this area, there is increasing experience to indicate that milder winters are failing to eliminate overwintering stages of some parasites with important results for land uses. Ticks are being found to be present on their “home range” in increased and increasing numbers and to have moved perhaps 300ft higher than the normal maximum altitude at which they were found. This, through the impacts of tick-borne diseases, will impact red grouse populations, including on some higher moors, which have previously been too high for tick infestations. Threadworms are also reported to have increased in numbers with increased grouse mortality. If grouse moors become less economically viable, and their management abandoned or reduced, this might well have implications for deer range and numbers – for example if tree cover re-establishes itself in such areas landowners may need to make changes in land use.

6.2.4 Slope Stability

Recent events, in which major transport routes have been blocked by landslides during major heavy rainstorms, have indicated that slope stability, at least along transport routes, is likely to become increasingly important. Slope stability may also prove to be more important where steeper slopes lie above rivers, as landslips can dam rivers in these situations, leading to dangerous buildups of damned water. Such dramatic events are triggered by major storms but often behind the event is some sustained influence like heavy grazing that progressively weakened the inherent stability of the slope.

6.2.5 Bank Erosion

As mentioned in Section 5.1.3 there is increasing appreciation of the links between heavy grazing of the riparian zone, bank erosion, and the negative impacts of this on river widening, damage by eroded material to fisheries, and other ecological effects on river wildlife. The process of watercourse widening in the Lake District for example, due to heavy bankside grazing by sheep, has reached the point where substantial lengths of hill beck no longer flow on the surface. Increased frequency of heavy rainfall, when the great majority of such erosion occurs, may mean greater attention must be paid to establishing riparian woodland and scrub mainly through control of grazing pressures to maintain bank stability,.

6.2.6 Deer Numbers

It has been suggested that deer numbers may increase due to lower mortality and higher fecundity associated with milder winters and an increased period of herbage growth.

6.3 General Implications of Climate Change for Sustainable Deer Management

An interesting example of the possible implications of climate change comes from current work on the Bassenthwaite catchment in the Lake District which experienced 72 landslides, large and small, in the winter of 2004/05, during heavy storm events. This has led to studies of terrain to identify vulnerable slopes which it is then intended to convert from open hill to native woodland. The storm events which triggered such landslides also caused the great bulk of the erosion of sediment that entered the river system and now appears to be causing irreversible ecological damage to the ecology of local lakes.

In general, there seem four points that emerge from the present situation regarding climate change :-

- 1) Climate change may precipitate significant changes in land use, for example through indirect impacts on grouse populations.
- 2) It is likely that considerations of factors like management of soil erosion and slope stability will advance arguments in favour of limiting grazing pressures in certain situations to moderate levels.
- 3) The uncertainties surrounding the issue of climate change and its implications, alongside the need to take action despite this, will require DCS to make intelligent and measured use of the precautionary principle in defining sustainable management of deer and in formulating policy.
- 4) A major influence on DCS policy may well emerge through the development of central government policies on ameliorating the extent and impacts of climate change, as these will in part focus on land use and land management. The recent report of the Environment and Rural Development Committee (39), and its recommendations, are indicative of this.

7.0 Considering DCS Policy and Approach to Deer Management

DCS has mapped out its Long Term Vision for deer management in Scotland (Box 4). In its Long Term Strategy (40), produced in 2001, it set out how, basically, it intended to fulfil that vision. The main strands of that strategy are to base their approach on broad public policy, focus on deer populations at the local level, and to employ its compulsory powers only where these measures failed. The Commission will make use of the provision of information, training, advice, and research in these efforts. It intends to focus on key problem areas as priority areas for action. It would promote partnership approaches at all levels including the national level through the use of a Deer Round Table, at local level through Deer Management Groups, and at even more detailed levels such as individual forestry schemes. It is a much more focused, structured and prioritised approach than that of its predecessor, the Red Deer Commission.

It is helpful to look at the situation the DCS is facing through the “prisms” of several different well established approaches used elsewhere, namely those of an Extension Programme, as an exercise in Natural Resource Management, Social Learning as an approach to solving such problems, and of Human Ecosystem Management, drawing on guidance from these fields of work.

7.1 DCS’s Long Term Vision and Strategy as an Extension Programme.

The Deer (Scotland) Act of 1996 equips the DCS with certain statutory powers to control deer where they are causing unacceptable damage to agriculture, forestry or the natural heritage. In the past the DCS and its predecessor, the Red Deer Commission, has not used its powers under Section 8.

The changing scene is now making the use of DCS’s powers more likely. Non-coercive approaches are still an important part of the approach of DCS and have been highly developed in various fields including agriculture and rural development, where it is

known as Extension, and it is worth looking at the DCS's present strategy in the light of insights from Extension programmes.

7.1.1 Designing Extension Programmes

In pursuing a non-coercive approach, one is attempting to persuade target group or groups of people to change their behaviour voluntarily. Key questions at the start of any such programme and before it is designed, include "Why do the people concerned behave as they do?" and "Why, if the newer pattern of behaviour is desirable, do the groups targeted not simply adopt the better practise without outside intervention?" (After all, human beings are intelligent and generally good at learning.) What are the constraining factors? What would change behaviour?

