NINA Temahefte 25

Large predators and human communities in Norway

A guide to coexistence for the 21st century

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John D. C. Linnell
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Scott M. Brainerd
(Eds.)

NINA
Norwegian Institute for Nature Research

Andersen, R., Linnell, J. D. C., Brainerd, S. & Hustad, H. (red.). 2003. Large predators and human communities in Norway. A guide to coexistence for the 21st century - NINA Temahefte 25. 48 pp.

Trondheim, June 2003

ISSN 0804-421X
ISBN 82-426-1454-7

Management area:
Conservation of biodiversity

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Print: Trykkerihuset Skipnes
Opplag: 300

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Foto: John Linnell

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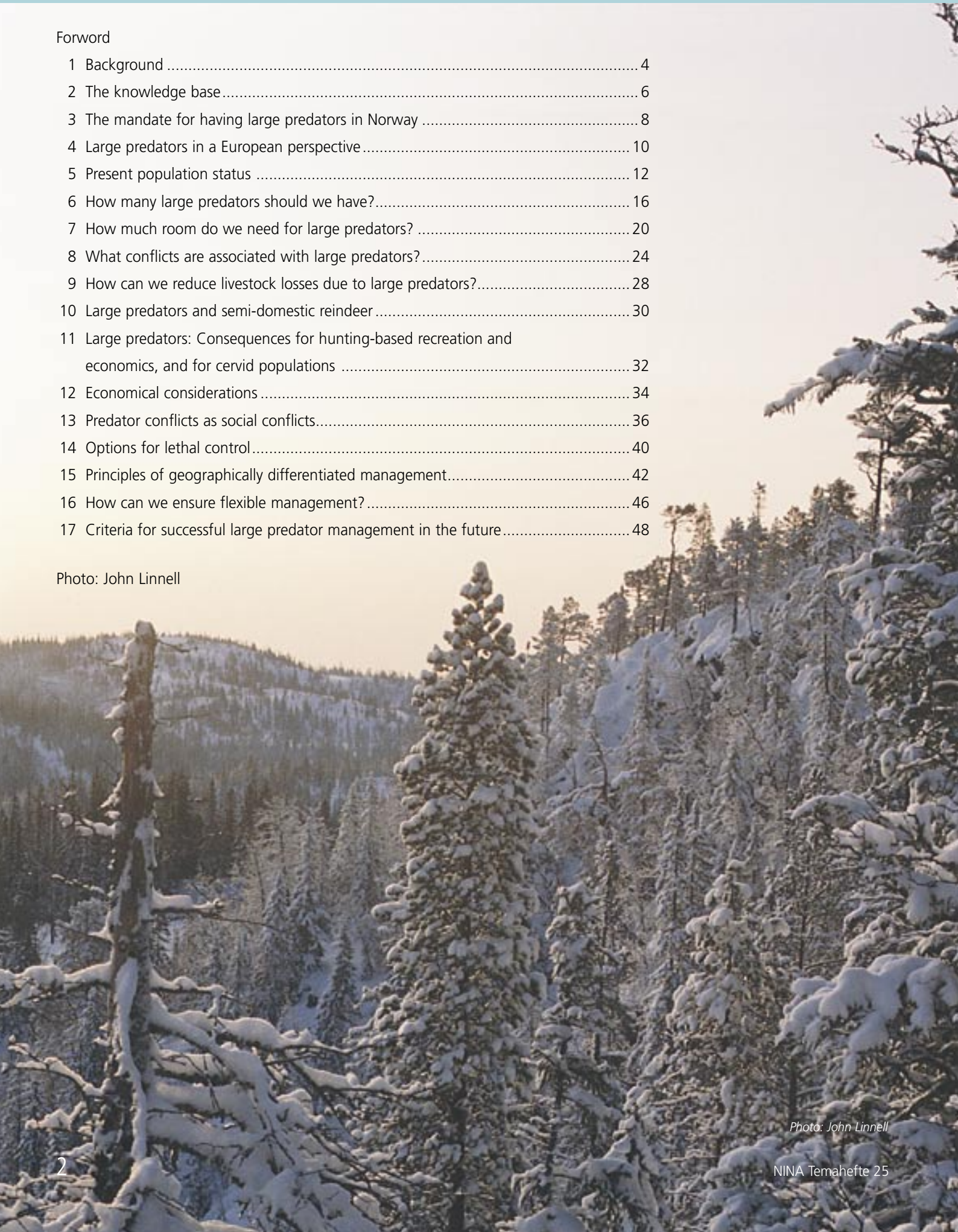

Photo: John Linnell

Forword

This booklet is the result of the efforts of many people. People who have one thing in common: their differences. That is to say, different standpoints relative to the organizations they represent, and the experiences and attitudes they have. It is unreasonable to expect that meetings between wildlife researchers, wildlife managers, livestock owners, reindeer herders, foresters, hunters and local politicians can result in a common manifest that presents only one solution for the future management of large predators. What everyone can agree upon is the fact that there is no single solution, and that the goal should be to find a more or less acceptable compromise through an acceptable process.

With this as a precept, the Advisory Group for the project "Large predators and human communities" (known hereafter by its Norwegian acronym "RoSa") has fulfilled its intended function. This project was initiated in the year 2000 as a broad, official effort to conduct research and investigate the large predator issue in Norway. The project has been financed by the Research Council of Norway through its "Changing Landscapes" program. Although the strong differences in standpoints between individual organizations can, at times, seem immovable and insurmountable, the work of the Advisory Group has shown that there are possibilities to find agreement on the general form a future management plan should have, which measures and tools should be used, what effects these will have, as well as the associated positive and negative effects different strategies will have on various conflicts.

The Norwegian Parliament has formally requested that the government present a new White Paper on Large Predator Management by the end of the year 2003. It is mandated that this policy document shall be based upon international conventions and the main points of present policy relative to this issue. The Advisory Group has also been given the same constraints for its work.

The Directorate for Nature Management has instructed the RoSa Project to participate in the effort to provide the scientific basis for the new White Paper on Large Predator Management. The intention has not been to determine which management strategy is best, but rather to provide a broad evaluation of pertinent knowledge upon which political decisions regarding future management policy will be based.

Researchers involved in the Advisory Group have themselves delivered a number of scientific reports that provide the basis for the White Paper on Large Predator Management. Some of the chapters in this booklet are based directly upon the contents of individual reports in this series. However, other chapters contain elements from several reports, and represent a synthesis of viewpoints that have been brought forth over a longer process, where the Advisory Group has acted as a "melting pot" for ideas and solutions. This thematic booklet is not a summary of these scientific reports as such, but attempts instead to point out the most important challenges that a future policy regarding management of large predators must address. That the diverse interests represented in the Advisory Group can stand united behind this document does not imply that there is general agreement regarding the proper avenue to a final goal. However, it does provide a statement that there is an implicit understanding that the solution lies closer to the center than one of the extremes in this type of conflict.

We hope that this thematic booklet will be of use as a guide for those that have the responsibility for formulating and implementing future policy regarding large predator management in Norway. It should also be read by anyone that has an interest in large predator management.

Trondheim, 6. februar 2003

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1 Background

During the last half-century Norwegian environmental management has, in pace with changing national and international attitudes, changed its strategy from one of persecution of predators to that of conservation of these species. Not surprisingly, this change of direction has created significant conflicts and problems for a number of interests in rural Norway. The recovery of lynx and wolverine populations, together with the recolonization of bears and wolves have resulted in large conflicts because of depredation on free-ranging livestock and semi-domesticated reindeer by large predators[1]. For local inhabitants, the return of large predators is often experienced as something that is both frightening and threatening. The present use of natural resources through recreational activities, grazing, and hunting is challenged more and more by the presence of large predators. At the same time, most Norwegians wish to have large predators as part of the naturally occurring fauna in Norway. The knowledge that these species exist is considered a positive thing by many people. Conservationists express a need to manage these species on a sustainable basis relative to their population viability, such that future generations can also experience large predators as a natural element of Norwegian fauna.

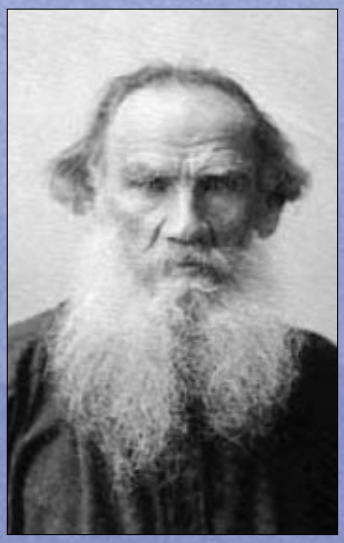
If the diversity of conflicts presented by large predators could be solved by one management strategy, the problem would be much easier to solve. However, a characteristic of this issue is that conflicts are often juxtaposed against each other. In other words, a solution to one conflict may well exacerbate another conflict in this regard. Thus the decision regarding a particular management solution becomes largely a political question.

A general perception has emerged that the two previous white papers on large predator management have, under the best of circumstances, inadequately evaluated the breadth and complexity of the problems large predators present. In general it can be said that measures and instruments have not been implemented to the extent that is deemed necessary, and that there has not always been adequate integration between measures and official predator policy.

The Anna Karenina-principle:

"Happy families are all alike; every unhappy family is unhappy in its own way".

The citation is the opening line in Leo Tolstoy's book Anna Karenina that was published in 1875. This principle can be adapted to understand most of life's problems. For example, a take on this from a nature management standpoint can be: "Successful management strategies are all alike; every unsuccessful management strategy is unsuccessful in its own way".



Leo Tolstoy

The message is that we often have a need to find a simple, single-factor explanation for success. The most important criteria for success is, however, to avoid the many separate and different reasons why one fails. This means that if large predator management is to be successful, that we must avoid being unsuccessful with:

- information about the management strategy
- implementation of the management strategy
- the communication process over time
- a genuine involvement of local parties
- compensation schemes
- measures for mitigating damage
- unifying scientific knowledge with local, experienced-based knowledge.

One cannot expect universal consensus for a particular solution when managing controversial resources. But almost all stakeholders in Norwegian nature now demand long-term predictability in large predator management such that a clear course can be charted in the direction of an acceptable compromise. Most understand that radical changes must be made regarding some issues, and that decisions must be made that will undoubtedly be unpopular relative to particular interests.

We will not go into concrete solutions here, but rather give a conceptual overview of the general "ingredients" that must be included, as well as how these ingredients can affect the "taste" of the finished product.

2 The knowledge base

The fact that the Norwegian parliament has revised its policy on large predator management 3 times in the past 12 years indicates the nature of the conflicts involved and the need for a dynamic and flexible policy on this issue. The strong official support for research on predator-related issues during the past 5-6 years should be seen in the light of this. In addition, several measures and instruments for reducing conflicts of both a substantive and psychological nature have been implemented locally, and through this we have gained experience at different management levels. In other words, there has been a significant gain in knowledge regarding various elements of this issue through research and experience in recent years.

A significant amount of money, channeled through the Research Council of Norway and the Directorate for Nature Management, have been allocated to research and mitigation measures since the last time parliament revised its predator management policy in 1997. Both of these institutions have recognized the need for increasing our knowledge about predators and associated conflicts, in order to better tackle the new challenges we face regarding their management. As a result, extensive field studies have been undertaken which have involved a number of research institutions and local interests.

During recent years the use of radio-telemetry has been an important method in predator research. This method has made it possible to follow individual animals, and has provided more precise and detailed information than was available through the methods previously used. Although this methodology has been available and used over the past few decades, the number of predators that have been radio-instrumented and tracked has increased dramatically as a result of the increased emphasis placed on predator research after the last policy revision in 1997. Emphasis has been placed on predator biology as well as livestock depredation and mitigation measures, and as a result we now have more precise knowledge on these themes. In addition, human-dimensions research on predator-related themes has greatly enhanced our knowledge of the relationship between people, large predators, and their management. There has also been an increased focus on research concerning grazing issues.

A growing number of articles in international scientific journals, as well as reports from various research institutions, have been published as a result of this work. This body of work has resulted in an accumulation of knowledge that has given managers the ability to increase the level of precision in management. In addition, a great deal of research on large predators has been undertaken internationally, and a long list of publications from different countries tells us that we are not the only ones placing

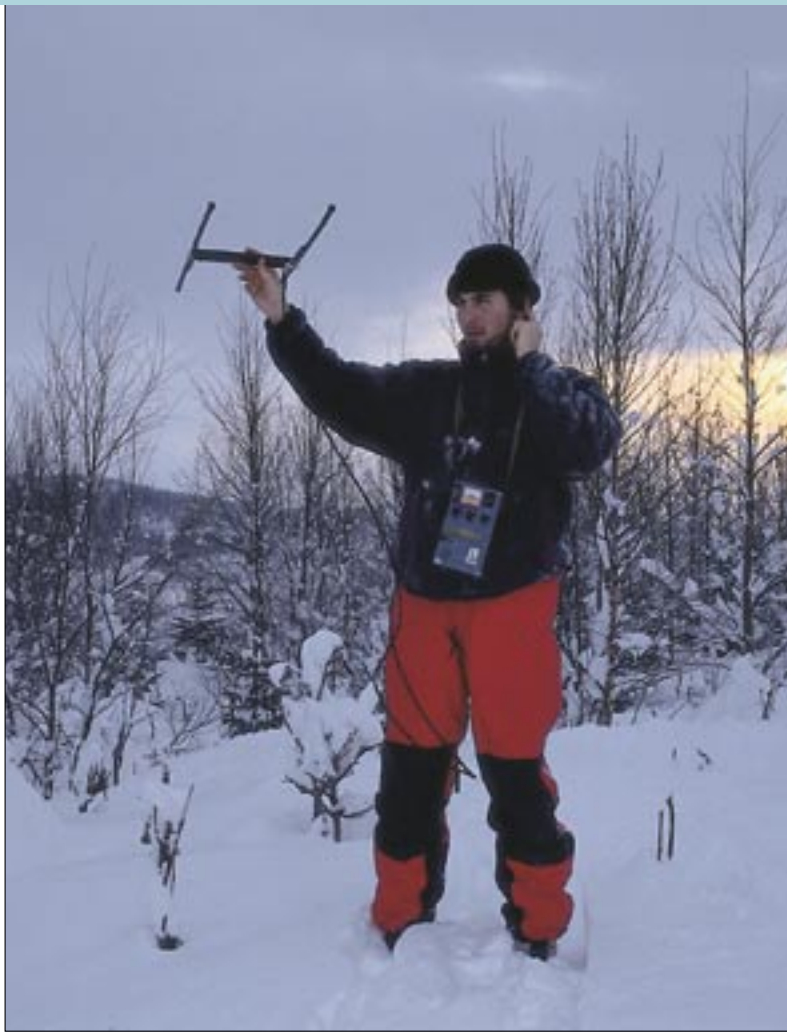


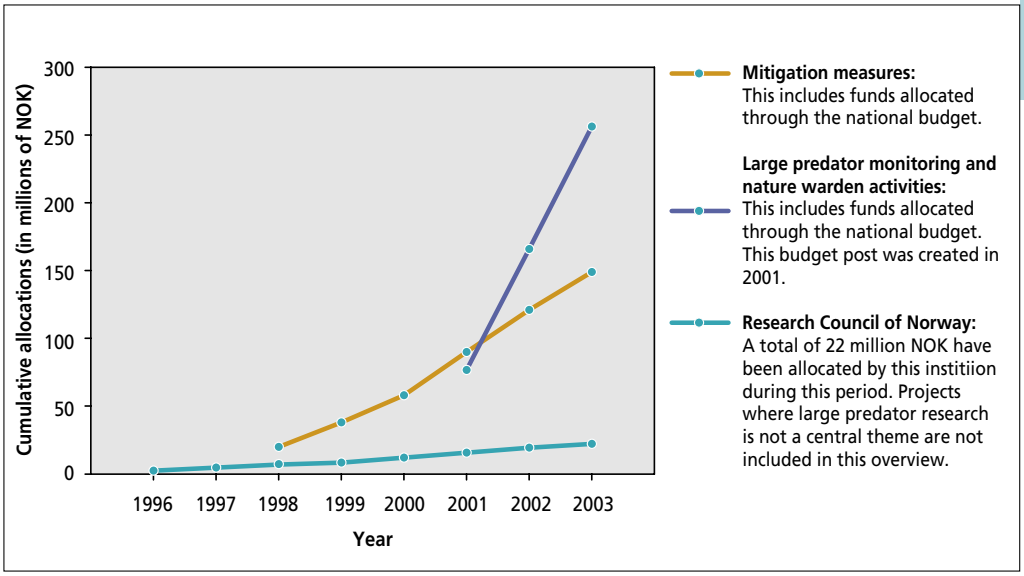
Photo: Jan P. Bolstad

emphasis on this subject. Although results from other countries may not be of direct relevance to Norwegian conditions, these papers have greatly contributed to our general understanding and knowledge regarding large predator biology and conflicts.

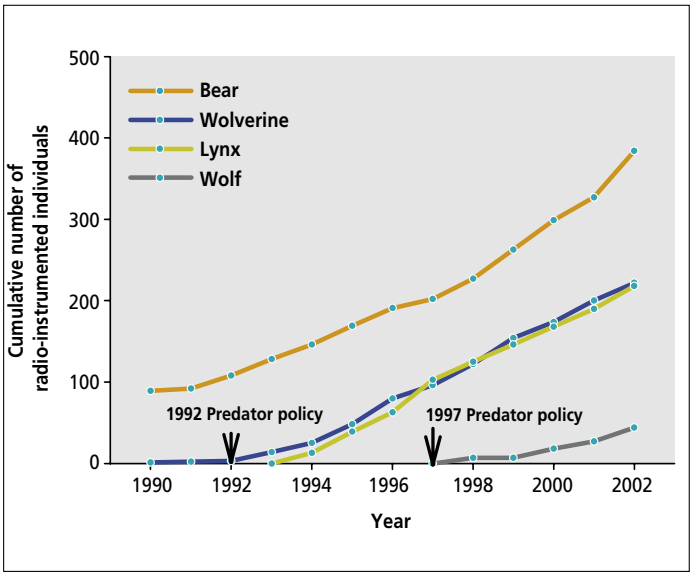
In addition to these research efforts, local inhabitants in areas with increasing populations of large predators have become acquainted with these species and gained experience with them in different manners. This has lead to an increase in the general experience-related knowledge regarding large predators. Statistics show that a significant number of large predators have been shot the past 10 years. Experience with testing and implementing a number of management measures has also given us valuable knowledge.

