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Introduction

This book deals with the distribution and the management within Europe of wild ungulates, the largest terrestrial mammals occurring in most European countries. Within Europe as a whole, there are some 20 species (and many distinct subspecies). Some distinctive subspecies are very rare and require explicit management efforts for their conservation, but the majority of species are widespread and abundant, often reaching surprisingly high densities. In Austria, for example, in an area of some 85 000 km^2, the estimated number of ungulates is 1.26 million, i.e. nearly 15 animals per km^2. Given that most of these are forest dwelling animals, and that forests cover less than 50% of the land area, local densities may reach even higher high levels. Red deer densities in some parts of Scotland may reach as high as 45 deer per km^2. This, when combined with the potential for high impact on other components of ecological systems means that wild ungulates commonly have a dominant role in the structure and ecological dynamics of both natural and man-made ecosystems (e.g. Putman, 2004).

The fact that many species feed very selectively means that often they select some species and avoid others. They may, in consequence, substantially change the composition and relative abundance of the different components of the vegetation affecting the species composition and species diversity of many plant communities, as well as the age structure and physical structure (e.g. Putman, 1986, 2004).

An obvious outcome of this impact on the vegetation itself is that ungulates may also deeply influence animal communities, especially insects, birds and small rodent faunas (e.g. Hill, 1985; Putman, 1986, 1994; Putman *et al*., 1989; Petty and Avery, 1990; Feber *et al*., 2001; Fuller, 2001; Flowerdew and Ellwood, 2001; Suominen and Danell, 2006).

This may in turn have knock-on effects on populations of predators dependent on those animals for prey (Hirons, 1984; Hill, 1985; Putman, 1986, 1994; Petty and

Avery, 1990). In addition, of course, the ungulates themselves represent the main natural prey of larger carnivores that are presently increasing their distribution and numbers in many European countries. In this context, wild ungulates are not only relevant because they are the natural prey of wolves and European lynx and thus represent an essential prey base in conservation measures directed at encouraging the expansion of these species, but they also represent an alternative to predation on livestock (Meriggi and Lovari, 1996), one of the main sources of conflicts between large carnivores and humans (Gazzola *et al.*, 2008).

Whatever their role in the ecological dynamics of natural or semi-natural systems, it is also recognised that the impacts of wild ungulate species can often cause conflict with human land-use objectives (e.g. Eiberle and Nigg, 1983; Putman and Moore, 1998; Putman, 2004; Ammer, 1996). Whereas in the past most reported damage from ungulates occured in agriculture (Gossow, 1983; Putman, 1989, 2004; Doney and Packer, 1998; Packer *et al.*, 1999; Putman and Kjellander, 2002), now damage to forestry through browsing and bark stripping seems to be a major and increasing problem in many European countries (e.g. Mitchell *et al.*, 1977; Mayer and Ott, 1991; Welch *et al.*, 1991, 1992; Gill, 1992a, 1992b; van Hees *et al.*, 1996; Reimoser, 2000). In areas with high densities of ungulates, young trees in particular may be heavily selected for and thus ungulates may also have a significant impact both in commercial plantations and in conservation areas, by reducing the chances of natural regeneration (e.g. Reimoser and Gossow, 1996; van Hees *et al.*, 1996; Gill, 2006; Vera *et al.*, 2006).

There is, in addition, increasing concern over damage to conservation habitats more generally (i.e. other than simply within woodlands) both in America (e.g. McShea *et al.*, 1997; Rooney and Waller, 2003) and Europe (Putman, 2004) – as reflected more generally in the provisions of Directive 92/43/EEC on the Conservation of Natural Habitats.

Collisions of ungulates with motor vehicles (accidents with cars, trains, etc.) are also increasing (Groot Bruinderink and Hazebroek, 1996; Romin and Bissonette, 1996; Putman, 1997; Hedlund, 2003; Putman *et al.*, 2004). Sickness transfer by wild ungulates to domestic animals and humans is also considered a severe problem for some pathologies (e.g. Bouvier, 1963; Delahay *et al.*, 2002; Huitema, 1972, for bovine tuberculosis) even if their role has been reconsidered for others (e.g. Gray *et al.*, 1992; Jaenson and Taalleklint, 1992, for Lyme disease).