Looking at the DCS Long Term Strategy, what is striking is that there is, on the one hand, a defined starting point of the present situation, a problem statement, and on the other both a very generally defined end point and a programme of non-coercive measures including education, training, research and monitoring of deer numbers intended to bring matters to that endpoint. But there is no analysis providing answers to the above key questions that would connect the one to the other, would identify peoples' reasons for their current practice or what would change it. Without answers to such key questions, it is not possible to design a programme of non-coercive measures that is likely to succeed. For example, underlying such actions as the provision of information on best practice lies the assumption that the constraining factor is lack of knowledge, but this is not necessarily the case. Dealing with tasks such as deer management involves the coupling of a natural system and a human system. Knowledge of and insight into the human system is as important, indeed often more important, than into the natural system, but research gets focused exclusively on the natural system and the problem treated as one of simply deer management.

7.1.2 Speculating on the Constraints on Progress

It is not possible, within the constraints of this report, to fully explore the situation but, to demonstrate the above point, it is worth speculating briefly on what the constraining factors might be and the possible implications of this.

In 1986, the then Red Deer Commission and the British Deer Society, in the face of mounting concern over deer populations and impacts, organised a conference called "The Changing Scene." It contained a series of informative papers, including a remarkably frank and insightful contribution by Lord Strathnaver of Sutherland Estates speaking from inside the situation (41). He poses the question, "Can sporting estates survive in the face of these criticisms and accompanying pressures for their abolition? Should they survive at all? Do they contribute to the Highland economy or do they not?" He responds, "In 1978 my answer would have been an emphatic yes; it is now a guarded yes. Before it becomes emphatic again, many changes will have to take place, not least peoples' attitudes."

In the same publication, Keysell (42), of Highland Venison Marketing, is scathing in his criticism of the condition of venison reaching him from estates and H Oliver-Bellais (43), as Chairman of the British Deer Society, is emphatic in his summing up on the key importance of cooperation between parties.

Nearly two decades later, there has been change in the situation, but what is striking is how little change. The system is remarkably resistant to change under present circumstances. The same problems of marketing venison were raised and restated at the workshop held under this study in 2005. The same problems were presented to us in interviews carried out for this report. For over 150 years management of the vegetation as a habitat has been fundamental to the whole enterprise, as with any livestock based

system for wild or domestic animals. Notwithstanding, researchers and others still find that many stalkers, although knowledgeable on such topics as the behaviour of deer, still cannot recognise degradation of habitat by excessive deer grazing. Muirburn has been practised in the Scottish uplands for centuries. Over such a period, in nearly all societies, indigenous knowledge on such a practice would be expected to produce high skill levels, but despite the benefit of significant scientific research into muirburn, badly practised muirburn remains an issue.

The study of the effectiveness of Pilot Deer Management Groups by the Macaulay Institute (44), while acknowledging some benefits of planning by these groups such as highlighting issues needing addressed, concluded:-

- “• Few set out their programme of action in the detail necessary to provide the basis for monitoring progress and achievement, or with regard to providing a transparent audit trail of their activities.
- None provides a comprehensive and coherent analysis and formulation of a collaborative/integrated approach to deer management in relation to other land use objectives.
- There is little evidence available to suggest that, so far, the pilot DMPs have had a direct influence on the management of red deer. None of the DMG representatives was able to identify a specific practical or economic benefit that had arisen from the production of a Deer Management Plan.”

Placed alongside the legal situation of deer in Scotland, it is not surprising there are problems in changing the situation. Adopting an approach to sustainable deer management focused on broad indicators, will involve much loss of control by landowners and their agents. Deer under Scots Law are not the property of any individual or group. They are “*res nullis*”, a common property resource, in so far as any wild animal can be “owned.” The right to hunt them may be legally vested in particular landowners, but the right to manage the population at large to achieve a more sustainable, balanced outcome of benefits and disbenefits, is vested more widely in society, hence the existence of the DCS! Despite this, as Callander and Mackenzie (47) point out in their report on the management of wild deer in Scotland, considering the spectrum of control of deer management between the state and private landowners, Scotland is at the extreme in of the spectrum placing control almost entirely in the hands of landowners. As Lord Strathnaver put it (41), speaking of management of deer numbers, “Continental friends are astounded at the power of Highland landowners who decide their own quotas and at the overall lack of government control over the number, age, sex and location of those shot.” Wightman et al (11), summarising the reasons given by sporting estate specialists for owning a Highland estate, cited owning a “private kingdom”, status, seclusion, and capital investment as important as hunting.

The point about this speculation is that the motivations and “yields” surrounding management of a deer forest are a melange of reasons for owning a sporting estate, elements of the hunting economy and of recreational deer hunting. There are strong indications that the limiting factors on change and innovation are largely not lack of knowledge but social and cultural ones that inhibit learning including skills development. But the DCS research programme focuses almost entirely on technical or scientific aspects of situation. It contains no social research to identify the main constraining factors. If social and structural factors are the chief constraints to learning, then extension efforts based on provision of information such as guidance on good practice miss the main point.