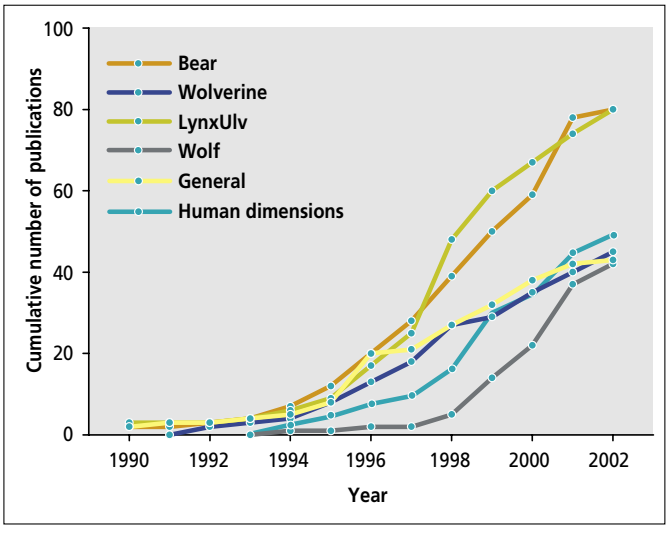
We can thus say that the emphais on research on large predators and related management measures has given us a much better basis for knowledge-based management of our large predators. This new knowledge has given us the ability to better predict the effects of different choices in management strategies that can be taken in the future.

Cumulative overview of funds allocated by the Research Council of Norway to large predator research in the period 1996-2003, as well as allocations from the state budget in the period 1998-2003

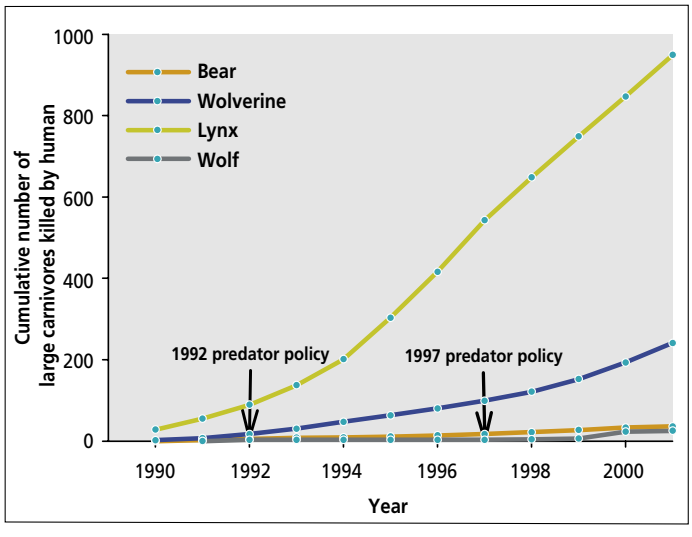


Cumulative overview of the number of radio-instrumented individuals of the four large carnivore species since 1990.





Cumulative overview of the number of publications on themes relating to large predators since 1990. The number includes Norwegian and Swedish publications in scientific journals, reports from different projects as well as M. Sc. and Ph.D. theses.



Cumulative overview of the number of large carnivores killed by humans since 1990. This overview includes legal harvest, illegal kills, and lethal control activities. These statistics are based on the end of the hunting calendar year (1 April- 31 March). (Bear = Bear, Wolverine = Wolverine, Lynx = Lynx, Wolf = Wolf; St. meld. Nr. 27 = 1992 predator policy; 1997 predator policy). (Source: Statistics Norway/Directorate for Nature Management).

3 The mandate for having large predators in Norway

Through the implementation and subsequent revision of government policy in 1992 and again in 1997, the majority of the Norwegian parliament endorsed a policy of maintaining populations of large carnivores[2] in Norway. This parliamentary decision reflects the will of the Norwegian people on this matter. At the same time parliament has endorsed a carnivore policy which also ensures that an all-round use of the countryside can continue, including utilization of rough-grazing resources.

Laws and regulations should ensure that the intentions of parliament are followed up. The Wildlife Act is the central law regarding management of large predators, and its purpose is stated as such: "Wildlife and the habitats of wildlife shall be managed in such a way that the productivity of nature and diversity of species be preserved. Within this framework, wildlife may be harvested for the benefit of agriculture and outdoor recreation". The Wildlife Act clearly states that all wildlife species are protected unless it is determined that specific criteria are met in order to allow harvest by hunting.

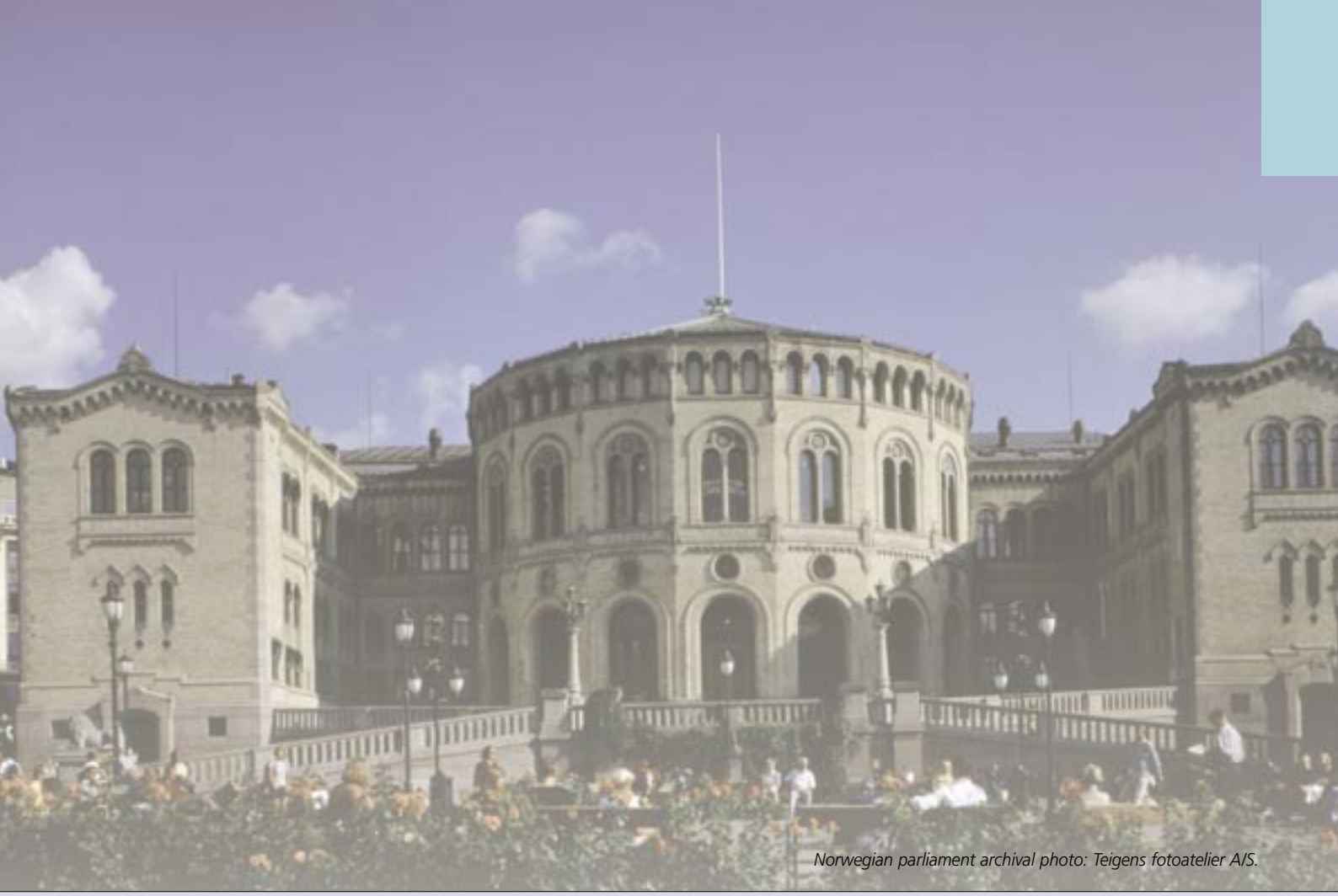
We find the mandate to conserve large carnivores and simultaneously maintain all-round use of the countryside in section 12 of the Wildlife Act: "In accordance with specific rules laid down by the King, the Ministry may, regardless of the regulations which otherwise apply, grant permission to kill a specific number of individuals of bear, wolverine, wolf, or lynx that causes serious damage to livestock or domestic reindeer." The regulation associated with this section of the Wildlife Act states clearly that "The intent is to ensure the survival of populations of bears, wolverines, wolves and lynx in the long term, and that within this framework efforts shall be made to keep damages caused by these carnivore species to the livestock and reindeer industry to a minimum. Management shall be differentiated such that considerations relative to protecting populations of large predators and considerations concerning grazing interests shall be weighted differently in different areas and for different species of large predator".

The mandate, as it is formulated in the Wildlife Act, states therefore that we shall ensure the survival of populations of large predators, and within this framework attempt to reduce the damage these species cause. Management shall be geographically differentiated. This does not imply that damages and conflicts will be taken less seriously in some areas, but rather that the use of instruments for solving conflicts will vary from place to place.

If we examine the evolution of laws, regulations and adoption of international agreements of significance for the management of large predators, we see that the mandate for conserving predators is not something that was decided only through the policy statements enacted by parliament in the 1990´s. The following table gives an overview of important milestones that have contributed to affirming the mandate for having large predators in Norway while simultaneously limiting associated problems through measures including hunting and lethal control of large predators.

Most of the international conventions that Norway has ratified, and that are of relevance for large predator management, are agreements of intention between countries. These in themselves do not authorize sanctions from an international judiciary. Signatory nations must themselves make provisions relative to these conventions in their own legislation. As the table shows, Norway already had pertinent legislation in place, and thus a mandate for conserving large predators, before we ratified these international conventions. Thus it is important to remember that the national interest for large predators instructs us to conserve these species, even without the additional responsibility imposed by international agreements.

Is the formal mandate, passed by the majority of parliament, and followed up in legislation, in step with what most people feel? Different surveys regarding attitudes indicate that the great majority of Norwegians want to have large predators. At the same time, only a few wish to have large predators in their own proximity. This is not surprising, and it follows the trend observed in most other countries where the majority of the population inhabit urban areas, but are interested in conserving different aspects of biological diversity, even though the contact they have with the nature they wish to protect may vary.



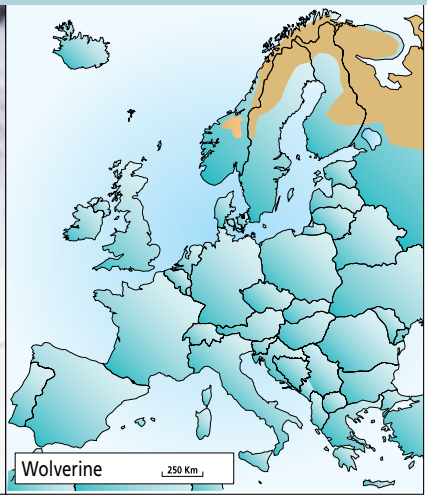
Norwegian parliament archival photo: Teigens fotoatelier AIS.

The development over time of laws, rules and ratification of international conventions pertaining to the management of large predators in Norway

Year	Event
1968	• The Golden Eagle is protected nationwide.
1970	• The Nature Protection Act is implemented, with regulations regarding wildlife protection.
1971	• The Wolf is protected nationwide.
1973	• The Brown bear is protected nationwide.
	• The Wolverine is protected in southern Norway.
	• Legislation for compensating livestock losses caused by large predators is introduced.
1976	• Norway ratifies the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).
1980	• Norway ratifies the European Convention for the Protection of Animals Kept for Farming Purposes
	• The bounty system and year-round hunting of lynx are curtailed.
1981	• The Wildlife Act of 1981 is enacted into law, with the principle that all wild animals are protected, unless they meet the criteria for harvest.
	• The Wolverine is protected nationwide.
1986	• Norway ratifies the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention).
1990	• Norway ratifies the ILO Convention (No. 169) concerning Indigenous and Tribal Peoples in Independent Countries.
1992	• A new section regarding protection of the environment is amended to the Norwegian constitution.
	• Parliamentary report (no. 27) "Regarding management of bears wolverines, wolves and lynx" becomes the basis of national policy.
	• The lynx is protected in southern Norway.
1993	• Norway ratifies the Convention on Biodiversity (Rio Convention).
	• A new regulation on the management of bears, wolverines, wolves and lynx is enacted.
	• A special permit hunt[3] is initiated on wolverines in northern Norway.
1994	• Quota hunts[4] on lynx are initiated in certain parts of Norway.
1997	• The parliamentary policy report no. 35 "Regarding large carnivore management" becomes the revised basis of national policy.
1998	• A special permit hunt for wolverines is initiated in southern Norway.
2000	• Section 12 of the Wildlife Act is amended, along with associated regulations. Lethal control of large carnivores can be used to limit depredation upon livestock or reindeer as a preventative measure, without demanding that this has actually occurred.
2001	• Parliamentary report (no. 42) on Biological Diversity is issued as a basis for national policy.
2002	• Parliamentary report (no. 12) on the Keeping and Welfare of Animals is issued as a basis for national policy.

4 Large predators in a European perspective

Photo: Roy Andersen



During the past centuries large predators have been heavily persecuted in Europe, and different forms of control programs have existed for hundreds, and in some places, thousands of years. In addition, the most important prey species for these predators were heavily reduced in number or directly threatened with extinction in many regions. These two factors have lead to the extermination or reduction of populations of large predators over large areas where these formally occurred.

The wolf was exterminated in the British Isles and most of Northern and Western Europe, while remnant populations persisted in the Balkans, northern Iberia and central Italy. Large populations survived in Eastern Europe and Russia. The lynx was exterminated throughout Western Europe, and survived only in Scandinavia and Eastern Europe. The wolverine was reduced to small remnant populations in Fennoscandia[5]. The brown bear persisted only in Sweden and in some very small areas in northern Spain, as well as in the Carpathian mountains, the Balkans, the Baltic and the Karelian region of Finland and Russia.

As a result of a gradual introduction of more restrictive lethal control strategies, protection, and active reintroduction, most European populations of large predators are either stabile or growing. Reintroduction programs have been undertaken for brown bears in France, Italy and Austria, and for lynx in Switzerland, France, Slovenia, the Czech Republic, Germany, Poland and Austria. Further, wolverines have been reintroduced to central parts of Finland. In addition, natural recolonization has also occurred in many areas. This is especially the case for wolf populations, which are increasing in Spain, northern Italy, and have recently begun colonizing France, Germany and Switzerland. In Fennoscandia, populations of all five species (including golden eagles) have increase in range and size. The maps display the present situation for large carnivores in Europe.

From the maps and tables it becomes clear that Fennoscandia is an important bastion for large predators in Europe. This is because there are still substantial populations of all five species in this region, there is much good habitat available, and there is continuity with larger populations to the east, in Russia. For the wolverine, Fennoscandia is an especially important region, since it is the only area in Western Europe which has populations of this species.

So what is the present situation in our neighboring countries? In Sweden, the parliament considered a proposition regarding a national policy for large predators for the first time in 2001. This has addressed, among other issues, future population targets for the four large carnivore species as well as golden eagles. For brown bears, lynx and golden eagles the minimum population size goals are set at today's levels, whereas those for wolves and wolverines have been set at stages which indicate a doubling of present population levels for these species. In addition, it has been decided that these species will be allowed to spread freely within their natural range of distribution, including southern Sweden. However, wolves will not be allowed to become established in grazing areas for semi-domesticated reindeer. In Finland, a report summarizing the distribution and population status of large carnivores was published in 1996, along with national management goals toward the year 2010. In general, the policy document recommended increased populations in most regions, except in areas with substantial reindeer herding, where populations should be maintained at present-day levels. Since both Finland and Sweden are members of the European Union (EU), management of large carnivores in these countries are also regulated by the EU Habitat Directive. According to the conditions regarding species protection given in this Directive, wolverines, lynx, bears and wolves are strictly protected. This status implies that these species cannot be hunted or trapped. The Directive, however, allows for exemptions for certain situations, including the need to limit depredation on livestock.

Present population status for large carnivores and golden eagles in Europe. Many of these population sizes are very uncertain, and in many regions the situation may change quickly. These population estimates must therefore be considered as approximate.

Region	Bear	Wolf	Lynx	Wolverine	Golden Eagle
Fennoscandia	2000	240	2800	700	1870-2200
Carpathians	6000	>3000	2000		85-88
Balkans	1500	ca 2000	300		380-465
Mediterranean[1]	200	3000	20		1660-1886
Western Europe[2]	40	50	300		732-840
Northeastern Europe[3]	250	1800	1300		80-95
Great Britain and Ireland					420-425

[1] For bears, wolves, and lynx: Portugal, Spain, Italy and Greece.

[2] For bears, wolves, and lynx: France, Germany, Switzerland and Austria.

[3] For bears, wolves, and lynx: Poland, Estonia, Latvia and Lithuania.

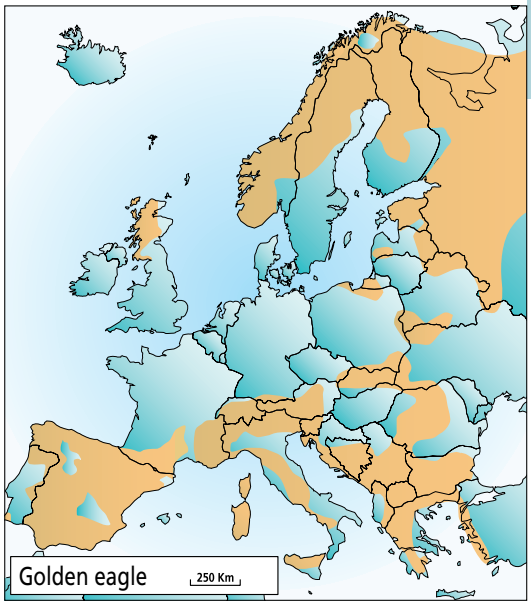
Goals for large predator populations in Sweden as set by a parliamentary decision in 2001. Numbers for bears, lynx, and golden eagles indicate minimum levels at about the present level, whereas numbers for wolves and wolverines represent first stage levels which represent a doubling of today's populations.