Finally, in this brief review of the place that wild ungulates play in our lives – and the range of management issues that they raise – we should also remember that, while the majority of species are expanding in Europe in both range and distribution, some taxa are less favoured and themselves warrant explicit conservation attention, coupled with management measures deliberately designed to safeguard dwindling populations and encourage their recovery. Still other populations, however well-established, are threatened from a genetic point of view, due to repeated

introductions of non-native individuals (in misguided attempts to 'improve' their qualities – usually as trophy animals – or bolster up populations perceived to be under threat) or through ongoing hybridisation with alien species (as, for example, hybridisation between red and sika deer in Great Britain, Eire, or the Czech Republic: Harrington, 1973, 1982; Ratcliffe *et al.*, 1992; Abernethy, 1994; Goodman *et al.*, 1999; Pemberton *et al.*, 2006).

For all the reasons outlined above, the need for effective policies for management of ungulate populations and their impacts at both a national and a European scale is abundantly obvious.

At the same time, we must place across this yet another 'strand': ungulate populations, which may build up biomasses exceeding 150 000 kg per 100 km^2, are also a significant economic resource in their own right, through the production of game meat and in recreational hunting (whether for venison or for trophies). Recreational hunting of ungulates is extremely important, both in sociological and in economic terms, and in many countries provides a very significant source of revenue. Ungulate populations thus represent a valuable resource, ecologically, economically and culturally, which should never be overlooked in determining appropriate strategies for management.

For such an important resource, and one with such a potential for a profound influence on the dynamics of both natural and man-made ecosystems, informed and effective management is absolutely crucial: a management based on thorough scientific understanding of the ecology and population dynamics of these species, and the wider systems of which they are a part.

In practice, current approaches to the management of ungulates are extremely diverse among European countries. This is in part due to differences in species present and their relative abundance, differences in the conflicts experienced between wild ungulate populations and other land-use interests and differences, in consequence, of whether or not management is primarily directed towards control, conservation or exploitation (by hunting). In addition, however (and particularly where management is carried out by 'volunteer' hunters), there are enormous variations in the cultural approach to hunting or game management, and strong national traditions in hunting practice.

Once again reflecting this diversity of objective and variety of national tradition, there are also marked differences between countries (often even between close neighbours!) in the legislative framework and regulations affecting hunting and wildlife management, while differences in patterns of land ownership, from mostly private to completely state ownership, have a profound effect on the organisation and integration of management activities. In some cases this may lead to extreme cases of opposite attitudes between bordering countries, resulting in a clear conflict of interest, often with negative consequences for the environment.

It is clear that while some of the differences in management practice and approach reflect differences in the objectives of management (or more usually, differences in priority of objectives) some differences are more 'arbitrary'. It is also apparent that, while some management approaches have been developed in a targeted way in order to tackle particular perceived problems of, say, agricultural or forest damage, in other cases, the problems *themselves* may actually arise as a consequence of inappropriate management practice.

While it is accepted that differences in legislation, differences in cultural tradition, together with differences in species of ungulates and objectives of management, will mean that management systems and management practices will often differ in different places, it is suggested that we should all work towards a more informed management, a management better designed to deliver the objectives sought – and at least learn something from each other's mistakes! Development of effective management in any one country might thus benefit enormously in learning from the experiences of others. Last, but not least, we consider of utmost importance a common approach in the management of populations shared by bordering countries or of taxonomic endangered units that are living in different nations. Taking into account all these factors we may foresee an attempt to reach a European perspective, not necessarily in the means adopted, but in the aims that are the ultimate goal of ungulate management, that is, biodiversity conservation.

For all of these reasons, we think it is time to promote a better knowledge of ungulates and their management within Europe. We believe this may help to reach better national management strategies and to develop a more integrated European management policy that will strengthen the conservation of healthy environments in Europe. We are convinced that only with open and informed comparisons of our different national experience will we be able in the future to avoid the serious mistakes that almost all nations have made in the past. This is especially true now as our environment is undergoing rapid changes. If successful, we will be in the position not only to achieve a more sensitive, and more effective management of ungulates in Europe but also to integrate wild ungulates and their management with the demanding requirements of the Agricultural Policy signed by the European Community and many non-members, and the wider conservation objectives established by the Rio Agreement.

This belief led us to bring together a group of expert scientists with special interest in applied ungulate ecology and specifically in ungulate management systems, at the International Conference Centre in Erice, Italy, in November 2004, to exchange information on the status and management of the ungulates in their respective countries and to discuss common problems and possible solutions. The conference was enormously successful, and we decided to extend upon this initiative by producing a book to review many of these same issues for a somewhat

wider audience. At the same time we resolved to offer broader coverage of Europe as a whole. At the conference itself, presentations were received from representatives of some 11 different European countries; for this book we have drawn together contributions describing ungulate populations and their management in 28 different countries (almost all countries of the EU plus Norway, Switzerland and Croatia).