7.2 DCS's Long Term Vision and Strategy as a Classical Problem of Natural Resource Management

There are now many examples in the world of complex problems of natural resource management. The natural resource may be a marine area, forests, mountain ranges, or soils. Despite the huge differences in focus, the problem of deer management in Scotland has much in common with other problems of natural resource management such as water in the Netherlands, forests in the Alps, or soil erosion and salination in Australia. Water management is emerging as possibly the most complex and urgent of these situations. They are a difficult meld of the management of environment and human beings that takes the form of "human ecosystem management." The ecological aspects of this vary enormously depending on the resource being considered, although there are important strands common to all natural resources. The processes and indeed the "pathology" of the human element, however, are remarkably consistent from one situation to another, although there are important variations depending on the local cultural, historical, and political situation.

Jiggins et al (48), surveying global trends in environmental management, identified six elements of response to the general situation that were almost universal. They were :-

- From planning to building a consensus for action.
- From expertise to facilitation.
- From information/technology transfer to knowledge management.
- From clients to partnerships.
- From autonomous enterprises to networks.
- From hard to soft systems.

The DCS's strategy already encompasses several of these features including trying to build consensus for action, working through a partnership approach, and establishing networks such as the Deer Round Table. In having to integrate the management of the "hard" system of deer and their range, with that of the human element, it is moving to the management of a "soft system," that is one that encompasses both the human and "natural" constituents. The other issues regarding facilitation and knowledge management are discussed later.

Each of these six trends is incorporated in the activities of a phenomenon that is emerging in the management of natural resource problems globally – that is the creation of "platforms of stakeholders" who jointly approach the problem and attempt to move towards a more sustainable and equitable solution. Stakeholders may be defined as group, agencies, or individuals who are affected by the issue, or have power to aid or obstruct solutions. A platform may be defined as a formal or informal grouping of stakeholders cooperating to resolve the issue. DMGs are clearly examples of such platforms, strongly indicating that this part of the DCS's strategy is correct. There is clear evidence from the management of such problems across the globe that, while some elements of standards and policy need to be resolved at a national or higher level, they also need to be resolved on the ground at a local level by negotiation among stakeholders. In other words, there is a need for platforms to operate at different scales, as envisaged in the DCS's Long Term Strategy. The more locally focused DMGs may deliver the policy on the ground, but the nationally focused platforms need to tackle specific overall tasks. Thus, the Deer Round Table, and the Deer Interagency Liaison Group, need to include among their functions the identification of key indicators of

sustainable deer management, the identification of research needs, and advice on training needs of stalkers and others.

Such processes are seldom easy. Campbell (49), who had much experience of natural resource negotiations in the Australian Landcare Movement, declared, "Resource negotiations almost inevitably involve clashes and struggles between conflicting interests, between alternative worldviews, between those comfortable with the status quo and those trying to change it, between diverse actors with differential power and access to resources. Getting the appropriate actors around the table to improve resource management and hopefully sustainability is difficult enough, as already-powerful actors are rarely interested in sharing power. Engendering a situation where actors can participate as equals would seem even harder."

7.3 Social Learning as an Approach to Natural Resource Management

Platforms of stakeholders do not start from a situation where they know either the solution, or can definitely predict the results of their actions. Rather, they jointly learn their way towards more sustainable solutions. Such joint learning has been variously termed "co-learning" or "social learning" and is termed here Social Learning. Leeuwis (50) summarised the levels of social learning as :-

- 1) Single loop learning – Learning how to do things better within the standard framework of values and norms of participants that underlie current practices.
- 2) Double loop learning - Where participants must let go of basic certainties, goals and values they acted on previously.
- 3) Triple loop learning – Which is essentially learning about learning- short questioning and reorganising how learning is organised.

Despite the conclusions of the Macaulay study of pilot DMGs, there are several examples of successful DMGs we have encountered in our investigations. The successful operation of Birse DMG as part of the Eastern Cairngorms Management DMG is explained in Box 5 and the approach of the landowning group centred around Glen Feshie in Box 7.

O'Leary et al (51) reviewing the resolution of environmental disputes, found that they are most likely to be resolved if:-

- 1) "There are a manageable number of identifiable interests.
- 2) There are a no major issues that involve scientific uncertainty.
- 3) The core dispute raises no fundamental value or symbolic issues.
- 4) The parties are able to achieve a level of trust and a sense of shared purpose
- 5) There exists a rough parity in relative power among participants."

The situations in Glen Feshie and Birse seem to fit these five requirements. Apart from one sporting estate landowner in Glen Feshie, who was happy to have a smaller number of shootable stags for his recreational purposes, none of the landowners concerned in In In Birse, none of the local landowners had deer as the major part of their enterprise, and in Glen Feshie, a landowner wanted only recreational hunting and found a reduced yield of stags acceptable. In discussions with local parties and woodland managers in Dumfries and Galloway we found deer management had reduced numbers there to the point where protection is not necessary to establish woodlands. Here too, there are no landowners for whom deer stalking is the major part of the land use pattern. However,

Box 7
Management of Red Deer in Glen Feshie

The control of deer numbers in this area is part of a combined effective effort of several landowners including the private landowner of Glen Feshie Estate, the Forestry Commission Scotland, Scottish Natural Heritage, and the National Trust, which owns Mar Lodge Estate.