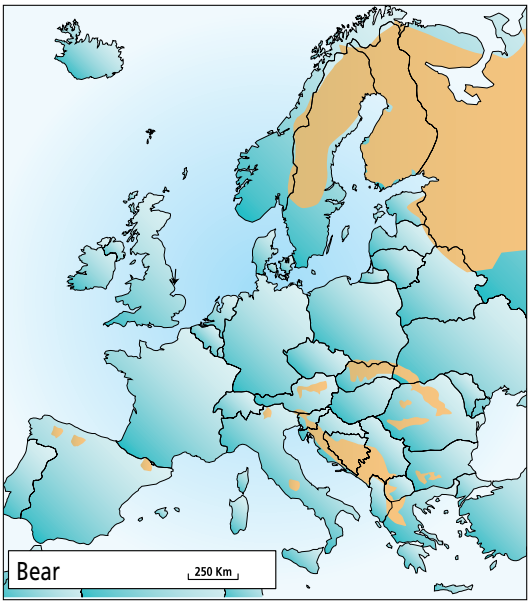
	Number of reproductive units	Total number
Bear	100	1000
Lynx	300	1500[1]
Wolverines	90	400[2]
Wolves	20	200
Golden Eagles	600[3]	

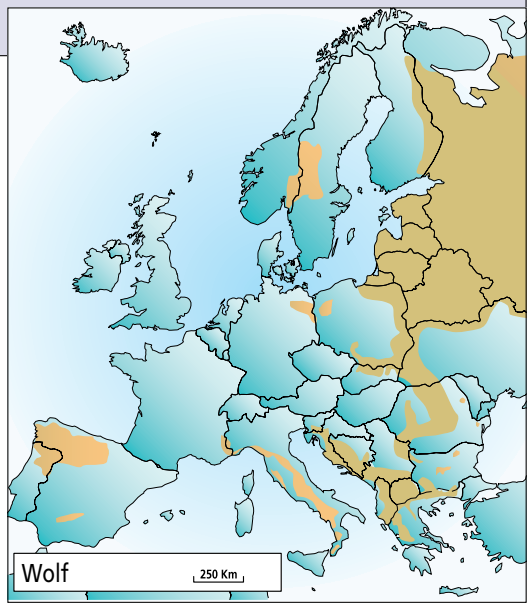
[1] The total number has been adjusted up to 1800 individuals, based on new data.

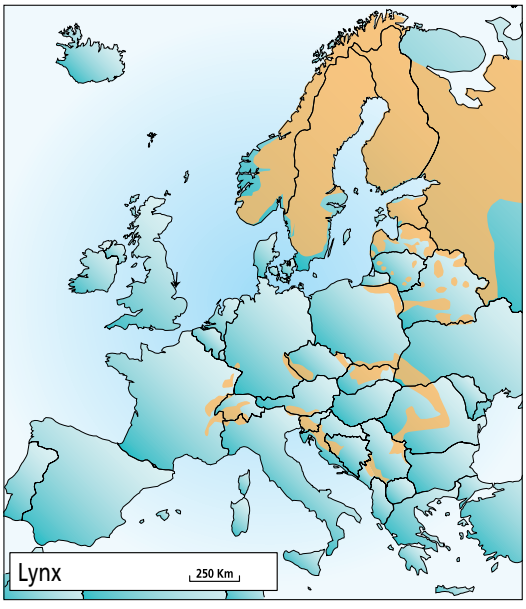
[2] The total number was later adjusted upwards to 575 individuals, based upon new data.

[3] The number of breeding pairs.









5 Present population status

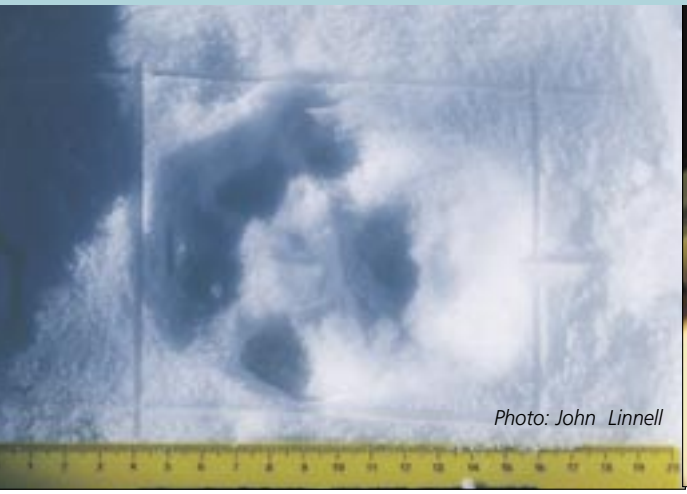


Photo: John Linnell

Photo: Olav Strand

Few if any questions are more controversial than "How many are there?". Determining the size of a wild population, however, is always difficult. This is particularly true for the large carnivores, which generally occur at low densities and often shy. These conditions make direct counts impossible, and are thus estimates are usually based on indirect indices such as scats and snow-tracking. Calculation of population sizes based on these methods is, however, controversial, and requires detailed knowledge of the ecology of each species.

In the year 2000 a national monitoring program for our four large carnivores was established, based upon knowledge gained through several Norwegian and international field studies. The program has as its goal to standardize, systemize and coordinate this activity at the national level. Since the four species have quite different ecological niches and behavior, methods have had to be adapted to each species. We present a short synopsis of the methods employed in this monitoring program, before we give an overview of population estimates and range for each species.

Methods

Wolverine: Monitoring of wolverine populations is based upon registration of natal dens. These dens are usually dug into snow banks, and can be found by following wolverine spoor in snow back to the den. Since adult wolverine females usually occupy the same area over several years such snow-tracking activity is usually concentrated in areas where dens have previously been discovered. Thus, a great deal of effort is made to check all known den localities during late winter. A significant effort is made in searching for new dens, as well. The results of this monitoring include the minimum number of wolverine females with offspring in a given year. Since reproductive females comprise a known proportion of the population, it is possible from these data to estimate total population size.

Lynx: Lynx monitoring is based upon the fact that lynx kittens remain with their mothers until they are at least 9-11 months old. Thus tracks from two or more lynx in the period before the breeding season will generally indicate the presence of a family group. Observations of family groups are accumulated during the whole winter, along with data on all juvenile lynx (< 1 year old) that are harvested or killed during the winter. Based upon data on movements and home range sizes of radio-instrumented lynx family units gathered from 5 different study areas in Scandinavia, we can utilize certain distance-based rules for determining the minimum number of family groups in relation to observation of tracks in snow. These observations of spoor from family units are based upon chance observations gathered throughout the winter, but also upon more systematic surveys. From these data on family units, an estimate of total population size can be calculated in a manner similar to that used for wolverines.

As a supplement to this methodology, a new method for lynx monitoring was introduced in 2002. This method is based upon a network of 3 km long index lines, each of which is checked every year for lynx tracks in the snow. The object of this method is to provide an index of population trend, as well as to ensure that a structured effort is made to find spoor from family units.

Wolf: The method utilized for monitoring the wolf population is based upon snow-tracking. Since the dominant pair of each pack (the alpha individuals) actively mark their territories, much useful information can be derived from snow-tracking. Spoor from one or more individuals can indicate a pack with a defined territory, and the border between to adjacent territories can be determined through intensive snow-tracking. In addition, precision can be increased since many wolves are at present radio-instrumented. In each year the minimum number of territorial packs and pairs, reproductions as well as the number of wolves in each pack is determined. In addition, the minimum number of both stationary and wandering wolves is also included in the annual population estimate.

Bear: The brown bear is the most difficult species to monitor because it hibernates during the winter snow-tracking season. The previous estimate from 1996 is based upon calculated densities and population growth rates from study areas in Sweden where the Scandinavian brown bear research project has conducted detailed research based upon radio-instrumented individuals. Since most bears in Norway roam on both sides of the border with Sweden, the estimate for Norway has been based on the average number of bears that found themselves on the Norwegian side of the border at any given time.

In 2002/03 a new estimate for the population of Scandinavian brown bears has been calculated. The population is given as the number of adult females, which are the easiest portion of the population to estimate based on observations of females with cubs-of-the-year (COY). The Norwegian parliament has also specified population goals for core areas in Norway in terms of the number of reproductive females. Since Norway is at the edge of the distributional range for expanding bear populations, and thus does not have a normal sex and age distribution in its population, it is difficult to determine total population size in Norway. The estimate is based upon the number of females with COY, as formally approved by the Environmental Protection Divisions of County Governor's offices as well as the State Nature Inspectorate during the period 1998-2002. From this an average number for the number of females with COY each year was calculated. This number was multiplied by the shortest and longest average time interval between litters, and thus gives a low and high estimate regarding the average number of females in each area during this period. The results are considered a minimum estimate, since not all females with COY are observed and reported.

Golden Eagle: Although there is at present no nationwide monitoring program for the golden eagle in Norway, we have a relatively good overview over the breeding population as compared to many other species. Extensive investigations have been conducted on golden eagles since the 1970's, by and large by interested amateurs. The golden eagle is also included in the Terrestrial Nature Monitoring Program in five areas: Børgefjell, Åmotsdalen, Møsvatn-Austfjell, Solhomfjell og Lund. Most of this effort is focused upon monitoring golden eagle reproduction, but these data also give a good overview of population trend.

Limitations: When a national monitoring program for our four large carnivore species was established it was necessary to make some compromises. For example we are only able to calculate minimum population size today. There will always be a danger that some groups and individuals will be overlooked, and thus such estimates are by definition conservative. For wolves it is possible to make an estimate of the number of pups, but since all the individuals in a pack seldom travel together all the time, estimates will be uncertain. Compromises are the result of the fact that methods for statistically estimating total populations are not practical to carry out on a national scale annually. It is also important to be aware that the present system of monitoring is, for the most part, based upon snow-tracking, and thereby upon the presumption that good snow conditions exist during winter. In certain parts of Norway unstable snow conditions in certain years can create extra challenges in this regard.

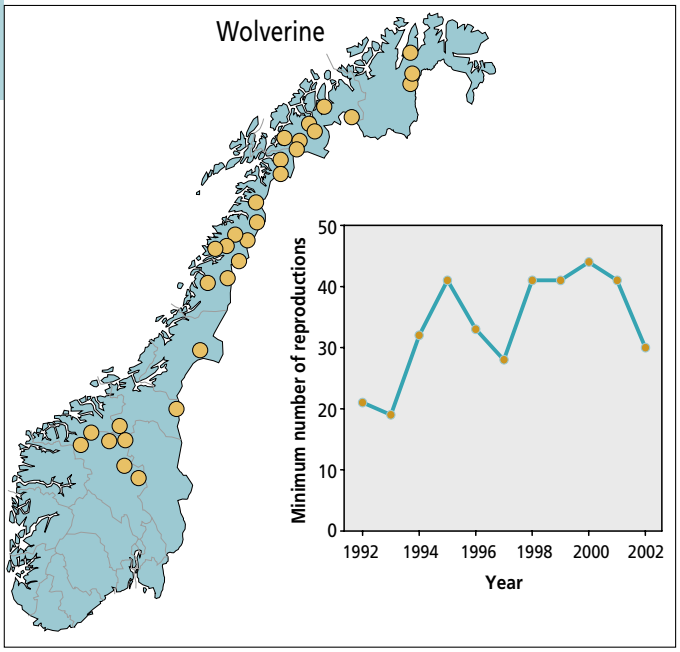
In order to avoid data conflicts, it is of great importance that calculations of population size are communicated in such a manner that the limitations and uncertainty associated with this system are made clear. Having said this, it is worth noting that Norway has one of the best monitoring systems for large carnivores in the world.

The importance of DNA-based techniques: Since the monitoring program was established in 2000 there has been dramatic progress regarding DNA-based analyses. Today we are able to recognize individuals, as well as determine their sex, through DNA profiles obtained from samples of urine, excrement or hair. It is therefore possible to estimate population size in an area by collecting scats from different species. In addition, replication can allow for a statistical evaluation of population estimates. At present, it is only possible to utilize DNA-based methods to make periodic "snapshots" of populations over limited geographical areas, since the costs associated with this method are high. However, DNA methods have tremendous potential as a supplement to more conventional methods for population estimation.

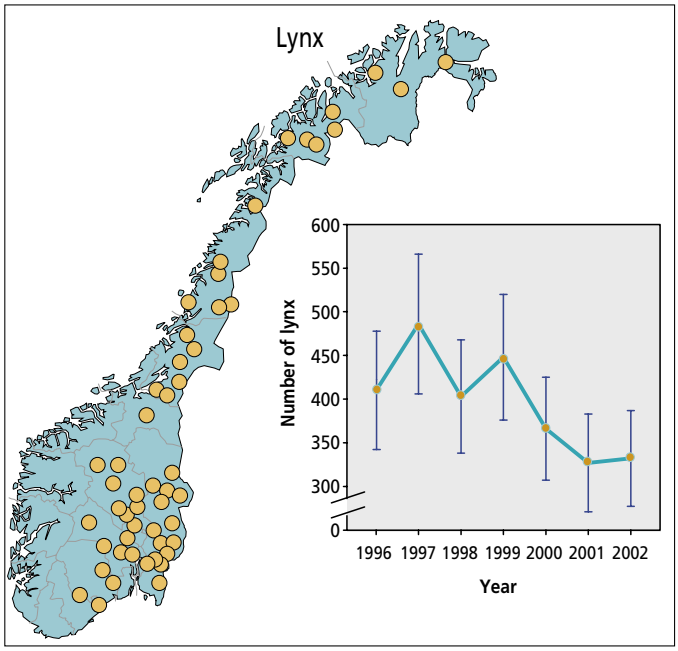
Status and numbers

Wolverine: There are two separate wolverine populations in Norway, with one occuring in the south and the other in the north. The northern population is the largest and is part of a contiguous population in Sweden, Finland and Russia. In Norway, this population occurs primarily in Nord-Trøndelag, Nordland and Troms counties. The Swedish portion of this population stretches further south, to the area bordering Femund in Hedmark county. The southern wolverine population is relatively small with little exchange between it and the population to the northeastern. These two populations are genetically different, although individuals from the northeastern population have contributed to the genetic make-up of the southern population and continue to do so.

The average population density for wolverines is usually calculated on the basis of the number of reproductions over a period



Distribution of natal dens for wolverines in 2002. The graph shows wolverine population trends in recent years.

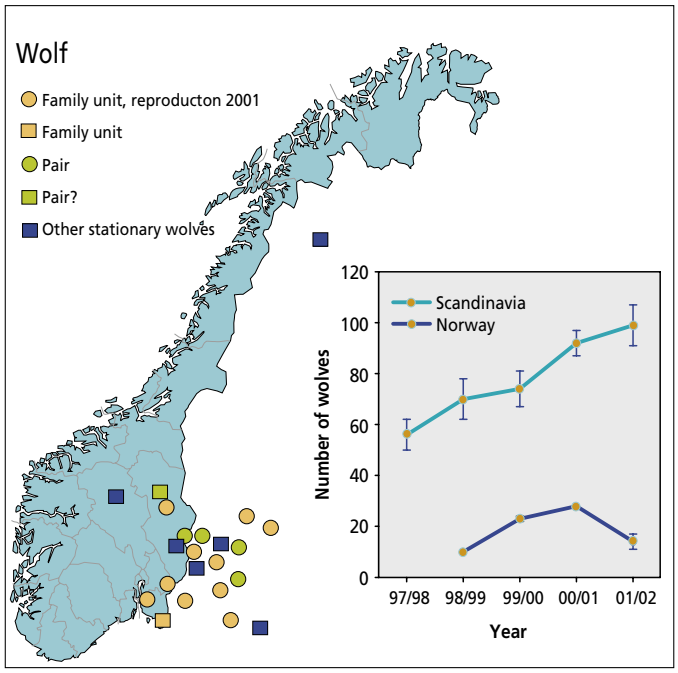


Distribution of lynx family units during winter 2002. The graph shows lynx population trends in recent years.

of three years, since not all wolverine females reproduce two years in a row. For the period 1995-97 the Norwegian wolverine population was estimated to be at least 220+34 individuals (whereof a minimum of 41±8 wolverines belonged to the southern population). In 1998-2000 this population was estimated to be at least 269±32 wolverines (with a minimum of 55±11 wolverines in the southern population). For the period 1999-2001 the minimum total was 271±32, with a minimum of. 62±9 in southern Norway, and for the period 2000-2002 the total population was estimated to be a minimum of 245±50 individuals with at least 64±12 in southern Norway. Results of DNA analyses taken from scat samples support estimates for the southern Norwegian population that were based on natal den surveys in recent years. The Swedish population is estimate to be at least 325 wolverines (1999-2001).

Lynx: There has been a 20-30% decrease in the national population of lynx during 1996-2002. The minimum population was estimated to be at least 400-500 lynx before the hunting season in 1996, and only 300-350 animals in 2002. In parts of Norway the population has been halved during this period. Even though the trend is clearly negative, we have witnessed large annual variation in the number of family units. This reflects the fact that the proportion of mature lynx females that reproduce has varied from year to year. We do not understand the reasons behind this variation. In Sweden, the lynx population is estimated to be about 1500 individuals, and there is exchange between the Norwegian and Swedish populations.

Wolf: At present, wolf packs have a disjunct distribution in southeastern Norway. In a survey conducted during the winter of 2000-2001, a minimum of 28 wolves were counted

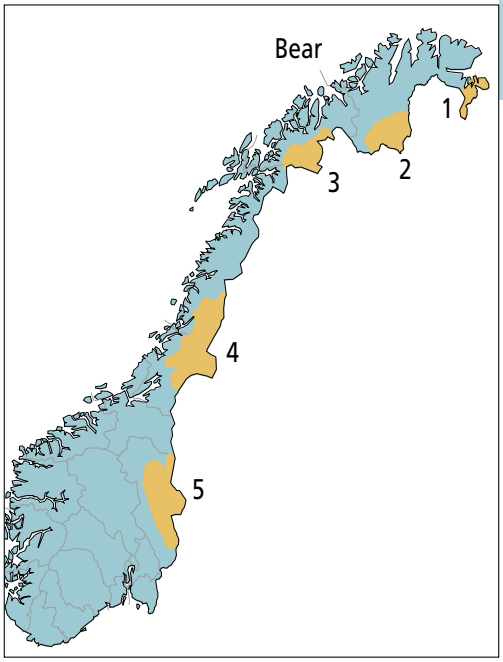


Distribution of wolf packs (family units) and potential breeding pairs in Norway during winter 2001/02. The graph shows wolf population trends in recent years.

(24 wolves in three packs, 2 occuring in a pair, as well as two solitary wolves). An additional 12 wolves occurred in packs in the border region between Norway and Sweden. In 2001-2002 the minimum number of wolves in Norway was estimated to be a minimum of 13-18 wolves (9-11 in two packs, 2 in one pair, one stationary wolf, plus 1-4 other wolves) in addition to 23-24 wolves in the area bordering Sweden. The Swedish portion of the population was estimated to be at least 62-72 individuals in 2001-2002. Although sporadic immigration from the Finnish-Russian population occurs, this southern Scandinavian wolf population is considered as isolated for management purposes.

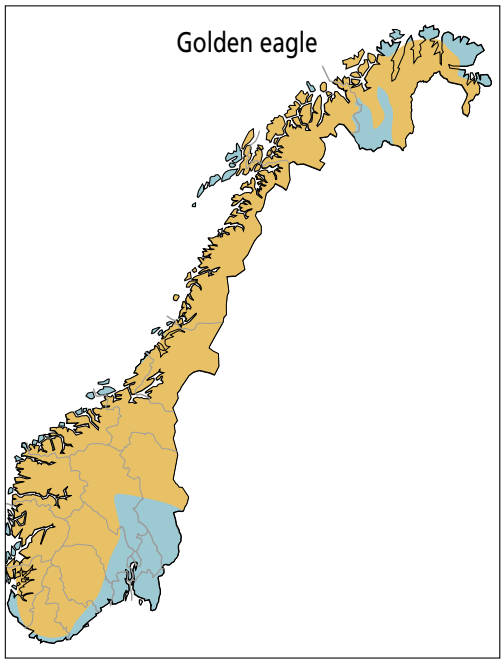
Estimates of the total number of adult females, based upon confirmed observations of females with COY during the period 1998-2002. The year of first observation of females with COY since reproductive bears returned is also given.