This book thus aims to present an overview of wild ungulate populations throughout Europe: species composition, numbers and distribution, as well as considering current management practices in different countries and problems experienced – either with the impacts of ungulates themselves, or in controlling those impacts. The book is deliberately constructed to highlight similarities and differences, to try to show how successes or failures of management may be correlated with a particular approach to that management, and finally to seek to learn from the successes and failures of others, which management approaches work in which circumstances – and which do not.

The book is targeted at managers themselves, those involved in the actual management of wild ungulate populations on the ground, but also at policymakers, those who create the administrative and legislative framework within which such management activity must be undertaken, since so often this regulatory context affects what management options may be available.

Quite deliberately, no attempt is made within the current volume to offer a detailed synthesis of this diverse body of material. Our main aim was, explicitly, to draw together in one place a convenient single source of reference for the primary information itself – and with the book already extending to some 27 chapters as it is, an equivalent 'weight' of synthesis would render the work so large as to be virtually unusable. In addition, we wished to make the material available to a wider readership as soon as possible. For now, therefore, we must leave readers to make their own contrasts and comparisons, and to draw their own inferences and conclusions.

However, a companion volume is already in preparation which will, in due course, offer a more comprehensive analysis and overview of various topics. Exploring, for example, the variation in hunting seasons in different countries – the apparent mismatch between hunting seasons and biological seasons in most cases – and the implications that this may have for achieving effective management; other constraints on management imposed by national and international law; the impact of ungulates on agriculture, forestry and conservation habitats, and management options; the problems posed by ungulate–vehicle collisions and the mitigation measures available; large carnivores and the impact of predation on populations of wild ungulates; large ungulates as vectors of disease; and the role of diseases in limiting or regulating ungulate populations.

In the meantime, we hope the present volume, as a compendium of information on ungulates and their management in 28 different European countries, will help to stimulate informed debate and improved management of this valuable resource. We truly hope that this will begin a process through which we may be able to improve our future management of this valuable resource into the twenty-first century.

Disclaimer

We live in changing times and, with 28 countries covered within the pages of this book, it is inevitable that something changes somewhere. As one Polish correspondent wryly remarked to the editors: 'In Poland hunters are never bored. The law changes every few years!' Even at the final stages of editing of this book, hunting seasons changed in England and Eire – and more changes are to be anticipated in the shelf-life of such a volume. While every effort has been made to ensure that the information presented in this book is accurate as we go to press, information on legislation and administrative structures must be taken as indicative only and not definitive. We believe the facts to be accurate as we write, but they may nonetheless be subject to future change; anyone requiring up to date information on, for example, hunting seasons, permitted weapons, licensing arrangements, etc., should not rely on details presented in these pages, but should seek independent confirmation of the current situation from the specific country concerned.

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Chapter layout

The essence of this book is to offer a review of the situation in each of the different European countries in relation to

1. status of wild ungulate populations,
2. administrative and regulatory systems and constraints,

3. current management practices and
4. problems arising from ungulate impacts, or problems with current management systems

Since contributions cover no fewer than 28 different countries, contributing authors were therefore asked to prepare their accounts according to a particular format in order to both ensure that all relevant topics were addressed in each account, and to better facilitate speedy comparison between countries (since the immediately comparable material will be presented in the same subsection for each chapter).

Inevitably, in some cases this 'fixed framework' leads to some stiltedness in presentation, or some repetition within chapters; in other cases, the need to address a particular topic which is not relevant to a particular area may be solved simply by saying that there is no information available, or the topic is not applicable in that particular country, but we felt that such disadvantages were more than outweighed by the advantages offered in terms of ready comparison between different countries.

The reader will thus find that all chapters share this common format, and treat topics according to the following framework:

- **Introduction to the country and the ungulate species present**
  1. **Individual species accounts**
     For each species present: history (native or introduced), history of distribution, current distribution. Where known, genetic status and estimated number of individuals for each species.
  2. **Legislation affecting management**
  3. **Management objectives**
     Is management/hunting primarily directed towards sport/recreation, for control of damage, for venison production/harvest, or for conservation management?
  4. **Management structure**
     Who does the management? Is it largely state-controlled managers/rangers, or is it mostly done by private individuals? Is there any overall (state-managed, or voluntary) coordination of management activities, at local, regional or national level.
  5. **Management organisation**
     Size of management unit, hunting licences cost if applicable, hunting examination, numbers of hunters, numbers of ungulate hunters.
  6. **Actual management and hunting practices**
     Are censuses or shooting plans required by law? Are records kept of hunting bag statistics? Actual hunting practices and general description.
  7. **Census types and methods**
  8. **Ungulate impacts and damage**
     Damage caused by ungulates to agriculture, to forestry or to conservation habitats; road accidents involving ungulates. Estimated value of damage and economic significance.
  9. **Supplementary feeding**
     Species fed, distribution of the practice in the country, aims.