Prolonged conflict has existed in Glen Feshie between red deer management for a sporting estate, and the interests of nature conservation as the Caledonian Forest has failed to regenerate due to grazing out of seedlings by red deer. Other more extensive damage has undoubtedly occurred to the wider habitat. The regeneration of pine and other seedlings in Glen Feshie has been more vulnerable because most of the mature native forest grows in the narrow floor of the glen. In winter, hard weather drives deer down into this confined sheltered area and a whole year's crop of seedlings can be devoured in a comparatively few days by the many deer.

Management Proposals :-

Specifically, the management proposals for Glen Feshie estate involved the following :-

- 1) The area has been divided into five subunits, for management purposes.
- 2) Within each area, accurate deer counts have been made and targets set for their reduction within stated times.
- 3) Arrangements are in place to assess progress towards a total estate population of 1050 deer.
- 4) Management success or failure will be measured by a monitoring scheme designed to measure habitat response. – tree regeneration is a significant indicator.
- 5) Since deer are unaware of estate boundaries, the exercise on a joint estate basis with the estates of Glen Feshie, Mar Lodge, FCS, and SNH which share boundaries with Glen Feshie. A dialogue continues with the National Park and other neighbouring estates.

Background :-

These arrangements have been made possible by a combination of factors :-

- 1) The Glen Feshie Danish estate owner agreed to reduce the sporting stag objective from 150 to 80 so the total deer population can be significantly lowered to meet a new target. He is also willing to fund and support his staff. At present it costs approx £300K per year to operate the estate apart from funds generated stalking.
- 2) The NTS ownership of Mar Lodge; the indecision regarding the future of the NNR designation; the successful tree regeneration SNH demonstrated on Inshriach outside exclosures, and high commitment from FCS to control deer on their land.
- 3) The Cairngorms National Park's involvement
- 4) The factor, who was born, reared, and educated locally, is determined to pursue this policy, and advocates transparent decision making!
- 5) The DCS's strongly supportive stance.

If reduction to the new deer population targets does not lead to the regeneration of the pine forest, then the question arises as to how low a harvest of shootable stags the Danish owner will accept before the ownership of a highland estate is not worthwhile.

there is a perceived shortage of opportunities for recreational hunters to pursue their hobby.

In many other DMGs, acting as stakeholder platforms, this condition would not apply and it is important to deal with these issues.

A major issue is the question of power balance within stakeholder platforms. DMGs generally do not include stakeholders who represent public interests in land such as biodiversity, hydrology and landscape. Thus, important perspectives are missing from the dialogue, and important stakeholder groups are disempowered. Platforms of stakeholders need representation of all major stakeholders to function successfully and there is a need for stakeholder representation within DMGs to be expanded to include such interests.

Considering the question of fundamental value or symbolic issues, we have already indicated in Section 7.1.2 that these almost certainly exist. Annex 3 tables the stated perspectives of a range of major stakeholders or those with a general interest in deer management. The wording of remits and perspectives is drawn entirely from literature produced by the organisations concerned. On the face of it, there is much held in common between diverse interest groups and agencies, but the differences in values and perspective between stalkers, environmentalists and hydrologists for example towards red deer are great.

Considering Leeuwis's statements on learning, successful examples of DMGs quoted seem to have required only single loop learning. Double loop learning is more difficult and also, often, more threatening and is what is required in the situations of many DMGs. Driving it requires a strong motivation for stakeholders to change values, attitudes and even roles. It is increasingly being driven by the changes outlined in Situation Analysis (Section 4), and the threat of legislative powers being created to enforce adequate deer culling. Triple loop learning is a capacity that stakeholder platforms can develop – but usually only over a more prolonged period.

Social learning also requires good facilitation. There were strong indications that the successful development and operation of the Birse DMG partly owed its success to effective facilitation by the local FCS District Officer. Facilitation, as a branch of process management, is a distinctive set of skills, and its cultivation should be part of DCS's Long Term Strategy.

7.4 DCS Long Term Vision and Strategy as an Exercise in Human Ecosystem Management

O'Leary's condition for successful environmental dispute resolution that there should be "no major issues that involve scientific uncertainty" was optimistic, for reasons that various authors have explained. Platforms in the situations of DMGs actually function at the level of ecosystem management and hence encounter the problems of complexity and risk. On complexity Roling and Jiggins (52) state that,

"Ecosystems function as a huge range of lifeforms, other solid features, and cyclical and linear processes. Within our current capacities at least, it is impossible to identify and understand more than a small fraction of what is present or happening within them at any one time. They are not just complicated. They are complex; that is to say they are to a considerable extent unknowable. On top of this they are now under the influence of

and linked to a highly diverse mix of human interventions on a global scale, which profoundly alters them and adds to the complexity”.