Core area	First observation of females with COY	Average number of reproductive females observed annually	Estimated number of adult females
1 Finnmark - Pasvik	1968	1,6	2,6--4,2
2 Finnmark - Anarjohka	1963	0,4	0,6--1,0
3 Troms	1991	0,8-1,6	1,3-2,6--2,1-4,2
4 Nord-Trøndelag/Nordland	1986	0,6	1,0--1,6
5 Hedmark	2001	0,2	0,3--0,5
Total	-	3,6-4,4	5,8-11,5



Administrative core areas for bears in Norway.

Bear: Bears occur in five administrative core areas in Norway today. These Norwegian populations are conterminous with those in Sweden, Finland and Russia. Dispersing bears, which are primarily young males, also occur throughout much of Norway. The previous bear population estimate (1996) determined that there were about 26–55 bears in Norway, with 9–13 in southeastern Norway, 8–12 in central Norway, 1-9 in Troms, and 8–21 in Finnmark. The new population estimate (2002) does not estimate the total population, but gives an estimate for the number of adult females. The parliamentary goal (1997) has been set at approximately 8-10 adult females in each of the two southern administrative core areas. For the other three administrative core areas, the number of adult females will be allowed to increase naturally relative to the carry capacity of these areas. The estimate indicates that females with COY have been observed in all five administrative core areas during 1998-2002. No confirmed observations have been reported outside these core areas. The number of adult females in Norway, as based upon observations of females with COY, was estimated to be at least 6-12. The Swedish bear population numbers approximately 1000 individuals.



Map of present range of golden eagles in Norway.

Golden eagle: The golden eagle is distributed throughout most of Norway, with the exception of the lower elevations of southern and southeastern Norway. The present breeding population is estimated at 773-1072 pairs. The golden eagle population has been relatively stable compared to the sea eagle population over the past 20 years in the areas where it has been monitored. There is good reason to believe that the population of golden eagles has increased somewhat in the counties of Buskerud and Telemark since the beginning of the 1990's. Nesting localities, which have previously been unoccupied for decades, have again been used recently. Several newly established pairs have also been registered in some localities along the coast, including the county of Hordaland. This may be explained by the fact that hares have been introduced onto some islands in this region. The total spring population is estimated to be between 2000 and 2800 individuals, including sexually immature eagles which comprise15% of the population. The number of breeding pairs in Norway is estimated to be approximately 600.

6 How many large predators should we have?


Foto: Roy Andersen


Foto: Arild Landa

It is mandated that Norway shall conserve populations of all its endemic species, including large predators. Setting clear population goals can therefore be an important part of management strategies for large predators. However, the criteria for setting such goals for population sizes can often be unclear. The need to conserve viable populations is often stated as a desired goal, but what is implied by the term "viable", and how can we calculate clear targets for population sizes? In many cases this lack of clarity is due to an inability to separate out the various elements that together determine population "viability".

Demographic viability

Population size varies over time as a result of variation in food availability, changes in habitat, disease, accidents or human-caused mortality, changes in age structure, as well as many other factors. There is always a chance that populations will die out if several detrimental conditions occur simultaneously and over extended periods. In general, small and isolated populations are more vulnerable than larger, continuous ones. In order to calculate the probability for extinction of a given population, biologists perform what is known as viability analyses. The minimum viable population is given as the population size that gives an acceptable risk that it will not die out during a set time interval. Determination of acceptable risk is a question of ethics and politics. According to the criteria set down by the International Union for the Conservation of Nature (IUCN), this risk that a given population will go extinct should be less than 10% over the course of 100 years.

There has been a significant development of methods for analyzing population viability, as well as a large increase in available data during the past few years. There is therefore a solid basis for making more realistic models that reflect the true situation. Until now demographic population viability analyses using the latest models have been performed for two of the large predator species in Scandinavia – bears and wolverines, based on field data from Scandinavia. For lynx, wolves and golden eagles there is still a paucity of data needed for performing this kind of analyses.

In 1997, it was determined that a bear population must consist of a minimum of 6-8 adult females if it is to be viable according to the IUCN criteria. In 2003, the comparable number for a wolverine population was set at a minimum of 22 sexually-mature females. Both of these numbers can change greatly with variations in demographic parameters. For example, a small reduction in the values for survival of adult animals can dramatically increase the required size for a viable population.

Genetic viability

The genetic variation of a given population is just as important as purely numerical considerations relative to its long-term survival. Genetic differences between individuals determine the ability of a given population to adapt and survive changes in the environment over time. This is known as its "evolutionary potential". We have, however, little available empirical data and mathematical models are poorly developed. A general "rule of thumb" for genetic viability based upon general studies, including domestic livestock herds, is the so-called 50/500 rule: a population should contain at least 50 reproductive individuals (effective population size) in order to avoid short-term (10 year) negative effects of inbreeding and

Photo: Svein Wik *Photo: Magnus Elander/www.de5stora.com*

loss of genetic diversity, and a minimum of 500 reproductive individuals in order to avoid long-term (>100 year) loss of genetic variation and evolutionary potential. Even though the validity of this rule is based more upon intuition than data, most geneticists would agree that maintaining the possibility for genetic exchange between populations is of the utmost importance.

Defining biological populations

Defining the boundaries between different populations is often difficult, particularly with regard to large predators in Scandinavia. If we just consider the vast size of individual home ranges for these species, we see that populations must cover large areas. In addition, the great potential for juvenile dispersal allows for the possibility for exchange between distant sub-populations. With this in mind, it is unrealistic, with the possible exception of the southern wolverine population, to take the view that Norway has its own populations of large predators. From a biological standpoint, we must consider populations at the Fennoscandian level when addressing conservation status and needs.

Norway signed the Convention on the Conservation of European Wildlife and Natural Habitat (Bern Convention) in September 1979, which was later ratified by parliament in September 1986. In article 1 of this convention it is stated that "The aims of this Convention are to conserve wild flora and fauna and their natural habitats, especially those species and habitats whose conservation requires the co-operation of several States, and to promote such co-operation." Herein lies a focus on conterminous populations of each species. The IUCN has similar criteria and categories for vulnerability for a global evaluation, and thus gives a basis for the global red list for threatened species. In many cases these criteria are also used at the national and regional levels, and can also be used as a basis for national red lists. Thus, a global category for a species may not necessarily be the same at the national or regional level.

Can viability analyses be a basis for setting Norwegian population goals?

If we recognize that biological populations of large predators exist at a Scandinavian level, and simultaneously recognize that

There are some differences between categories for large predators between the Bern Convenstion lists and the IUCN's global red list. While the wolf, brown bear and golden eagle are not mentioned in the IUCN global red list, these species are listed under the Bern Convention in the category for species requiring special protection.

	Wolf	Bear	Lynx	Wolverine	Golden Eagle
Bern Convention	Strictly protected	Strictly protected	Protected	Strictly protected	Strictly Protected
IUCN global red list	Not listed	Not listed	Threatened	Vulnerable	Not listed

Photo: Staffan Widstrand/www.de5stora.com

the management goals Sweden has set for its populations are higher than the levels for "minimum viable populations" from a demographic and short-term genetic perspective, it is difficult to find an objective way to set national goals here in Norway. It is therefore also a political question as to how much Norway shall contribute to increasing the viability of Scandinavian large predator populations above short-term minimum levels. Expressed in another way: to what extent shall Norway share both the burden and the interest in conserving large predators? Our habitat analyses show that Norway has a lot of potential habitat for large predators – the question is how much of this room will Norway allow these species to use?

Even if large predators and other species are ensured viability in other countries, there is still a mandate for having these species in Norway. The question regarding how many large predators we should have cannot be answered solely by stating the number needed to ensure minimum biological viability. We must also decide how many are needed to fulfill the national interest to have large predators in Norway.

The concept of social carrying capacity

For species that are a source of conflict with human interests it is not uncommon to express goals in relation to social carrying capacity. That is to say the number of individuals of a species that people are willing to, or economically capable of, accepting within a given area. For large carnivores it is probable that the social carrying capacity is much lower than an areas ecological carrying capacity. We must remember, however, that different species have different social carrying capacities. One approach for setting population goals is to aim for the number of large predators that we can afford, or that can be tolerated within existing economic, social and ethical limits. Social carrying capacity can be gradually increased over time by focusing on investments in proactive conflict reduction rather than reactive compensation. This can allow for so-called "stage goals", where more ambitious, long-term goals can be slowly achieved in increments. This can give the necessary time for changes relative to both patterns of land-use and sociological acceptance for the presence of large predators.

If we return to the question posed in the title of this chapter "How many large predators should we have?", we see that there are many different conditions that must be taken into account. The question does not have an absolute answer.

Photo: Lars Gangås

7 How much room do large predators need?

Photo: Lars Gangås

Photo: John Linnell

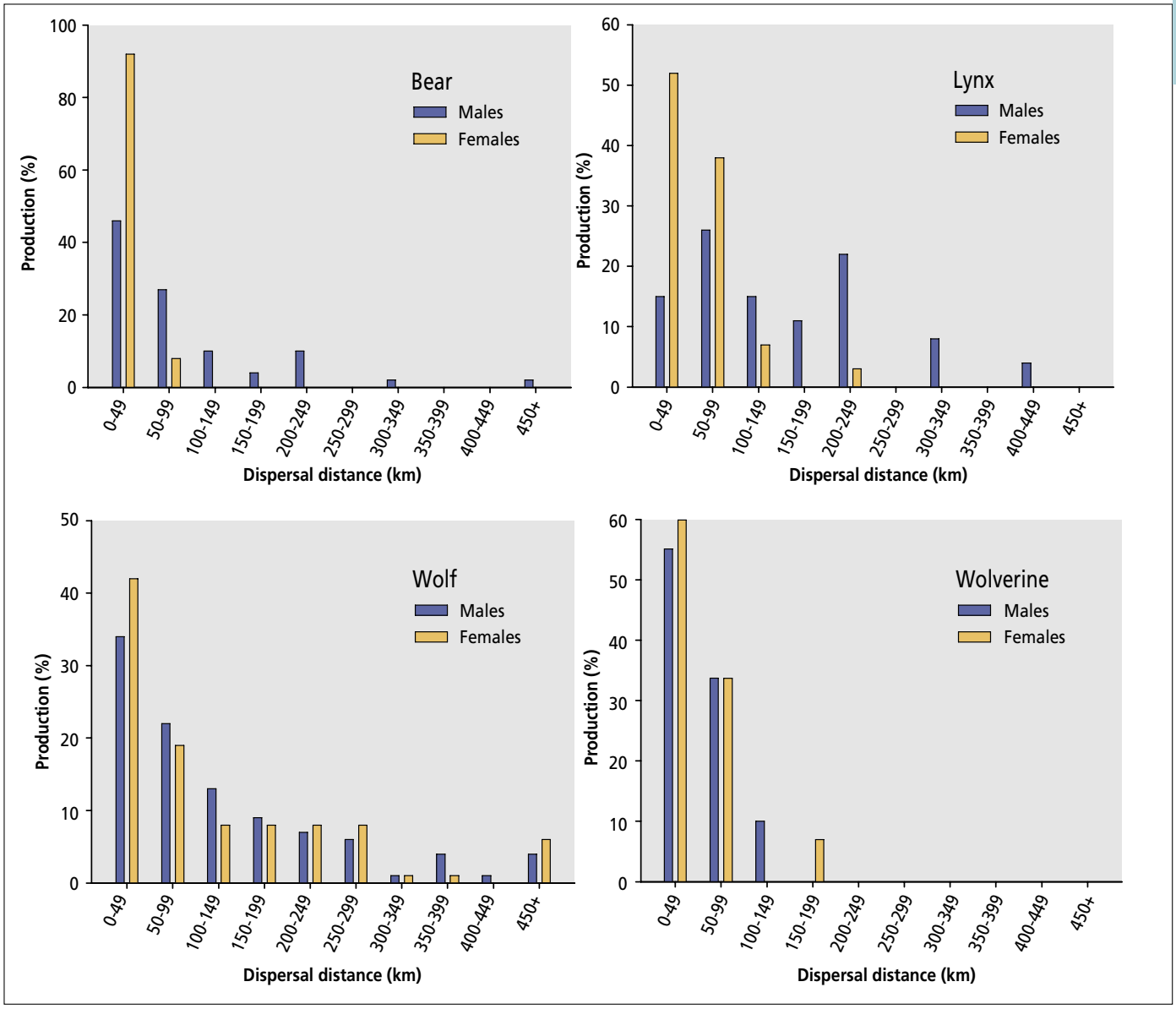
As one would expect from their position at the top of the food chain, large predators occur at low densities. Each individual has large spatial requirements, which can cross national boundaries. This size will vary from area to area. Different factors, such as habitat quality and density of prey are decisive in influencing home range size. For example, individual wolves in Saudi Arabi have home ranges that are 20 km^2, while wolves in northern parts of Canada use areas that are 50,000 km^2. The extensive use of radio-telemetry has, in recent years, given us good data on the size of home ranges for wolverines, lynx,bears and wolves, based on a number of different habitats. For all four of the large carnivore species home ranges in Scandinavia are large compared with other places in Europe, and individuals use areas comprising several hundred square kilometers. Another characteristic for these species is that males use larger areas than females. In certain cases, such as for male lynx in eastern Hedmark, territories can be up to 1500 km^2. Most large predators have stable home ranges, even if the boundaries between these can shift somewhat from year to year.

The size of individual home ranges for large carnivores and golden eagles in Scandinavia. The numbers indicate the range between average numbers for different study areas.

Species	Males (km^2)	Females (km^2)
Brown bear	800-1000	120-280
Lynx	600-1500	300-800
Wolverine	500-700	100-600
Wolf	400-1880	
Golden Eagle	100-200	

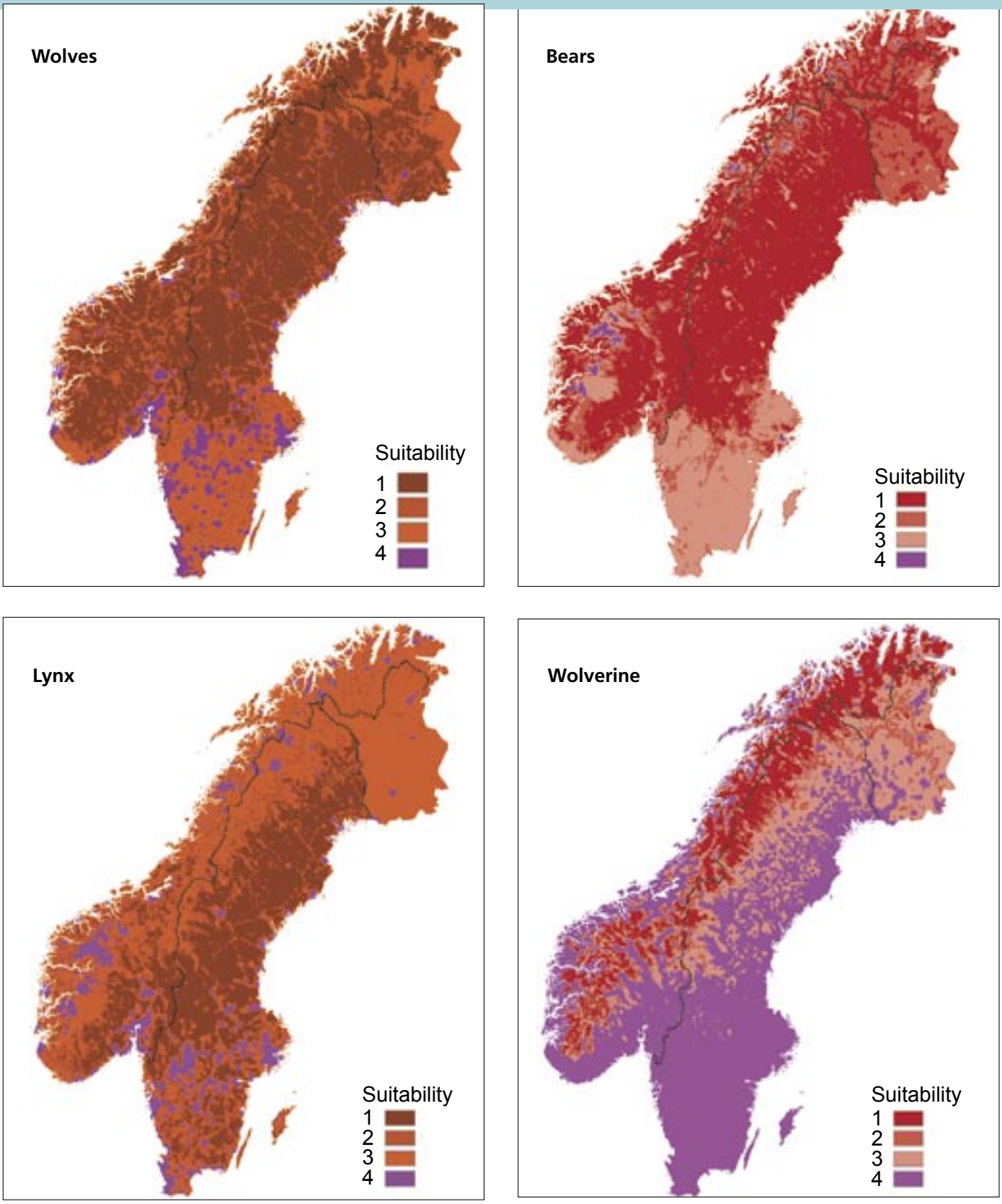
Both lynx and wolverines appear to have social systems with strong intra-sexual territoriality. This means that the home ranges of neighboring males or females overlap only to a small extent. For wolves, packs or pairs are the social unit that generally defend territories. A consequence of this type of social organization is that all three species exist in very low densities. Typical densities for lynx, wolves and wolverines is 3-20 individuals per 1000 km^2. Bears are not territorial in the same way as the other three species, but these also occur in relatively low densities. The density of adult females in the primary range for bears in Sweden has been calculated to be about 1 per 1000 km^2.