10. **Effectiveness of current management strategies**
Each chapter ends with a section where the authors were invited to consider problems with current management and suggest possible changes in management approach for the future.

Management of wild ungulate populations: clarification of English language terminology

Clearly, people of different nationalities use technical terms in ways which may show subtle differences of actual meaning. In translating this book into English we have again tried to standardise terminology to current English usage. This may, however, mean that in their usage here some technical terms have a rather different meaning than where used elsewhere. To help readers who may be used to using these terms in a rather different way, we present a short glossary of usages adopted in this book.

Hunting/hunter: In English, these words carry the implication of recreation/pleasure, rather than simply management, and imply that people take pleasure in the killing itself, rather than simply using it as a management tool to control population size. However, in the majority of European countries the two terms are interchangeable, and use of the word 'hunter' simply implies a person who shoots game (for whatever goal).

Culling/to cull: To kill animals during the process of management of the population for control or exploitation. Usually, the implication is killing for control.

Control/controlling: Again a useful word for attempts directed at influencing/affecting the size of an animal population. It implies efforts to reduce numbers or at least to stop them increasing.

Harvest/harvesting: By whatever method (rifle, shotgun, bow, trap, etc.), the implication in the use of this word is *sustainable exploitation* of the population concerned.

Management: The *concept* of 'taking responsibility for' or influencing the dynamics of animal or plant populations, and the *activities* associated with that.

Manager: One who is responsible for, or involved in the management of wildlife populations.

Native/Introduced/Exotic:

Although the words **autochthonous**, or **allochthonous** are used by some continental authors, in English these words are archaic and not in current usage. In this book we use the words.

Native: to imply a population which is considered to have had continuous presence in a given area (= autochthonous).

Introduced: to imply a species which could occur in any geographic region but in practice is not native in that particular country and has been introduced within historic time by humans.

Exotic: to imply a species introduced by humans well outside its natural geographic distribution.

Status: The word status is used to refer to the numerical abundance of a species and whether it is abundant and/or widespread, or whether it is rare or threatened.

Composition: In relation to community or population structure, a more suitable word would be composition. Thus we talk of the 'species composition' of a community, or the age- and sex-composition of a population.

(These two words (status and composition) are thus used throughout this book to replace the usage by some authors of the word '**consistency**' which, in this particular context, is not correct English.)

Provisioning/artificial feeding/foraging: One regular source of confusion that emerged during editing of these chapters was use of the word 'foraging'. In English, 'foraging' is used for natural grazing by the animals themselves, and literally means the activity of searching for and consuming natural foodstuffs. For artificial provision of additional or supplementary foodstuffs at different periods of the year, we would talk about 'artificial feeding' (if it was intended to supply 100% of all needs), or 'supplementary feeding'. Very occasionally one might see the word 'provisioning' (meaning the providing of feed), but this is not usual.

In this book,

Foraging: implies therefore natural grazing by the animals themselves

Provisioning/artificial feeding: implies the provision of artificial feedstuffs to wildlife populations

Supplementary feeding: As above, but here the clear implication is that feeding is in addition to natural feed available, and a supplement only. It does not attempt to provide 100% of nutritional requirements.

Latin binomials

In this book, common names are used through the text except where the latter are used to identify a particular subspecies. Species implied are:

Cervidae:	
Chinese muntjac	*Muntiacus reevesi*
Chinese water deer	*Hydropotes inermis*
Moose	*Alces alces*
Reindeer	*Rangifer tarandus*
Roe deer	*Capreolus capreolus*
White-tailed deer	*Odocoileus virginianus*

Red deer	*Cervus elaphus*
Sika deer	*Cervus nippon*
Wapiti	*Cervus canadensis*
Fallow deer	*Dama dama*
Axis (or chital)	*Axis axis*
	and their subspecies
Bovidae/Ovidae:	
European bison, or wisent	*Bison bonasus*
Musk ox	*Ovibos moschatus*
Alpine chamois	*Rupicapra rupicapra*
Pyrenean chamois	*Rupicapra pyrenaica*
Barbary sheep	*Ammotragus lervia*
Mouflon	*Ovis orientalis musimon*
Alpine Ibex	*Capra ibex*
Spanish ibex	*Capra pyrenaica*
Wild goat	*Capra aegagrus*
	and their subspecies
Suidae:	
Wild boar	*Sus scrofa*

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