To put it simply, no matter how much research we do into deer management and their impacts, no matter how much experience we accumulate on the ground, our knowledge will always be partial, indeed very partial. This has important results for how we approach such situations. It raises the key issues of uncertainty and risk. Summarising this, Roling and Jiggins (52) state:-

“An important result of this situation is that we cannot be certain as to the results of human intervention in ecosystems, as occurs in water resource management. Ecosystems spring ‘surprises’.”

Jiggins et al (53) explore this in more detail, pointing out that what continues to inform much of western science and public policy is the assumption dating back to at least the time of Pythagoras that if the “facts” are clearly established, in this case by science, then the “right” solution is apparent. They state this in terms of a “simple and unambiguous relation between the True and the Good”, the first leading directly to the second. This is worth taking note of, as the beliefs and model underlying much of the research pursued on deer populations and biology, and their impacts on habitat, may be just as this.

What we now know about ecosystems emphasizes the importance of uncertainty and risk. Morris et al (54), in considering ecological constraints in sustainable management of natural resources, summarised it clearly, stating,

“Ecosystems are assumed to change over time towards a natural climax state, depending on climate and geology, that represents ‘good ecological status’ in the Water Framework Directive. It is now recognised that ecosystems can exhibit different patterns of behaviour including succession to a climax, cyclical change between different states, or chaotic change. Many factors change continually as a result either of ecosystem function or of human activities.”

Placing all this in the context of DMGs, as platforms of stakeholders, what needs to happen is that, through dialogue and action, stakeholders explore each others’ perspectives, exchange bodies of knowledge, create joint models of the problem and the resource, and explore options for solutions. Because the results of interventions in ecosystems are not entirely predictable, management is adaptive and the key question is not what is the final solution but what are we going to do next? That is to say, an action to intervene in the resource is taken, the results monitored, and praxis adjusted in the light of this.

Within this platform based situation, as pointed out above, the role of science and research has to be clearly understood. Funtowicz and Ravetz (55) have discussed this. Classical science has been about exploring a subject objectively and rigorously to provide accuracy of understanding and hence predictability of results of an action such as an intervention in an ecosystem. They point out however that in these situations,

uncertainty is high in the face of complexity, we always have partial knowledge, and hence risk is always present. The different stakeholders have different values and interests. They have described the science practised in this situation as "second order science" while not meaning to devalue either form of science.

Scientists in these situations must work closely with stakeholders, help them with such insights as research can provide, but cannot provide total insight into problems, or reliably predict the results of many interventions.

7.5 General Summation of Conclusions Derived from Considering Different Approaches to Deer Management

In situations like local control of roe deer numbers, or limiting the spread of sika deer, DCS probably has to take a simple problem solving approach, but in a situation like red deer management on their home range, especially within deer forests, it has to focus on improving whole systems. The spread of actions within its present strategy reflects a move towards such an approach.

DCS is relying mainly on a non-coercive approach at present. Looking at the strategy as an extension effort therefore, it is noteworthy that the strategy defines problems, and identifies solutions, but has no connecting analysis of causal links that demonstrate that the solutions fit the problem. Solutions like the provision on Best Practise Guides seem based on the belief that the constraint on progress is lack of knowledge, but there is significant evidence that the constraints are organisational and social, leading to a low capacity to innovate and hence to learn. DCS research needs to have a social parameter that investigates these aspects.

Experience from the field of natural resource management demonstrates that the use of platforms of stakeholders at national and local scales are important in solving such problems and hence the DCS strategy of developing Deer Management Groups at a local level and having platforms such as the Deer Round Table at a national level is correct, but it is important for the full range of stakeholders who reflect the full range of public and private interests to be represented on these bodies, not just landowning interests.

Research into the development of successful platforms shows that such bodies seldom start out with ready made solutions but learn their way to them through a process of social learning developed through joint management actions and aided by skilled facilitation.

In the situation where management is basically intervening in a human ecosystem, that is in a coupled human and "natural" ecosystem, then the problem of complexity enters into the situation. The results of interventions are uncertain, science can supply guidance but seldom reliable prediction of the results of interventions, and management has to be adaptive with action revised in the light of the monitored results of interventions.

There are a number of authors who have studied the effective operation of stakeholder platforms in these contexts (56) and several texts that deal with the subject more broadly (57, 58,59) and which are worthy of study.

8.0 Conclusions and Recommendations

On the ground, the management of diffuse impacts of deer cannot be separated from the management of other impacts by deer and hence what follows applies broadly to deer management. Looking broadly across this report, the following general recommendations can be made :-