Among large predators, juvenile often disperse long distance from areas where they are born before establishing themselves in stable home ranges or territories. The most



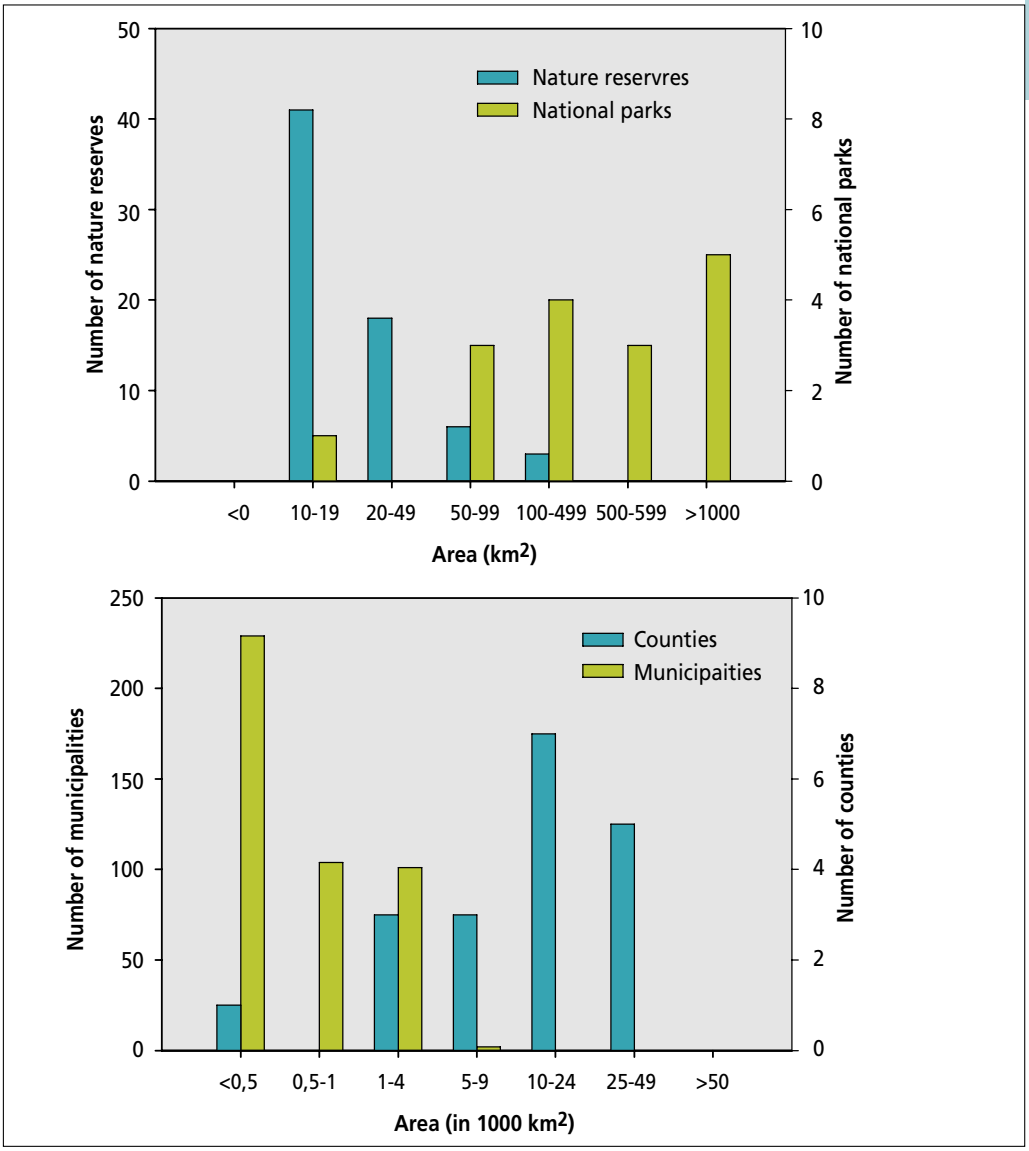
Dispersal potential of young, radio-instrumented bears, wolves, wolverines and lynx. Dispersal distance is determined as the straight-line distance between the place of birth and the place where an animal establishes its own home range, last point of contact, or place of death. All data are taken from Scandinavian populations, except for wolves, where the data come from North American studies. The limited data on wolves from Scandinavia indicate, however, that dispersal distances are of similar magnitude to those found in North America.

An illustration of the potential area of influence around four study areas for lynx. The circles are drawn on the basis of the longest known dispersal distance from each respective study area.



Potential habitat for wolves, bears, lynx and wolverine in Scandinavia. Class 1, 2, and 3 (1 is best) are determined as suitable, whereas Class 4 is considered unsuitable.

The size of national parks, nature reserves, counties and rural municipalities in Norway.



extreme distances are registered for wolves, where dispersal distances of up to 800 km have been documented.

Dispersal distances of up to 460, 450, and 178 km have been recorded for brown bear, lynx and wolverine, respectively. These are extreme values, however, and most large predators can be expected to disperse 50-100 km from their natal ranges. For wolverines, wolves and lynx both sexes disperse from their natal ranges, although males tend to have a stronger dispersal instinct. For brown bears, however, it is rare for females to disperse long distances from their place of birth.

Because of these large spatial requirements and long dispersal distances it is necessary to manage large predators within large management units. Thus, traditional management units such as private properties, hunting allotments or rural municipalities are less suitable as management units for large predators, since most individuals will utilize larger home ranges that are often larger than these units. Even some counties will be too small for managing more than a few individuals. This large spatial requirement is one of the greatest challenges for managing large predators. Even though there are many national parks and protected areas in Scandinavia, most of these are too small for even a few individual large predators, and none of these areas are big enough to maintain entire populations. As consequence of this, populations of large predators must be mostly maintained in multiple-use landscapes.

Through the use of geographical information systems we have estimated how much potential habitat is available for large carnivores on the Scandinavian peninsula. The results from these analyses indicates that almost all areas (>90%) in Scandinavia are suitable for bears, wolves and lynx, and while almost half of this area (48%) is suitable for wolverines. This information can be interpreted such that there is room for several thousand large carnivores of each species, in Scandinavia. The ecological carrying capacity will therefore be larger than the present social carrying capacity. As a result, the decisive factor limiting conservation of large carnivores in Scandinavia hinges upon human tolerance to a much larger degree than habitat availability.

8 What conflicts are associated with large predators?

Foto: Hans Christian Pedersen

The countryside in Norway is a multiple-use landscape characterized by scattered settlement and a multitude of activities associated with its exploitation. As a result, there are numerous interfaces between different interests and increasing populations of large predators, and in many cases these are considered to be full of conflict. In order to reduce these conflicts parliament has sanctioned a form of management that utilizes an array of tools, including hunting and lethal control of large predators. This use of lethal methods in management creates its own set of conflicts by provoking those who wish to have large predators in Norway. Thus, conflicts associated with large predators are quite varied, and here we give an overview over the most important kinds of conflict.

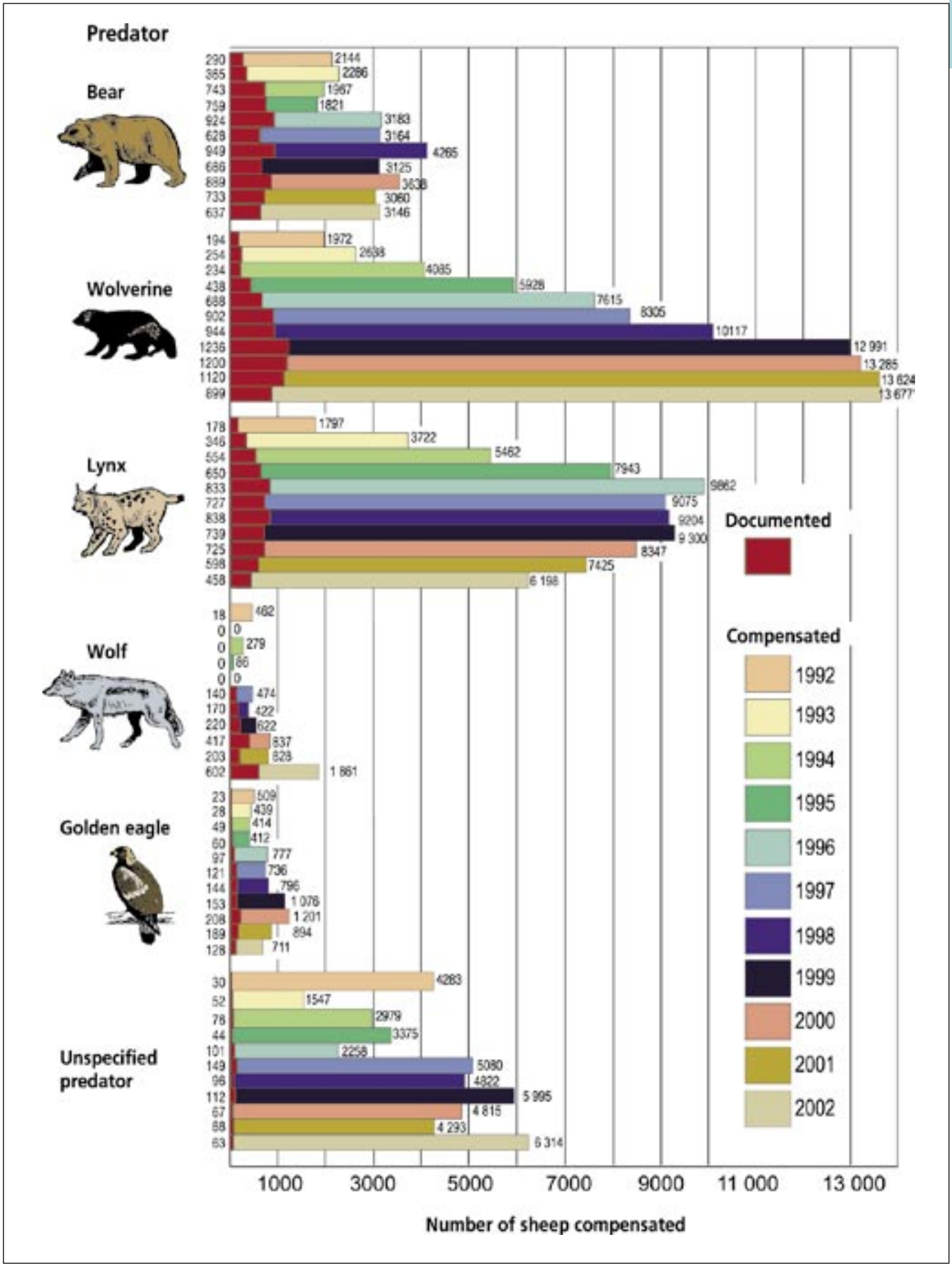
Livestock depredation

The sheep grazing industry is based on rough grazing on the open range during the summer, with limited supervison. This system was developed during the 20th century on the basis of a complete absence or very low populations of large predators. About 2.1 million sheep are grazed on the open range annually. In addition, about 200,000 sheep graze on fenced pastures. Since the number of large predators has increased as the result of conservation measures during the past 20-30 years, sheep farms in different parts of the country have experienced significant loss of livestock to large predators.

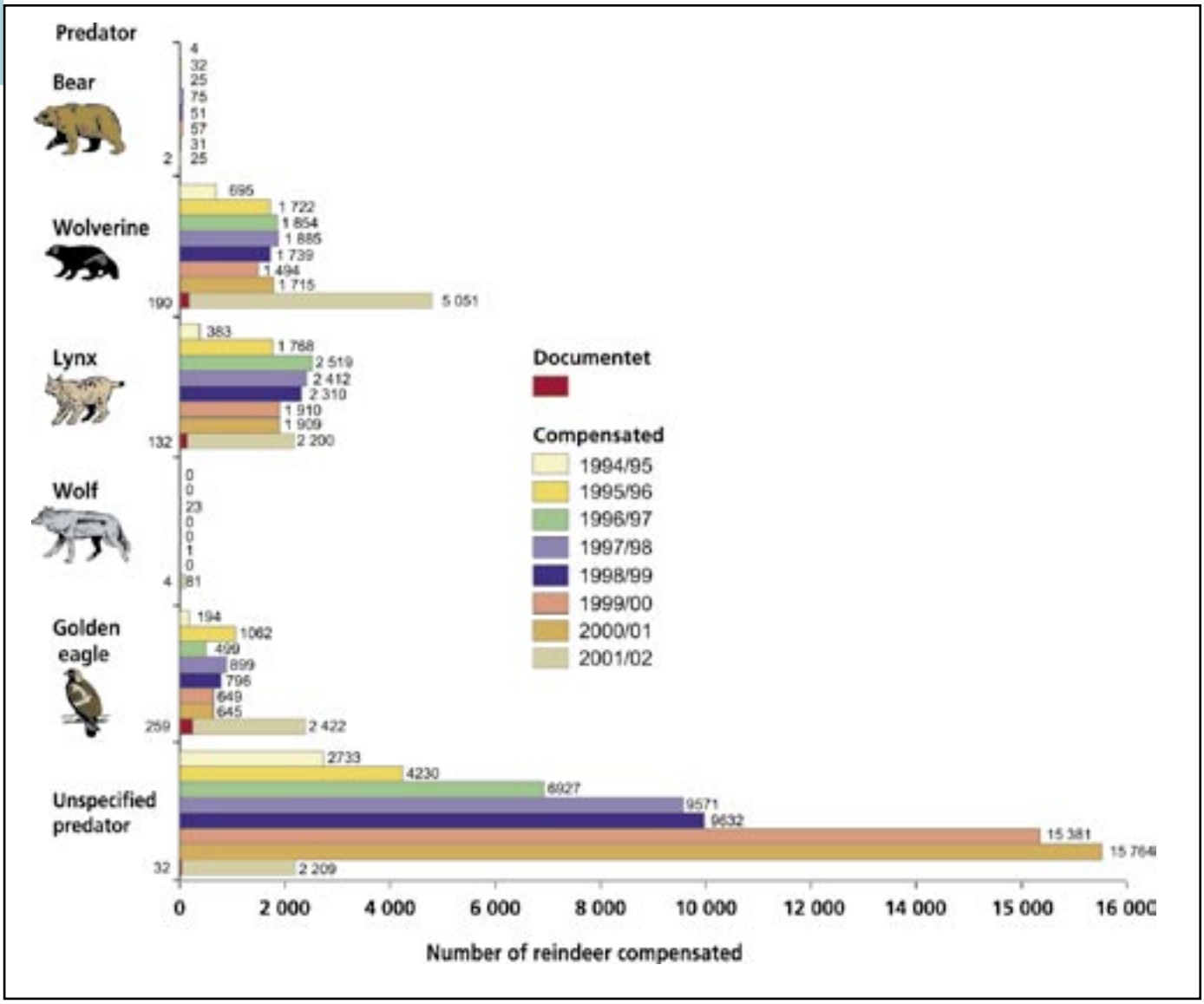
The total depredation loss that is compensated for by the state has increased throughout the 1990's. In 2002, about 57,000 sheep were claimed as being killed by large predators, for which around 31,000 were compensated. In order to reduce the level of conflict, it has been important to document the actual loss caused by large predators. At the national level less than 25% of the total number of sheep lost on the summer range are compensated for as depredation losses. However, these losses are unevenly distributed throughout the country. Most sheep owners in Norway do not experience depredation by large predators, and thus the total loss is concentrated on a few that experience relatively high losses. In some cases individual sheep farmers lose over 40% of their flock through depredation. These large differences are due to the different densities of large predators, and is most pronounced relative to depredations by wolves, bears and wolverines. These losses have negative consequences from the dual perspectives of economics and animal welfare, and are traumatic for farmers experiencing such losses.

Beekeeping is also an activity of some importance in Norway, particularly in Hedmark county, where 7000 beehives produce honey valued at about 5-12 million kroner annually. The number of beehives in Nordland county is 1000, in Troms county 250 and 50 in Finnmark county. Bears are notorious for plundering beehives, and can cause significant losses for beekeepers. At present bear-related damage to beekeeping is moderate (183 beehives depredated by bears in Hedmark county), but has been increasing in pace with the increase in the bear population. The state used to compensate beekeepers for such bear depredations, but this is no longer the case. The main reason for this is that there are effective measures for preventing bear damage.

Relatively few goats, cattle or horses are depredated by large



Causes of sheep losses by species of large predator during the period 1992-2000. Source: Directorate for Nature Management.



Causes of semi-domesticated reindeer losses by species of large predator during the period 1992-2000. Source: Directorate for Nature Management.

predators, partially because these are gathered in, particularly at night, and partially because of their size (horses and cattle). Having stated this, depredation on these may increase as populations of wolves and bears increase.

Depredation on semi-domesticated reindeer

Reindeer herding occurs over 40% of Norway's land area, in the counties of Finnmark, Trom, Nordland, parts of Nord- and Sør-Trondelag counties, as well as northern Hedmark county. The number of reindeer in Norway varies greatly from year to year, peaking in 1989/90 at 260,000 reindeer, but numbering only about 180,000 reindeer today. In contrast to sheep, reindeer are exposed to depredation by large predators throughout the year. In addition, wolverine and lynx have reindeer as a primary prey species in northern Norway. These reindeer are less domesticated (tame) than sheep, and wander over large areas with only limited monitoring, and can cross boundaries between municipalities, counties and countries. Such depredation has always been a part of reindeer herding, but in recent years it has been recognized that these losses are far too great for economically viable production.

The total depredation loss of reindeer that has been compensated has also increased throughout the 1990's. During the herding season 2001/2002 herders applied for the compensation of approximately 40,000 reindeer that were killed by large predators, and about 12,000 of these were later granted compensation. This represents a decrease in compensated loss of about 35-40% relative to the previous season. Most of the reduction has occurred in Finnmark and Sør-Trøndelag counties, while Troms and Nordland compensation has remained nearly constant. As with the sheep industry, it is important to accurately document the actual losses caused by large predators. At the national level, about 30% of the total loss is compensated for as depredation. The causes of reindeer

Photo: Magnus Elander/www.de5stora.com

mortality in this industry are complicated, and there is large variation between areas relative to both numbers and loss of reindeer. Losses caused through depredation have negative consequences in terms of economics, use of grazing resources, reindeer behavior, herd structure and animal welfare, and is difficult for the herders to bear.

Conflicts with hunting interests and hunting-related rural economics

Since wild ungulate species are a natural prey for large carnivores, it follows that as carnivore populations increase, their effects on these game populations will also increase. This will result in less game and hunting opportunity for hunters, while landowners that are dependent on income generated by hunting leases will experience reduced remuneration and in some cases reduced property values[6]. In addition, there is a real danger that wolves can attack and kill hunting dogs, something which represents a challenge for many forms of hunting where dogs are used in areas with wolves. This can result in reduced hunting opportunities and loss of hunting traditions in such areas. Hunting properties where wolves occur are avoided by hunters with dogs, something which can reduce income for property owners or those with hunting rights.