- 14) The expansion of red deer range is likely to produce increasing conflicts.
- 15) Concern over the perceived expansion in numbers of deer and their range, especially red deer, and their impacts, has to consider not so much what the situation is now, but what it might be in ten to twenty years if effective action is not taken and, for example red deer colonise the lowlands, or continued with strong impacts on parts of their current range.
- 16) The importance of emergent land uses and ensuing environmental legislation show that sustainable management of deer must be defined broadly in a manner that take the public interest and public goods in land into account,
- 17) These phenomena and major political changes such as devolution indicate that there is limited time for voluntary solutions and that, for those involved in deer forests or where deer are the dominant large herbivore, the core task is the renegotiation of a more acceptable contract with society.
- 18) If, as some evidence suggests, moderate to low grazing intensities provide advantages to the natural heritage and some landscape parameters, then pursuit of such grazing levels would be important.
- 19) The likely impacts of more than moderate grazing levels on general biodiversity, soils, and hydrology show that the best indicators of sustainable deer management are the condition of the vegetation and of general biodiversity, and impacts on ecological processes, not deer numbers, which seem not very useful indicators, although they are an important indicators of cull targets.
- 20) In general, DCS should perceive their task, in areas where deer are the dominant large herbivore, not as one of regulating populations to achieve a balance of land uses, but one of human ecosystem management in which a human and a “natural” system are coupled and knowledge of both is important.
- 21) The impacts of climate change are as yet uncertain but DCS may well have to take greater account of certain aspects such as slope stability, soil erosion within the riparian zone with resultant damage to fisheries and freshwater ecology, and changes in land use patterns.
- 22) Looked at as an extension programme, the DCS’s strategy correctly makes an attempt to improve a whole system where it is addressing areas like red deer control in the Highlands and Islands. However it needs to do social research to

establish links between the stated problem and the solutions to ensure its measures will be effective.

- 23) Regarding the problem faced by the DCS as one of natural resource management, the DCS correctly is developing DMGs as platforms of stakeholders to address problems at the local level and other bodies to address them at the national level. There needs to be appropriate functions for the platforms at the national level and at the DMG level and they must have the full range of stakeholders represented on them if they are to be effective.
- 24) Such platforms have to learn their way to solutions, but there is evidence on the nature of the major constraints on this that such learning will require changes in values, basic beliefs etc by key stakeholders and will take time.
- 25) Successful platforms need skilful facilitation and the DCS needs to consider how this should be provided.
- 26) Because of the problem of complexity in ecosystem management, management of deer populations has to be adaptive, with scientific research providing guidance but seldom totally reliable prediction of the impacts of management interventions in the situation.

Annex 1

Significant Statements from Legislation and from Scotland’s Biodiversity Regarding Deer Management

Source	Section	Quotation	Comment
Nature Conservation (Scotland) Act 2004	Section 1(1)	“It is the duty of every public body and office-holder, in exercising any functions, to further the conservation of biodiversity so far as is consistent with the proper exercise of those functions.”	Under the same section, the Act requires that they must have regard to any strategy designated under the Act, as well as the United Nations Environmental Programme on Biological Diversity.
	Section 2 Scottish Biodiversity subsection (1)	The Scottish Ministers must designate as the Scottish Biodiversity Strategy one or	See sections below for the relevant sections of the Scottish Biodiversity

		more strategies for the conservation of biodiversity.	Strategy.
“Scotland’s Biodiversity” as prepared by the Scottish Biodiversity Forum.	Page 7 Para 2.3 Common Issues	The common issues identified include: - 1) Promoting biodiversity as a key consideration of all proposals, plans and policies. 2) Taking account of the Scottish Priority Species and Habitats Lists 3) Incorporating the Ecosystem Approach	
	Page 7 Para 2.4.1 Promoting biodiversity as a key consideration for all proposals, plans and policies	This paragraph draws attention to the role of Strategic Environmental Assessment in assisting the integration of biodiversity into policies	
	Page 9 Para 2.4.6 Taking steps to Address Climate Change	Notes the need to identify measures and actions which can help mitigate against and adapt to climate change within a biodiversity context.	
	Page 9 Para 2.4.7 Genetical Biodiversity	The Convention on Biodiversity requires us to conserve genetic diversity and therefore needs to be an important component of the Scottish biodiversity activity.”	
	Page 10 Para 2.4.9 Incorporating the Ecosystem Approach	The ecosystem approach is quoted as “---a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way.”	

	Page 32 Para 5.2.2 Uplands and Mountains	“The vision for uplands and mountains is to enhance the ecological resilience and natural processes operating at a landscape-scale in order to maintain or enhance mosaics of semi-natural upland habitats that will be able to adapt to climate change and socio-economic change and still retain their characteristic species.”	
	Page 34 Para 5.2.4 Woodland and Forestry	“The key aim for the Forestry and Woodlands sector is to conserve and enhance biodiversity by strengthening the role of natural processes within Scotland’s forest and woodland resource. This means taking action not just for species, habitats and special sites, but also focussing on restoration, expansion and habitat network development at a landscape scale.”	
	Page 45 Para 4.5a	DCS completes review of their capacity and responsibilities to further biodiversity conservation goals in light of the Nature Conservation (Scotland) Act 2004 and the Deer Act Scotland 1996	To be completed by 2006. DCS the lead agent
	Page 45 Para 4.5b	Report prepared investigating ways to enhance efforts to	To be completed by 2007

		manage deer populations in ways consistent with biodiversity objectives and the achievement of woodland Habitat Action Plan targets for expansion, restoration and improvement.	DCS the lead agent.
	Page 49 Para 5.9	Research to be undertaken into the nature of environmental change affecting biodiversity values in the uplands – especially grazing intensity by different species and other factors.	This is to include a prioritised and co-ordinated research and dissemination strategy relating to biodiversity in the uplands. SNH the lead agent

Annex 2

Brief Description of Work on Deer Grazing and Impacts at Macaulay Institute for Land Use

(Courtesy of A Nolan 3.05.05)

RAPID IMPACT ASSESSMENT METHODOLOGY

This work has used an approach based on field sampling of the impacts of grazing and trampling on $\frac{1}{4}$ km² sample areas, combined with modelled prediction of impacts to assess the impacts of larger herbivores on the vegetation/soil complexes of heather and blanket bog mosaic, undifferentiated heather moor, blanket bog and other peatland vegetation, blanket bog and heather mosaic, and montane vegetation (Macaulay Institute, 1992). The validity and accuracy of the modelled predictions of impact have been tested, based on full-coverage surveys of Deer Management Group areas (Nolan et al, 2003; Brewer et al, 2004) and the relationship between sample size (in terms of % of the area sampled) and accuracy of prediction have been determined. This has demonstrated good correlation between field surveys and the GIS model-based predictions. About one third of DMG areas have now been assessed that way.

The work has demonstrated that general pattern of impacts in any particular area is related to the numbers, distribution and type of herbivores present, and to the grazing quality of the vegetation, determined primarily by climate, geology and soils. Other influences, notably slope, altitude, aspect, shelter, heather burning and management also have an effect on impacts.

Light and Light-Moderate Impact Classes were recorded principally on the less-preferred vegetation categories of blanket bog and dwarf-shrub heath. The heavier impacts (Moderate, Moderate-Heavy and Heavy) were generally associated with grassland vegetation, and mosaics of heath and grassland. This reflects the relatively high grazing value and attractiveness of such vegetation to grazers.

Grassland vegetation is generally more tolerant of heavier impacts than dwarf-shrub heath, blanket bog or montane vegetation. However, some of the heaviest impacts recorded were on mosaics of heath and grassland, and it is in these areas that there is the greatest likelihood of decline in heather cover through time.

In areas where both sheep and red deer were present, impacts were generally higher compared to areas with red deer only.

Sustainable Use of Vegetation Types

Examining the levels of utilisation of shoot growth is one of the primary indicators of the impact of grazing on heather vegetation. Ideally, this should be carried out in late-spring – early-summer prior to commencement of growth, when the impact of grazers over the previous twelve months on one year's growth of heather shoots can be assessed most readily.

A combination of cutting and grazing experiments on heather in north-east Scotland have shown that young heather on dry moorland can tolerate removal by grazing of up to 40% of the current season's shoot biomass without an effect on the productive capacity of the heather in the following season. Heavier grazing, with removal of 80% of current season's shoots, resulted in the death of some shoots, a decline in stand density, the appearance of bare areas and, after five years of such grazing, a reduction by 40-50% in the production of new shoots in a sixth, ungrazed season (Grant et al, 1982). Grazing intensities that remove more than 40% of current season's shoot

biomass of heather stands in their pioneer or building phase may be assumed to be detrimental to the future productivity of highly productive dry heather moorland. For dry and undifferentiated heath vegetation of late-building to mature stand age, dominated by intermediate and older heather, Grant and Armstrong (1993) suggested an upper limit of 10% utilisation of annual shoot production to maintain heather cover in the long-term, though experimental evidence to support this is not available. Older heather, with its lower proportion of green shoots to wood, is less tolerant of grazing than younger heather and takes longer to recover from heavy grazing. Grant and Armstrong (1993) also suggested an upper limit of 15% utilisation of annual shoot production to maintain heather cover on blanket bog vegetation.

The link between the field assessment of impacts and such experimental data on sustainable levels of heather utilisation is made through the field indicator for percentage of heather shoots browsed. Here the levels of 33% and 66% of heather shoots browsed, representing the boundaries between the Light and Moderate, and Moderate and Heavy categories, equate to levels of 20% and 40% utilisation of annual shoot production, respectively (Armstrong and MacDonald, 1992, MacDonald et al, 1998). Thus, for younger heather, Light and Moderate impacts may be regarded as sustainable, but Moderate-Heavy and Heavy impacts may result in a decline in heather productivity and cover in the long-term. In comparison, for older heather, and blanket bog where heather is less vigorous, Light and Light-Moderate impacts may be considered as sustainable, but even Moderate impacts may result in a long-term decline in the heather resource.

In contrast to heather, smooth and coarse grassland vegetation types are able to sustain higher levels of utilisation (60% and 30% respectively) without an adverse effect on stock-carrying capacity. Areas of smooth grassland are generally the most preferred grazing resource in any such open hill situation, attracting heavy grazing pressure throughout the year. Indeed, heavy grazing may maintain such areas in a productive state, though short sward heights are generally associated with sparse or no flowering of grasses and small herbaceous species, with a consequent reduction in the nature conservation value and biodiversity. In relation to coarse grassland, particularly *Nardus*-dominated areas, it is generally the more-palatable inter-tussock grasses, sedges and herbaceous species that are grazed in preference to *Nardus*. Where dwarf-shrub heath occurred in mosaic with grassland, impacts were generally considered to be unsustainable in the long-term from the point of view of maintaining cover of heather and blaeberry. This situation was encountered in a number of localities throughout the DMG area, although not on an extensive scale. However, it is at these interfaces of heath and grassland where there is a generally higher risk of loss of heather cover than on areas of continuous heather. Moreover, the practical issues associated with reducing impacts on such areas are problematic in themselves because of their inherent attractiveness of such vegetation to larger herbivores.