Social conflicts and conservation interests

Most Norwegians are not directly affected by material conflicts between large predators and livestock, reindeer or hunting interests. Having said this, many still experience conflicts with these species. Many people experience fear and anxiety to some extent where large carnivores, and particularly wolves and bears, occur in their locality. For some, there can be a mixture of feelings associated with living in areas where "somebody else" has dictated that large carnivores shall live. The feeling of being trampled upon by society and not being part of the decision making process is strong in many localities. Many people feel that the exploitation and recreational value of nature is reduced with respect to hiking, berry picking, hunting and other recreational interests. Even if people do not themselves fear for their lives or health, many can have worries and concerns for others, such as their own children.

There are few Norwegians who wish to exterminate large predators, but it is typical that local people often feel that populations are larger than researchers and managers state. Today's limitations on hunting and lethal control are often considered to be unreasonable, and researchers and managers are often blamed for being arrogant and dishonest when local opinions are neglected. Many feel that the price of having large predators impoverishes rural areas.

On the other hand it is important to remember that most Norwegians are positive to large predators. Not everyone views these animals as problematic, perhaps first and foremost in areas without large predators, but also those that experience them at close hand. For these people, management may itself cause conflicts because it is perceived that too many predators are killed through either legal harvest or lethal depredation control relative to the need for conserving viable populations. Many also react at the methods that are used for removing large carnivores. The knowledge that large predators exist in nature is positive for many people, and there is also a wish to give generations to come the possibility to experience these animals as part of Norwegian fauna. We have seen that people living in areas where large predator populations shall be established can experience this as something negative. On the other hand it is possible that people living in areas where these species will not be allowed to become established may also resent being excluded from having positive experiences with these species.

9 How can we reduce depredation on livestock?

The current parliamentary policy regarding management of large predators has the dual goals of ensuring viable populations of these species and simultaneously maintaining sheep and reindeer grazing in the countryside. Loss and injury must be limited for reasons of ethics as well as policy. Depredation losses to livestock caused by large predators is far above what is acceptable at present.

From knowledge passed down from earlier times, as well as research and experience with different measures for preventing depredation, we know a lot about which actions reduce such depredation and which do not. A basic principle for a satisfactory preventative measure is that it must reduce losses without displacing damage to other herds, maintain good animal welfare, be economical to implement and not reduce the quality of production. At present we know too little about how such measures can, in reality, be used in Norwegian sheep production in ways that are defensible in terms of economics, practicality and animal welfare.

There are other benefits associated with the sheep industry than just production of wool and meat, such as maintaining the pattern of settlement, the "cultural landscape" and grazing-dependent biodiversity. Tradition and ecologically friendly utilization of natural resources are also important aspects. We must examine the extent to which such "products" can be combined with adaptations such that depredation losses can be decreased.

Norway is an expensive country, and measures for reducing depredation are often costly and require operational changes. This requires substantial and predictable allocation of funds. The state must compensate for the limitations and costs that large predator management imposes upon the grazing industry.

Measures for mitigating depredation by large predators can be split into three groups:

1. Measures that focus on livestock that reduce the chances of interaction between livestock and large predators, in other words, separating them in time and space.
2. Measures that focus on livestock where "barriers" are used to prevent loss when predators and domestic stock meet.
3. Measures that focus on depredating predators.

Measures that have not shown themselves to be particularly effective at reducing losses include taste aversion, taste and smell repellents, feeding predators, removing carcasses, moving predators and using guard dogs alone with sheep on the range.

Measures focused on reducing the chance that predators and livestock will meet:

Moving sheep

Moving sheep can have a good effect on loss reduction in relation to all predator species, under the condition that there are predator-free areas to which sheep can be moved. This is, however, a complicated measure, and a number of factors must be taken into consideration. More intensive monitoring and shepherding in new sheep ranges the first few years, agreements with new landowners, as well as increased transportation costs, must be taken into account. Besides this there is the risk of disease transmission between herds that have not been in contact before. The regulations for disease prevention forbid movement of sheep over county lines, and in some cases even between municipalities.

Shortening the grazing season on the open range

This entails either delayed release or early gathering of sheep. This measure has the greatest potential for preventing depredation by wolverines or bears in early autumn, but can also reduce lamb losses to golden eagles during the early spring. This measure requires available pasture or other grazing areas that are less exposed to predators, as well as funds for leasing additional area and for buying additional forage if necessary. This measure should primarily be conducted as an acute action where extensive depredation losses occur, but it can also be done in areas with predictable depredation conditions during parts of the grazing season.

Conversion measures

In situations where it is difficult or impossible to implement preventative measures, the possibility of converting the type of livestock operation should be considered. Such a measure leads inevitably to a reduction of the sheep industry and will principally be a solution only in areas with high depredation problems. Conversion measures can lead to reforestation because grazing by sheep ceases. At the present time funds are not given to non-agricultural conversion measures.

Measures directed towards livestock where barriers are employed

Predator-proof fencing

This measure is presumed to have had a good effect relative to

all predator species if properly designed and properly constructed fences are used. Electric fences are the most effective and the most cost-effective. Five-wire electric fences with an electric current of up to 10,000 volts can be necessary. This measure requires an area of suitable size and forage of adequate quality. Parasite problems, increased need for medication, and the effects on other wildlife species and human use of the countryside also need to be considered. Electric fences are also the most effective measure for protecting beehives from depredation by bears.

Shepherding

Shepherding is a method for directing the way sheep use an area and for keeping the flock together and under watch, if necessary with the use of night corrals. Daily monitoring of sheep flocks that roam freely is not adequate in areas of high depredation risk. Shepherding has shown itself to be a good preventative measure relative to all predator species and it also reduces "normal loss"[7]. The Norwegian sheep breeds (with the exception of "old Norwegian sheep") have poor flocking behavior, something which makes this activity more demanding. By concentrating sheep in smaller areas over time, problems can arise due to parasites and the possibility of reduced growth rates. The primary barrier for implementing this measure is a matter of cost, since employing shepherds at Norwegian pay scales is expensive, and thereby requires considerable economic resources for any large-scale undertaking.

Use of guard dogs

Livestock guarding dogs are any of a number of larger breeds that have been bred for the purpose of protecting livestock from attacks by predators. Experience in other countries has shown that the use of guard dogs is a very strong preventative measure. Guard dogs are imprinted upon sheep at a young age, such that they consider themselves a part of a sheep flock and will then defend them if they are attacked. This requires, however, that sheep move together in flocks, which increases the risk for intestinal parasites and reduces meat production. This measure has been documented to dramatically reduce depredation on sheep for all predator species except golden eagles. There are three variants of this method that have given positive results in Norway: Guard dogs used in combination with shepherding, guard dogs used alone among sheep in fenced pastures, and guard dogs that patrol unfettered with a shepherd who conducts extensive and systematic monitoring in a grazing area. The use of guard dogs demands that dog handlers are very knowledgeable about this activity. Conducting this type of activity on any large scale will require significant economic resources and a knowledgeable group of competent dog trainers and handlers. If such dogs are used improperly, they can quickly be viewed as a threat to people involved in other uses of the countryside.

Measures direct towards depredating predators

Lethal control

Livestock grazing can occur with certain levels of predator abundance and depredation loss. The challenge is to keep losses down to an acceptable level in a given grazing area. Removal of large predators can prevent losses, as long as new predators do not move into the area afterwards. When sheep graze freely in the countryside, most predators that meet sheep will be potential depredators.

If preventative measures are implemented to reduce depredation, then lethal control can be directed towards individual predators that these measures are less effective against. Lethal control should therefore be concentrated on a limited number of predators, since only a few will be less affected by such measures. It should, however, be possible to remove particular predators that have extreme behavior in areas where depredations cannot otherwise be mitigated, insofar as laws and regulations allow this to take place. We also know that there are categories of predator that kill more than others; for example, male lynx kill many more sheep than females. Since hunting may also increase the wariness of predators, it may help to increase the threshold for predator attacks for preventative measures that are associated with human activity, such as shepherding or fenced pastures on farms.

Organizing mitigation measures

For a number of reason, it is important to take into consideration relatively large areas when determining the type of prevenative measures that are to be used effectively. It is therefore advantageous that municipal authorities contribute to the development and application of preventative measures. Common measures for all livestock within a given grazing area[8] must be prioritized such that any measures that are implemented do not simply push the problem onto other grazing units and flocks. Measures should be implemented over longer time periods in order to give the necessary predictability sheep herders need to plan their operations. Local knowledge of conditions should be emphasized when planning and implementing all such measures.

Work with mitigation measures should be combined with efforts within the context of the program "Organized grazing" and with municipal grazing planners. When a grazing plan does not exist, an initiative should be taken to create one in cooperation with the municipal government. In areas where acute depredation problems can occur during the course of the grazing season, plans should be made in cooperation with municipal authorities.

10 Large predators and semi-domesticated reindeer

Photo: Roy Andersen

Reindeer husbandry is considered to be one of the most important foundations of the Sami culture. In order to maintain a viable Sami culture and settlements it is therefore important that sustainable reindeer herding is maintained. During the past 10-15 years losses of reindeer to large predators have risen to unacceptable levels in many areas. This has resulted in poor economic situations for individual reindeer herders in some places. At present, reindeer herders consider increasing populations of large predators to be one of the greatest threats for sustainable reindeer herding. Research conducted in northern Norway has confirmed that lynx and wolverines are particularly important depredators on reindeer. In addition, the golden eagle is also considered by reindeer herders to be an important depredator on reindeer. Studies show, however, that many reindeer perish as a result of famine and that reindeer can also be particularly susceptible to depredation when subjugated to harsh climactic conditions.

In contrast to sheep, which generally graze on the open range for about 3-4 months annually, reindeer are exposed to depredation throughout the year. There are also few effective mitigation measures for preventing depredation on reindeer. The distribution of wolverines coincides to a great extent with that of reindeer, and the availability of the latter may be an important prerequisite for wolverine presence. The availability of sheep is, on the other hand, not a prerequisite for the presence of large predators anywhere in this country.

Within reindeer herding areas in Norway there are large regional and annual differences in reindeer density and mean calf production. In large portions of the counties of Nordland and Troms the density of reindeer is low, and the physical condition is good, although productivity is low. In these areas reindeer herds utilize coastal winter ranges which are characterized by deep snow and icing conditions which make forage unavailable. As a result, animals are in poor condition in the spring and are thus particularly vulnerable to large predators. It is therefore difficult to have a clear understanding of the extent to which this low productivity can be ascribed to forage availability or alternatively to depredation by large predators. In Finnmark county, as well as the counties of Sør-Trøndelag, Hedmark and the non-Sami domestic reindeer herds of south Norway, the density of reindeer is generally higher. In these areas reindeer graze on relatively snow-free winter ranges where the availability of forage is generally good. High densities of reindeer can, however, result in lower autumn weights and increased winter mortality under harsh climactic conditions. This can also affect the vulnerability of reindeer to depredation.

The problems for the reindeer industry are complicated, but it is apparent that depredation losses in certain areas are unacceptably high. In such situations it is important that a holistic approach is taken in solving this problem, where the use of areas outside of the reindeer districts is also taken into consideration. A holistic and long-term management of large predators that can give

Photo: Svein Wik

the reindeer industry a greater degree of predictability can be acheived through better coordination of instruments and goals between different government agencies. There is also a need for an effective forum for the exchange of knowledge between management, research, and the reindeer industry.

A more holistic, flexible and differentiated management can be achieved if the distributional range of wolverines in northern Norway can be considered to be part of the total range of the Fennoscandian wolverine population. In order for this to happen, exchange and connectivity between the northern and southern Norwegian wolverine populations must be ensured. Such connectivity would then allow for a greater flexibility regarding differentiated removal of wolverines without compromising concerns regarding population viablity.

Research indicates that there is a connection between the magnitude of reindeer calf depredation and the proximity to reproductive wolverine dens. The potential for depredation appears to be particularly great in calving areas. This is an important consideration when planning removal of depredators. It is also important that the total predation pressure in a given area be taken into consideration when measures are taken to reduce reindeer losses. A holistic regime for lynx management in Norway should also allow for flexibility and differentiation of lethal control, such that removal of lynx also is consider relative to the loss caused by wolverines in any given area. Social acceptance for management strategies can be augmented by actively using the knowledge possessed by local reindeer herders regarding the presence of reproductive dens for wolverines and family groups for lynx.

11 Large predators – consequences for deer species, hunting and hunting-related economics

Photo: Tonje Stubsjøen

Traditionally, the focus has been on the conflict between large carnivores and livestock, but there is also an increasing concern for the consequences large carnivores may have upon game species, including different species of deer. Moose, red deer, wild reindeer and roe deer are among the most important game species from an economic standpoint, and are at the same time the primary prey for large carnivores such as wolf, lynx and to some extent brown bear. The establishment of large carnivores in an area will therefore lead to increased predation on deer species, while those interested in hunting small game with dogs will be negatively impacted, particularly in areas with wolves. As a result, such predation can have negative economic consequences for those holding hunting rights and hunting-based enterprise, and also reduce hunting opportunity for the hunters themselves.

The extent to which deer populations will be impacted by large carnivores will be most dependent upon the density and productivity of deer populations. The greatest proportional effect can be expected in areas with high carnivore densities and low density and productivity of deer. In Norway today the densities and productivity of deer species is at an all-time high, whereas the density of large predators is low. Thus, only a small percentage of the total annual increment for deer is removed by large carnivores (about 5%), while the remainder is removed through harvest (about 90%) or collisions with vehicles or trains (about 5%). Moose and reindeer are the species primarily preyed upon by large carnivores, since the distributional ranges of large carnivores have only limited overlap with wild reindeer and red deer.

Despite the low overall predation pressure on deer species, there is great geographic variation due to variations in density of large carnivores. Particularly high predation pressure can be expected, and is observed, with wolf pack territories, where a large proportion of the annual increment of the moose population is removed in areas with low moose densities. We can also expect that both roe deer and red deer will have lowered survivorship within extant wolf pack territories since these species are generally preferred over moose. Lynx predation on roe deer is proportionally high in inland areas where densities and productivity of roe deer is low. In comparison, the effect of brown bears on deer species (primarily moose) will generally be low since bear densities are still low and since bears generally kill few moose. In areas with higher bear densities (such as Pasvik in eastern Finnmark county) we can expect that the relative impact on moose will be higher. However, early calf loss to bears and wolves may be often compensated through increased calf production by affected moose cows the following year.

We must remember that according to the Norwegian Wildlife Act, hunting can only be allowed where there is a harvestable surplus of a given species. In areas where large carnivores, over time, have removed the entire harvestable surplus of big game species such as deer, harvests will not be lawfully permitted.

There are several conditions which may change if ranges and populations of large carnivores expand in the future. First of all, we can expect that the cumulative effect on deer species will increase. The extent of this will be dependent upon which carnivore species increase the most. The effect on deer will probably be greatest with an increase in the number of wolves since wolves have greater energy requirements than lynx, have a carnivorous diet year-round (in contrast to bears) and can occur in high densities within pack territories. Since wolves preferentially prey upon moose, the most economically important game species in Norway, the economic impacts on landowners and others that benefit economically from moose hunting

Photo: John Linnell

will be greater than if bear or lynx populations increase locally.

As the number of large carnivores increase it is also possible that these will spread to new areas where other deer species will become the main prey. For example, coastal areas in southeastern Norway (roe deer) or western Norway (red deer). In both of these regions the density and productivity of these deer populations is high, and thus these should be able to sustain relatively high predation levels. Even so, hunting pressure will have to be reduced unless there is a specific desire to reduce cervid densities. Wild reindeer populations may also experience higher predation pressure, particularly in smaller populations near forested areas in southeastern Norway.

Hunting with dogs is an important aspect of the hunting experience for hunters over the entire country. In areas with wolves a real danger exist that wolves will attack and kill hunting dogs. In such areas some forms of hunting with dogs will be greatly challenged, with the consequence that the hunting experiences will be reduced for many hunters. There will also be a danger that time-honored traditions for different forms of hunting with dogs will disappear.

A number of mitigating measures have been tried for reducing the direct and indirect impacts of large carnivores for owners of hunting properties as well as hunters themselves. By far the most successful attempt has been the so-called "wolf telephone", which is an automated telephone service which informs hunters of the last known location of instrumented wolves with the goal of reducing the risk that dogs will be killed by wolves within wolf pack territories. However, this service has not been able to guarantee full safety since not all wolves are instrumented, pack members are not always together and wolves can also move over large distances quickly.

In 2001, different areas in southeastern Norway were given the option of participating in a trial arrangement whereby those holding hunting rights were compensated economically for the direct loss due to wolf predation within pack territories. This experimental system was implemented in portions of Stor-Elvdal municipality in Hedmark County, and feedback has been positive from participants that received compensation through this project. Many did not wish to participate, however.

Knowledge on the effects of predation by large carnivores must be integrated into future management of Norwegian deer population, through adjustments in harvest strategies and other measures. A special focus should be made on the effect of the social structure of wolves on the number of moose that are preyed upon within a wolf territory. Experience from Scandinavian and other countries indicated that the number of moose that are taken per pack per year is little related to the number of wolves in a pack. If a given number of wolves are the goal for management it will be preferable to have a large proportion of large vs. small wolf packs in order to minimize the impacts of wolf predation on moose within territories. Other measures may also be developed in the future as we gain more knowledge about the behavior and ecology of both large carnivores (e.g. what kind of wolves kill dogs) and cervids (e.g. what kind of moose are most susceptible to predation) in Scandinavia.

12 Economic considerations

Photo: Staffan Widstrand/www.de5stora.com

Conservation of large predators costs money. Society must allocate significant financial resources for compensation for depredated livestock, preventative measures, production conversion, and other forms for mitigation and compensation. Many million Norwegian kroner have been paid out throughout recent years, primarily for the replacement of lost livestock. The question is if there is a better way to use economic instruments for reducing conflicts.

At present, the compensation system for livestock (including semi-domesticated reindeer) is provided for in the Wildlife Act, which means in principal that all probable and confirmed depredation losses are compensated fully by the state. Opinions about this system are divided. Many feel that the principle behind the system is good, since it provides for compensation for actual losses. Other believe that this system could be better, since it does not allow for losses which are difficult to document. This holds especially true for reindeer. The system requires greater knowledge regarding causes of loss in order to greater compensate for all the depredation that livestock-owners believe is caused by large predators. Still others believe that this type of compensation system does not give economic impetus for reducing depredation loss. Other alternatives are being discussed by the authorities relative to the coming revision of national policy on large carnivore management. One such alternative measure is a form of compensation which pays out funds based on the presence of large carnivores in a given area. This principle builds upon the fact that since the presence of these species will lead to depredation loss, livestock owners will receive a lump sum annually based on expected loss in a given area. Such a form for compensation exists in Sweden (in reindeer districts), but direct adoption of this system in Norway is complicated because of very different forms for organization of livestock interests.

Measures for reducing depredation losses are expensive, and require a long-term, foreseeable economic framework for those that wish to use them. This is necessary for planning and implementing such that those involved have stable economic conditions in the long run. Experience thus far indicates that availability of funds for such measures has generally been too limited, too fragmented and unfocused.