Assessing impacts on montane vegetation presents some difficulties because the vegetation is by nature suppressed due to the prevailing harsh climatic conditions, there are limited indicators that can be used, and recovery from grazing and trampling is slow. Also, there is the contrast between wind-clipped heath, dominated by heather, and grass-sedge-moss wind-clipped heath, dominated by more palatable species. Such areas provide an attractive grazing resource during the summer months, particularly when biting insects cause a nuisance at lower altitudes, but heavy impacts can lead to change in species dominance. However, as has already been indicated, such vegetation will invariably attract herbivores and be relatively heavily grazed, irrespective, to a certain extent, of overall herbivore densities. It is highly likely that the patterns of impact recorded in the montane areas are well-established, unless there has been considerable change in management practices in relation to sheep grazing, or changes in herbivore numbers in the recent past.

Thus, high impacts are not simply a function of overall deer (and other herbivore) populations, but also partly a reflection of the complex interactions between the requirements of animals for grazing and shelter, the available habitat, and human factors such as culling, disturbance and the management of domestic livestock.

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Annex 3

STATED REMITS AND PERSPECTIVES OF SOME STAKEHOLDERS AND ALSO PARTIES WITH A GENERAL INTEREST IN DEER MANAGEMENT

Agency or Organisation	Relevant Remit	Perspective
Deer Commission Scotland	Furthering the conservation, control and sustainable management of all species of wild deer in Scotland	Commitment to identify areas where serious damage by deer is occurring, to stimulate effective local deer management in these areas and to develop effective techniques for deer management.
Scottish Natural Heritage	To work with Scotland 's people to care for our natural heritage.	SNH has the opportunity to drive forward the joint working Approach (ministers' preferred means) of trying to reconcile public and private interests in the management of deer. If, within the 3 year term of the DCS Board which has just taken up office, joint working is not making significant progress in reducing the damage to natural heritage caused by deer, SNH will not be alone in calling for a new legislative framework.

Forestry Commission Scotland	To protect and expand Scotland's forests and woodlands and increase their value to society and the environment.	
Scottish Rural Property and Business Association	To represent the role and interests of those involved with rural property and businesses connected with the land	The conservation, control and sustainable management of deer becomes increasingly significant where local, site-specific deer management needs to be effective. Deer managers must work together to ensure that effective, local management is achieved to the benefit of the local deer production and its habitat.

<p>Scottish Gamekeepers Association</p>	<p>To unite all Scottish Gamekeepers, Stalkers and Gillies in a strong representative organisation and to promote their professional role in the management of the Scottish environment</p>	<p>If there is not sufficient game to allow enough gameshooting days to be let then the keeper's job is likely to become redundant Rabbits, hares, goats and sheep have also (and will continue to) cause damage which red deer seem to be persistently blamed for" in areas where there are neighbouring deer interests and where tree regeneration is taking place or is planned: fencing must be in place to prevent damage.</p>
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<p>Association of Deer Management Groups</p>	<p>To represent its member Deer Management Groups</p>	<p>Is committed to the welfare of deer and their habitat through sustainable management practices and protecting employment and rural communities where deer management is a major economic land use.</p>
<p>Scottish Environment Link (Developing a combined view of environmental and outdoor recreational groups)</p>	<p>To co-ordinate the development of the views and activities of its member environmental and recreational organisations</p>	<p>(Draft Vision - Still in development)</p> <ul style="list-style-type: none"> • A reduction of widespread damage caused by overgrazing by deer; • The restoration of significant areas of the Scottish uplands through natural evolution of the vegetation at a landscape scale; • A radical improvement in a wide swathe of benefits to the public interest without any threat to existing land uses – indeed these too would be improved; • Maintenance of thriving deer populations at levels well below those of the present day, in a healthy, beautiful and biodiverse habitat; • The use of fencing as an exception rather than the rule; • The removal of conflict between the landowner and fellow citizen - neighbour, walker, farmer, crofter, motorist or whatever; • The meeting of public policy objectives in

		biodiversity protection, catchment management, climate change mitigation, rural development and resource efficiency
British Deer Society	To conserve the six species of deer wild within the UK	
Deer Interagency Liaison Group	To establish joint working between DCS, FCS, and SNH	
John Muir Trust	To conserve and protect wild places with their indigenous animals, plants and soils for the benefit of present and future generations.	Effective grazing management depends on integrated policies for both domestic livestock and deer. JMT wish to work alongside the Deer Commission for Scotland and other bodies in promoting best practice in habitat management. We consider that deer should be managed sustainably for the natural habitats within their range.

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