Large carnivores, and bears and wolves in particular, affect populations of game species. They also affect the process of hunting itself, since wolves kill hunting dogs. In many cases this will require adaptive and precise wildlife management, as well as measures aimed at hunters

Photo: Jan P. Bolstad, Per Jordhøy, Roy Andersen and John Linnell

and those with hunting rights. One possible avenue for compensations is by strengthening local wildlife management. In order to compensate for lost hunting revenue in areas where wolves limit game populations, authorities have implemented a trial system whereby the state leases hunting properties within wolf pack territories. The state also has a compensation system for hunting and other working dogs that are killed by large carnivores, and it is possible to buy private insurance against such loss in Norway. When local hunters are engaged to shoot depredating carnivores, financial compensation for their efforts must be provided for.

It is not necessarily sufficient that different compensation schemes and allocation of funds for preventative measures are considered successful by recipients. It is also necessary that society at large accepts the use of such funds for these kinds of measures. In order to satisfy the dual goals of promoting viable populations and utilization of grazing resources, it is important to examine how national economic instruments can be made more flexible relative to different types of livestock operations and conversion to other activities. In addition, it may be relevant to allocate funds to municipalities relative to the challenges of a general nature that local communities experience with expanding and increasing populations of large carnivores.

13 Sociological conflicts related to large predators

Photo: Per Jordhøy

The fact that conflicts with carnivores are to a large extent social conflicts has been an important conclusion from sociological studies. In other words, conflicts are as much the result of conflicts between people as between people and large predators. In some cases social aspects are clearly at the forefront, with large carnivores almost acting as bystanders. Therefore we often experience the apparent paradox of human acceptance of large predators juxtaposed upon strong lobbying efforts to change large carnivore policy. Several studies have shown that those who are critical to state predator policy are not necessarily those who have great problems with the animals themselves. However, this does not prevent them from being strong advocates.

We do not wish to insinuate that the material damage caused by large carnivores is not serious, or that the anxiety people have in regards to them is not real. Both are well documented by research in Norway. Even when these problems receive great attention, we have the impression that people's frustration and anger are stronger relative to human opponents than to the large predators themselves. It is human decisions that are regarded as being responsible for increasing predator populations and for what is considered to be the unnatural and problematic behavior of these species.

The social dimensions of predator conflicts are not restricted to various economic interests associated with rural areas, different interpretations of conflicts between people and animals, or different interpretations of predators themselves. Cultural and economic power relationships and processes of social change that do not directly affect carnivore populations, livestock interests or outdoor recreation must also be taken into account if we are to understand what is going on. Examples of this can be the tensions between urban and rural groups, and the differences between generations regarding attitudes towards nature and animal life. A highly educated "new middle class", where many are newcomers, comprises an increasing proportion of populations in rural areas. Agriculture and extractive industries that utilize local resources are on the decrease, and employment in the important forestry industry has declined precipitously. Ever larger groups are losing touch with the practical use of natural resources, and do not immediately identify themselves with a lifestyle based upon agricultural or resource based industries. These changes, along with the combination of centralization and weakening of the economic foundation for rural life, can be viewed as threatening by many. The return of large predators has become symbolic of the tendencies of urbanization and uprooting in rural society, and the desire for large predator populations is therefore associated with urban lifestyles and urban concepts about nature. It is synonymous with a romantic and dreamlike concept of untouched wilderness, an ideology which does not take into account the consequences for those affected. That which is considered to be the power elite's desire for increasing populations of large predators becomes a symbol for the deplorable state of modern times, and present management of large predators thus represents something akin to big city chaos. And those that consider themselves hard hit by this phenomenon, have in some ways been caught up in exactly what they have tried to avoid: the big city and life within it.

This means that the attitudes of different parties (people in other words) regarding this issue can be at least as important to the development of such conflicts as attitudes towards predators and the use of natural resources. It also means that conflicts associated with predators can certainly not be eliminated as long as these are intertwined with other and more fundamental patterns of social conflict, and can in effect have an important symbolic function. But these can be assuaged, and we shall now look at how this can be done.

What can be done nonetheless?

Research has shown that trust between different parties is a central issue in large predator management. Today there is often little trust between these groups, and this undoubtedly contributes to augmenting conflicts. It is not surprising that trust is usually weakest between local interests that wish to reduce large predator populations on the one side, and researchers, managers and environmentalist on the other. However, it is also true that carnivore enthusiasts can also feel slighted and ignored, and have attitudes towards managers and researchers which are similar to those of their opponents.

Such problems are not peculiar to carnivore management in general or for Norway in particular. In order to mitigate such conflicts, a number of attempts have been made to develop management models that include interest groups that otherwise might not be included in decision-making processes. Much experience has been gained in North America in particular regarding different variants of "collaborative management".

Collaborative management involves dialogue and cooperation between different local and official interests (including various national and regional business and environmental organizations) when planning and implementing management measures. The goal is to increase understanding between stakeholders and achieve a greater degree of agreement regarding decisions that are made, thus reducing conflicts. There are many different models for collaborative management, but the greatest common denominator is the need for a good overview of the groups involved, as well as partitioning of power and responsibility between these. Likewise levels of knowledge, recognition of different forms of knowledge, mutual education, establishment of meeting places, good information flow and communication are important elements in this process. Collaboration should occur over time and include several processes. A broad and equal representation of interest groups is particularly important. Time and money are central elements because collaboration will involve increased demands on both with longer and more time-demanding processes. There is much international experience with collaborative management of protected areas, as well as wildlife and fisheries in general; however models dealing with large predators in particular do not appear to be common. However, it should be possible to make some general conclusions from the extensive experience derived from these processes. In Norway there a few examples of management forms which are related to large predator management and which contain elements of collaboration, such as the advisory committee for large carnivore management (known in Norwegian by its initials – RUR) as well as lynx and wolverine management boards.

However there are a few things still lacking for such organs to fulfill the requirements for real collaborative management. We believe it is important to invest efforts in developing models for collaborative management which ensure broad representation and actual influence in the process. No assumption should be made, however, that such organs will function at very local levels, since we know that the management of large predators must also reflect the demand these species have for large home ranges.

We believe that collaborative management models can be an important contribution, but they are not enough. Even such management regimes will be developed at some distance from most people, and there is thus a need for further building of trust and communication. In addition, it is obvious that there are certain groups with strong involvement in predator issues that feel estranged relative to formal approaches and the scientific foundation which will influence even the most collaborative management model.

We shall now take a closer look at other measures which may be able to reduce certain aspects of the predator conflict. Certainly we are in a situation colored by distrust between the main stakeholders, and these conflicts are integrated with social tensions at a level which is far above the realm of predator management. But even though the situation often can appear to be in deadlock, we see possibilities for several options which can guide developments in the proper direction.

We wish to emphasize here that we do not have the ambition to describe measures that aim to reduce every kind of conflict relative to large predators, and particularly not those directly related to economic and other material damage which people can experience. These are discussed in other sections of this report. Research has shown that, for wolves and to some degree bears, conflicts are primarily born by other interests than sheep farmers – i.e. "common folk" that are interested in hunting, dog handling, berry picking and other forms of outdoor recreation. That problems related to livestock interests do not always dominate the conflict complex is best illustrated by the situation in Østfold County in southeastern Norway[9]. Parallel research in Østerdalen in Hedmark County (where there is a certain amount of sheep grazing on open range) and Østfold (where there is little grazing of sheep on open range) gives the impression that the conflict was decidedly higher in the latter region, despite the minimum loss of livestock there.

Practical cooperation

Cooperation on practical matters can possibly be a wise instrument for improving trust between groups that today tend to blame each other for problems. Practical forms for cooperation on common problems generally works well for pulling people together, and at the same time this kind of effort can be effective in integrating local "experienced-based" knowledge and knowledge based on science. This kind of cooperation can thus facilitate recognition of values

which are central for many people with strong views on carnivore issues – values related to knowledge based on the everyday experiences of locals in contrast to "high-browed" academic knowledge.

This means that local stakeholders should be involved to a greater extent in activities conducted by researchers and managers, even if these in some case can seem to distract from or even come into direct conflict with the original aim of such activities. The goal of such activities should, however, be broadened such that this also includes establishing good relationships with local people, in order to reduce or prevent conflicts. This cannot, of course, be applied to all activities, but should be integrated with the most high-profile ones such as hunting/lethal control, trapping, and radio-tracking. Such activities must be planned such that local involvement becomes possible, even though such solutions may not be in keeping with the dictates purely based on the needs of research and management.

The large-scale snow-tracking censuses conducted in Hedmark county are an example of an activity at the interface between research, management and non-governmental organizations. The county-level and local-level organizations of the Norwegian Association of Hunters and Anglers have a central role in this effort. Disagreements regarding the size of the lynx quota were the basis for the desire by hunters to get good data on the size of the lynx population, and thus lynx quotas are the main focus when annual censuses are conducted. Lynx hunting has become popular in Hedmark, due to the fact that it is an exciting form of hunting and because hunters feel they are able to control the population of a potentially problematic large carnivore. Many hunters therefore have a strong interest in ensuring that "proper" quotas are set for lynx hunting. Thus, there is a strong connection between the census and hunting/population control, and we assume that this is the foundation for the positive attitude many locals have to this activity.

In Hedmark, local hunter's clubs form the backbone of this activity. This seems to lend strong credibility to these censuses and the resulting population estimates.
Cooperation base on this example, with involvement of local and regional hunter organizations on the one hand and management and research on the other, can be usefully applied to other areas. Of course, such cooperative efforts can also include other organizations representing landowners, livestock interests, and environmentalists as is the case in Østfold county. However, this may not always enjoy the same level of legitimacy relative to the greater arena of "carnivore skepticism". In southeastern Norway where wolves and bears occur it can be safely stated that cooperation with agricultural interests are not adequate for ensuring a broader, local acceptance for population estimates and other potentially controversial interpretations of the large carnivore situation in this region. However, we can not dismiss the possibility that this situation may be different in areas with high levels of depredation on livestock and where livestock is more important to the local economy. The same may also hold for areas with extensive reindeer grazing, where we still have little knowledge on how local opinions are formed.

Dialog and information

It is important that dialogue with local stakeholders be emphasized. This is a two-way process, and is not the same as information. However, information is an important component, and we are primarily concerned with information related to management and research activities. This is something other than factual information on carnivore biology. As the situation stands today, it is probable that so-called "neutral", research-based "information" on the behavior, number, etc. of large carnivores will fall on deaf ears within important groups. This, as we have pointed out, is due to several reasons. Confidence in managers and researchers is threadbare, and – perhaps more importantly – people with strong opinions regarding carnivores consider themselves as anything but ignorant on this subject. They feel they have knowledge, but that this knowledge is ignored and belittled. In order to facilitate information transfer to such individuals, it is important that this information fulfills an expressed need and simultaneously does not challenge important, identity-based values. Patronizing lectures on how carnivores "really are" will not satisfy this requirement among important local stakeholders, and may in fact be viewed as extremely provocative.

More active dissemination of information on activities conducted locally, and with regard to the roles researchers and managers themselves perceive that they have, is an important need that has been shown in several studies, and which perhaps can contribute to building trust as a basis for improved dialog regarding carnivore biology that that which is the case today.

Priorities in research and other forms of information gathering
Management and particularly research should seek to adapt

Photo: Staffan Widstrand/www.de5stora.com

research projects and other investigations to subjects which local people are interested in, and strive to develop measures that can be of use locally. The fact that interest is shown may be as important as the results themselves.

There are, of course, a number of examples of research that has focused on themes that are also of interest for groups that generally are not receptive to research. Research on wolf-moose relationships in Østerdalen is such an example. Another example is research on wolverine-reindeer relationships in northern Norway, which is considered potentially useful by the reindeer industry. But the list should be longer.

"Carnivore contacts"[10]

"Carnivore contacts" have an important position between management, research and local stakeholders, and enjoy a large degree of trust in both camps in many areas. One reason for this may be that many consider these individuals as clearly separate from the state management authority (even though these are actually employed by the state). There is little doubt that the local background, personal characteristics, and "middle-man" position of these contacts is of great importance. Even thought there are examples of carnivore contacts that have not enjoyed particularly great trust locally, we recommend an increased emphasis on this link in the management system. An important requirement in the recruitment process should place emphasis on obtaining people with local roots and necessary personal characteristics. Only then can knowledge which has been gained in the interface between practical experience and research-based knowledge enjoy wider acceptance. In this way an important skill can be implemented: the ability to speak to local people on their own level. This will also facilitate a channel for good two-way communication. This will make possible a more effective way of bringing "grassroots" perspectives to management.

New groups

Stakeholders with strong rural roots will naturally have a central role in closer future cooperation. However, there is also a desire that other groups should be involved. This can contribute to differentiate the picture of massive local predator opposition, and in the longer term a more open attitude towards predators as a part of the local fauna. We know that attitudes towards large predators exhibit large variation between areas. Strong exposition of groups without strong positions may provide a reality check for the strongest predator opponents, who often consider local communities as being more homogeneous and tight-knit than they actually are. Naturally there is also a danger that greater conflicts can be created by making visible these different standpoints, but in the longer run it is probably sensible to bring forth groups that are not strongly rooted in traditional use of the land and resources. Even among these there are many that have concerns for outdoor recreational activities and nature, and in the interests of fairness the opinions of everyone who lives in areas with large predators should be taken into consideration, be they sheep farmers, hare hunters, or academic newcomers that just go skiing occasionally. It would be advantageous if a more balanced view of the local pattern of opinions comes forth. This in turn may affect the main stakeholders and different groups in the affected community, and perhaps even modify some of the most steadfast viewpoints.

14 Which forms of hunting and lethal control can be used?

In order to satisfy the dual goals of conserving large carnivore populations and simultaneously maintaining a general use of rural areas, the Norwegian Parliament has implemented a management policy based upon a diversity of instruments, including hunting and lethal control of large carnivores. This is in keeping with Norway's international obligations relative to the Bern Convention, which under specified rules allows for the killing of protected large carnivore species, as long as this does not harm the survival of the population in question and where there are no other satisfactory solutions available.

The Norwegian Wildlife Act is the main legislative tool that regulates the management of large carnivores, including forms of hunting and lethal control. In its statement of purpose the Act states that "Wildlife and their habitats shall be managed such a way that the productivity of nature and diversity shall be preserved. Within this framework, wildlife may be harvested for the benefit of agricultural and outdoor recreation". The Wildlife Act also states that all wildlife species are protected, unless there is a basis for harvest based on certain specified criteria.

With the exception of lynx, killing of large carnivores is presently based upon the need to prevent acts of depredation. Killing of these species is primarily regulated by section 12 of the Act, which states: " In accordance with specific rules laid down by the King, the Ministry may, regardless of the regulations which otherwise apply, grant permission to kill a specific number of individuals of a predatory wildlife species that is causing serious damage to livestock or domesticated reindeer.

Provisions are also given in a regulation issued on 30 June 2000 regarding the management of bears, wolverines, wolves and lynx, which states that killing of these species can be conducted by the following forms of killing or harvest:

- Killing to limit depredation on livestock and domestic reindeer
- Killing of certain individuals relative to specific situations
- "License hunting"11through a set quota in order to limit the growth and/or distribution of a population,
- Removal of juveniles and/or mothers from reproductive dens,
- Quota-based harvest of lynx
- Quota-free harvest of lynx

In addition another regulation (dated 22 March 2002) regarding permitted methods for hunting and trapping stipulates special rules for how general harvest and license hunting, including tracking of wounded game, shall be conducted.

This management regulation states clearly that "The aim is to ensure the survival of populations of bears, wolverines, wolves and lynx in the long term, and that measures to minimize depredation on livestock and reindeer will be undertaken within this framework. Management shall be differentiated such that concerns for the protection of large carnivores and those relative to grazing interests will be balanced differently in different areas relative to each carnivore species".

Photo: John Linnell

Sustainable harvest of huntable species can only be conducted on species that fulfill the requirements for harvestability set down in section 3 of the Wildlife Act, and can be limited by quotas. These requirements specify that particular emphasis must be placed on the ability of the population of the species considered to produce a harvestable surplus, and if there is a resource value associated with such harvest. In addition, weight shall be given to the traditions regarding hunting and trapping of the species in the area considered, and relative to the level of depredation caused by the species. Lethal control and license-hunting are not hunting in the normal sense of the word, but are forms of legal killing motivated by a need to reduce depredation loss. These forms for killing of large carnivores are based on the condition that the species in question does not satisfy the above-mentioned requirements for harvestability, and/or that the species is protected through international agreements to which Norway is a signatory party.

At present, the lynx is the only species which is harvestable today under the requirements of the Act, and is differentially managed with and without quotas regionally. This form for hunting is, however, also motivated by the need to reduce depredation damage according to sections 3 and 12 of the Wildlife Act. Where bears, wolves and wolverines are concerned, these can only be killed in order to reduce depredation losses caused by these species, even if these populations are not considered as harvestable by law. These three species are also listed in the Bern Convention as species that shall be strictly protected, where lethal

Photo: John Linnell

control can only be conducted under the exceptions specified in the convention. Presently, only wolverines are killed through the license hunting system, although the management regulation also allows for similar take of bears and wolves when deemed necessary.

The Wildlife Act was changed on 30 June 2000 through parliamentary acts, in order to allow for a more flexible legal basis for differentiated management of these species, and likewise meet the challenges associated with their increasing populations. These changes in legislation have also been undertaken with the aim of harmonizing Norwegian law with the exceptions given in the Bern Convention. Changes in section 12 of the Wildlife Act and associated regulations means that lethal control can be undertaken to prevent depredation on livestock and domestic reindeer, without the need for documenting actual depredation loss.

The issuance of so-called limited control permits is conducted by the Directorate for Nature Conservation. Every year this agency determines the limited number of individuals of bears, wolverines and wolves that permits can be issued for relative to depredation on livestock or domestic reindeer. The authority to implement lethal control when stipulated requirements for this are met, is delegated to the County Governor's Office in different parts of the country, as well as certain municipalities on a trial basis.

Section 14 of the Wildlife Act permits the killing of certain species which cause damage in particular instances, without regard to protection or hunting seasons. The lethal control of golden eagles is provided for in this section of the Act and associated regulations. This legislation also allows the Directorate or delegated management authority to prevent injury to people, significant damage to property, fauna, flora or ecosystems when otherwise necessary outside of the rules laid down in sections 12 and 13 of the Act.

Under the provisions of the section dealing with self-defence (section 11) large predators can also be killed when directly attacking livestock or domestic reindeer without the need for permits.

It is is important to recognize that paragraph 35 of the Wildlife Act allows the Directorate to permit killing of protected predator species without the need for the permission of landowners12. At present this is related to stipulations regarding license-hunting. There has, over time, been a general perception that license-hunts automatically supercede the general requirement for landowner permission. However, this is not the case, and the Directorate can also allow for this form of hunting with the requirement that landowners give their permission. This is important when provisions for license hunting are to be considered in the future.

There are many indications that hunting can lessen conflicts. Here we do not refer to state control actions, but rather ordinary forms of hunting where local hunters participate. There are various reasons why hunting by locals can reduce conflicts. First of all, hunting can contribute to population reduction. In addition, general hunting may lead to increased wariness by large predators, such that meetings between with humans become less frequent than otherwise experienced.

Hunting can give local stakeholders the possibility to actively engage themselves in bringing problematic situations under control. Hunting can, in other words, reduce the feeling of impotency many locals experience relative to modern carnivore management. By allowing for license hunting, which is based on the need to limit depredation, measures should be taken to allow the participation of local hunters. This can then contribute to normalizing the status of these species locally.

When implementing permits for control of protected predator species, efforts should also be made to involve local personnel. Conducting such actions can often be very demanding in terms of time and resources, and will in many instances require different forms of compensation for those involved in these activities.

The presence of snow for tracking can be an important factor for controlling populations of large carnivores. The lack of snow coverage during winter in certain parts of the country therefore presents greater challenges.

The hunting and killing of large carnivores can also create conflicts, since those interested in protecting these species may consider such activities as indefensible on small populations of these protected species. This type of conflict will often be considered the lesser by local managers confronted with negative aspects where conflicts between large carnivores and local interests are high.

Many people react negatively to the methods used to remove protected predator species in certain situations. This is particularly true when helicopters are used. This can lead to a misplaced opposition to hunting in general.

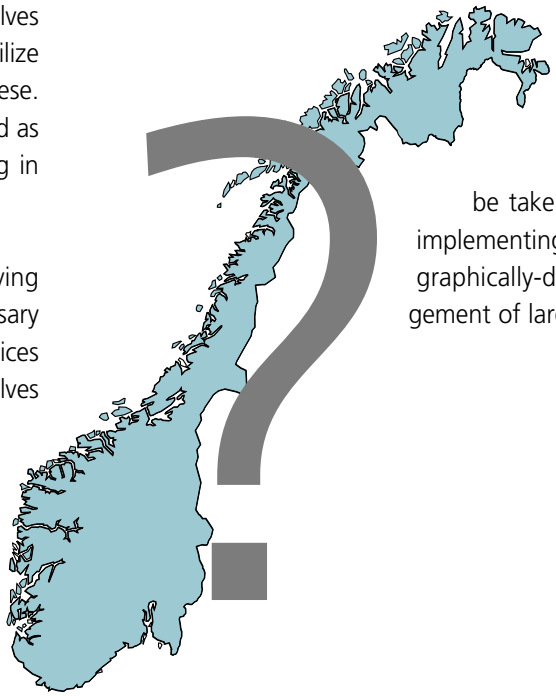
15 Principals for geographic differentiation of large predator management

Conflicts with large carnivores are unavoidable when these return to places where they have been absent for long periods, particularly where earlier adaptations to their presence are long since forgotten. The conflict situation in Norway is typical of this type of process. The Norwegian form of sheep husbandry, such as it has been practiced in recent generations, is difficult to combine with dense populations of large carnivores. In addition, anxiety and fear tend to increase in areas where wolves and bears are returning, and forms of hunting that utilize dogs are also vulnerable since wolves attack and kill these. Thus, the return of large carnivores can often be viewed as something foreign rather than natural by people living in such areas.

In developing management strategies for conserving large predators while minimising conflicts, it is necessary to determine where these species shall exist. The choices range from allowing these species to establish themselves wherever there is suitable habitat, to establishing different management strategies for different portions of the country and thereby regulate the abundance and distribution of these species as we wish (geographically differentiated management, or zoning). Such choices can be made for species individually (spread the species over a large area at low densities, or allow it to concentrate in smaller areas) and at the multi-species level (several species in the same area, or each species in its own area).

Over the past decade Norway has implemented different management strategies for the four large carnivore species, as well as the golden eagle. At the single species level, management has been relatively restrictive relative to the areas where populations of bears, wolves and wolverines can established, either through management zones for wolves or administrative core areas for bears and wolverines. The lynx has spread itself over large portions of the country, but present policy aims at preventing the establishment of reproductive populations in southwestern Norway and portions of northern Norway as well as on some islands. The golden eagle has been allowed to recover without restriction in its natural range since it was protected in 1968.

At the multi-species level, however, carnivores have been spread singly across the country, with little overlap between geographic management zones for different species. As a consequence of the fact that problems associated with different species are widespread, people in relatively large portions of the country experience what they consider to be unacceptably high levels of conflict, in part because they lack the necessary adaptions to large predator presence. The system of core areas and management zones is regarded as being controversial by people that experience problems with large predators, and thus there is a need to review the potential role geographically differentiated management of large carnivores can have in Norway.



There are six main principles which must be taken into account when implementing an effective geographically-differentiated management of large predators.

- Geographic differentiation of large predator management must be coordinated.
- Units must be of an appropriate size and placement.
- The management regime in a given area is dependent upon the management strategies in other areas.
- There are different conflicts associated with each species.
- The positive and negative aspects of geographically differentiated management will vary from conflict to conflict.
- Geographic differentiation must be consistent in practice.

The relative rank of species-specific levels of conflict for central predator-related conflicts. The rank is based on the estimated level of conflict per individuals.

Conflict	*Rank*
Sheep[1]	*wolf > bear > wolverine > lynx >> golden eagle*
Domestic reindeer[2]	*wolf >> wolverine >lynx > golden eagle >> bear*
Fear[3]	*bear > wolf >>lynx > wolverine >> golden eagle*
General social conflicts[4]	*wolf >> bear >> wolverine > lynx >> golden eagle*
Moose hunting[5]	*wolf >> bear*
Roe deer hunting[5]	*lynx > wolf*
Hunting with dogs[6]	*wolf*

1 Based on species-specific compensation for depredation losses.
2 Based on existing data, the experience of reindeer owners, and older literature.
3 Based on self-reported levels of fear.
4 Based on a comprehensive evaluation of social conflicts.
5 Based on predation rates.
6 Based on predation/killing of hunting dogs.

The relative rank of species-specific levels of conflict for central predator-related conflicts. The rank is based on the estimated level of conflict per individuals.

The fact that different conflicts have different positive and negative aspects relative to geographic differentiation is illustrated by the following examples:

For sheep husbandry mitigation measures exist which can reduce depredation losses. Measures that work for bears and wolves, also work for lynx and wolverines. When effective measures are established, these function well independent of the density of large carnivores. Such measures are, however, expensive and time consuming relative to the needed degree of predictability, and require extensive changes in operations. Sheep husbandry can benefit from a differentiated management of those large carnivore species which are considered to be the most difficult to combine with sheep farming, that is to say bears and wolves, together with a rather relaxed differential management of lynx and wolverines. This would exclude large carnivores from regions with the greatest potential for conflict, and sheep farmers in areas with populations of large carnivores will have the necessary predictability needed to adapt their operations to their presence. Differentiated management will allow the possibility for maintaining extensive sheep husbandry over large areas. Since adaptations are expensive, it is advantageous that the number of grazing operations that need these is reduced under this scheme of differentiation. Thus there is a need to provide for a system which allows for the voluntary buying out of farms as well as voluntary change-over of husbandry or coversion to other forms of agriculture. In this manner differentiated management will limit the number of operations which are affected, and thus the human and economic costs associated with this will be reduced. However, an extreme concentration of depredation pressure that leads to elimination of grazing in some rural areas will be unacceptable to many stakeholders.

The situation for domestic reindeer operations is different. There are few measures which effectively reduce depredations loss, except for actual reduction of large predator numbers. Reindeer husbandry can benefit from differential management either through exclusion of large predators from grazing and calving areas, or through reducing the total depredation pressure by spreading populations over larger areas at lower densities. Experience indicates that wolves in reindeer districts will lead to unacceptably high levels of conflict even at low wolf densities. Alternatives which include significant adaptations within the reindeer industry, and eventually conversion to other activities, must be considered in light of Norway's special national and international obligations for the preservation of the Sami culture.

The conflict relative to hunting interests is special in that it is impossible to prevent large carnivores from killing and consuming their natural prey. The reduction in the harvestable surplus of game species will occur in areas where large carnivores are concentrated, particularly where several species occur in the same area, and will be impossible to prevent. Conflicts may be less relative to hunting interests through maintenance of large carnivore populations at low densities

Photo: Lars Gangås

over larger areas, with the lowest densities in areas where carnivores have the highest potential for impact, i.e. where prey densities are correspondingly low. It is unclear to what extent the conflict between wolves and hunting dogs can be solved through geographically differentiated management.

When social conflicts are considered it is difficult to see arguments in favour of a severe geographic differentiation. The local level of conflict associated with wolves, and to some extent with bears, can be very high even in areas without conflict with livestock interests. Therefore, there is no reason to believe that the general level of conflict regarding these most problematic species will be helped through geographically differentiated management. Rather, it is probable that such a management model will augment all other dimensions of conflict, including those relating to hunting activities, rather than those related to depredation on livestock and domestic reindeer. Every form of geographic differentiation of management that is regarded as externally imposing restrictions on lifestyles and activities will lead to higher levels of social conflict. Particularly if geographic differentiation does not allow for hunting of large carnivores locally. The uncomfortable feeling of having large carnivores locally can possibly decline with experience, but may increase if carnivore densities are high. Severe differentiation with heavy hunting pressure in certain areas will also be considered problematic by those that desire larger populations of large carnivores, or by those that are against the widespread use of hunting and lethal control, or dislike the methods employed. Moreover, those that feel that large carnivores have a right to occur in Norwegian nature may experience conflict if they live in areas where populations of these species
are to be suppressed or excluded.

In summary:

Advantages associated with geographically differentiated management

1 Resources for preventative measures can be concentrated over limited areas such that some conflicts can be reduced.
2 This will lead to larger areas with very small or no problems with large carnivores.
3 This will lead to predictability in time and space.
4 Management is simplified.

Disadvantages associated with geographically differentiated management

1 Conflicts will increase in areas where populations of large carnivores shall be maintained. This will be the case even if depredation problems on livestock are mitigated, since conflicts with wolves and bears are only partially related to depredation.
2 Many will be provoked by the notion that they live in a "reserve" where they are forced by others to live with large carnivores. The more that lifestyles and natural resource usage is affected, the higher the conflict will become.
3 Concentrating large carnivores within certain areas will lead to higher predation levels on game species, and thus lead to higher levels of conflict with hunting interests in such areas.
4 Without effective measures for reducing conflicts, a minority will have to bear a heavy burden alone.

As we know, large carnivores require large areas, much larger than our protected areas and small patches of wilderness can support. This means that conservation of carnivores must occur in a multiple-use landscape where conflicts with other activities is unavoidable. Modelling through the use of GIS (Geographic information system) analyses has shown that most of the landscape in Norway is potential habitat for bears, wolves, and lynx, and that large tracts also satisfactory for wolverines. There are sources of conflict everywhere in Norway, even if the nature and context of these conflicts varies a great deal from region to region. For example, domestic reindeer herding is concentrated in central and northern Norway, while sheep grazing is most extensive in alpine areas of southern and western Norway. Because of the particularly high potential for conflict in some areas, it is difficult to imagine a management regime without any form for geographic differentiation since the potential for conserving large carnivores in such areas will be limited.

It is therefore not without good reason that geographically differentiated management of large carnivores has been a central principal in the two previous revisions of parliamentary policy and concordant law on this issue. This does not mean that damage and conflict are lesser in certain areas, but rather that the instruments used to solve conflicts vary from place to place.

Geographic differentiation can be used in several different ways. An extreme situation (black & white) is complete protection of large carnivores in some areas, and their complete exclusion in other areas. For Norway, an alternative with different shades of gray will be more suitable in the multiple-use landscape. This will involve a fine-scale gradient of management practices for different areas, such that one may, for example, regulate populations of these species in areas where they are allowed to become established. Such a regime may be composed of several different management areas with different population goals, management regimes, and implementation of depredation mitigation measures. In this way everyone in Norway will live in some form type of management area for large carnivores, including those areas where management goals preclude their establishment through strict population control measures. As such this will be similar to management of other wildlife, except for the fact that large carnivores require larger management units across political boundaries. Since juveniles of these species require very large dispersal areas, it will be difficult to maintain sharp delineations in a black & white system.

From all of this we understand that the optimal degree and configuration of geographically differentiated management will vary from conflict to conflict, and that this requires a prioritizing of conflicts. This is a job for politicians. However, it is possible to formulate a few basic principals for compromise, based on scientific data (both ecological and sociological) and experience gained from the past decade of carnivore management.

- Look upon geographically differentiated management as a way of setting limits on potential distribution of large predators rather than creating reserves for them.
- Geographically differentiated management is based upon the varied use of management tools in different areas.
- It must be made clear that all areas of Norway are included within a larger management area for large predators, even though the management regimes can vary with regard to management goals, levels of harvest and use of conflict-mitigating measures.
- At the same time, greater restrictions should be placed on the geographic range of establishment for wolves and bears relative to wolverines, lynx and golden eagles. This will reduce many, although not all, conflicts.
- Geographically differentiated management can be necessary, but units should not be so small that locals feel they are living in a reserve.
- It may be necessary to exclude all species of large predators from areas with the greatest potential for material conflicts.
- Geographic differentiation should also be based upon areas with and without domestic reindeer herding by the Sami people.
- At the same time it is important to not limit the geographic range of large predators to such an extent that it will be impossible to actively regulate their numbers in all areas.
- Attempt to achieve the advantages associated with multiple-species management (i.e. preventative measures that work for wolves and bears that also work for lynx and wolverines) where possible.
- Prioritize contact with Swedish, Finnish and Russian populations. This will ensure a greater degree of survival for large carnivore populations, and a greater degree of flexibility in management relative to population control and regulation.

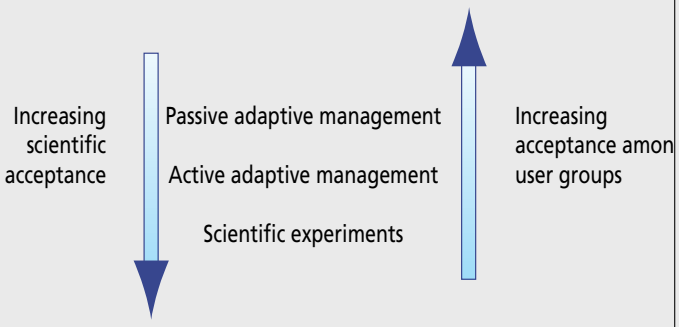
16 How can we ensure an adaptive management

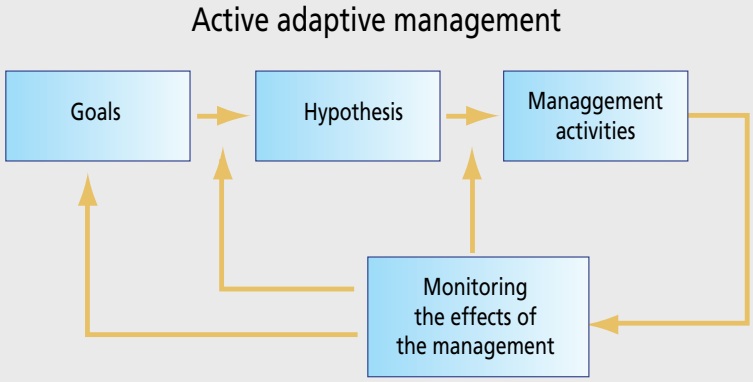
What is implied in the concept of adaptive management, and why is this and important concept relative to management of large predators?

In the past few years, the concept of adaptive management has gained a wide following as a principle for management of biological resources. This principle is based upon a form of management that can be adapted on the basis of results achieved through implementation of different management measures.

There are two different types of adaptive management strategies. Passive adaptive management occurs when information is only updated when results are observed – in other words a "wait and see" strategy. If, however, management decisions are designed such that they maximize feedback for future management, then we call this process active adaptive management. In an active adaptive management strategy knowledge based on experience is handled in a systematic fashion.

Photo: Erlend B. Nilsen





A passive, adaptive system of management can, for example, allow for the setting of a lynx harvest quota without a clear idea of how this may affect the population. If lamb losses go down in the area, it can be assumed that this is due to a reduction in the lynx population, which in turn means that harvest has removed more animals than are being recruited into the population. But we still do not know how large a harvest the population can sustain.

Lynx quotas in Norway are set on the basis of the number of registered family groups of lynx. If a standardized system of registration is implemented after each harvest season such that results are comparable, the effect of harvest can be measured. This is the case today, and is an example of active adaptive management.

In order to achieve set goals, management activities can the be adjusted (i.e. increase/decrease quotas), or the goals can be changed if they are found to be difficult or unrealistic.

In general, a management system based on a "wait and see" strategy is most acceptable for user groups. This means that the scientific uncertainty about what is actually happening can be high as long as the general acceptance for the measure is also high.

When management of large carnivores is considered, most people agree that there is a need for good precision in management measures, and that these measures should enjoy wide local acceptance.

Therefore it is important that three criteria are satisfied:

- Local and regional managers must cooperate with researchers in the formulation of management measures. Thus, the effect of measures can be quantified, and knowledge based on experience can be used in a systematic fashion.
- Local acceptance must be strengthened through the use of local personnel in population counts and their participation in management measures, such as hunting, where this is possible.
- A properly functioning system for monitoring changes in large carnivore populations and affected species must be in place. At present, there is no such system for domestic reindeer, red deer or roe deer.

Time, personnel and economics are often not adequate for providing managers with the desired information needed for making decisions. However, a delayed decision is also a decision! This means that one should strive for a strategy of active adaptive management where possible, such that the effects of management measures can be measured and experience from these be applied to the further formulation of management strategy.

17 Successful criteria for a future strategy for large predator management.

On the basis of increased scientific and experience-based knowledge gained since the last revision of Norwegian policy on this issue, as well as discussions within the Advisory Group, a number of criteria have crystallized which politicians should take into consideration when formulating future policy on large predator management.

If future management of large predators shall

1 contribute to viable populations of large predators and
2 maintain a general use of the rural landscape and viable human communities throughout the country,

there are at least 5 criteria for success that must be fulfilled:

- **Increased predictability**

- a management strategy must have a clear framework in time and space,
- long-term funding must be guaranteed in order to carry out the necessary measures relative to mitigation of the various conflicts,
- the use of management instruments must be harmonized between different authorities,
- management must be consistent.

- **Increased local acceptance for management strategies**

- ensure local involvement in formulating and conducting management measures,
- improve communication between research, management and local people,
- work for the normalization of large predator species locally,
- allow for hunting (by either permit or quota) where this is biologically defensible (with the possible exception of golden eagles),
- provide funding for compensating aspects of large predator conflicts.

- **Reduce depredation losses caused by large predators on livestock and domestic reindeer**
  - reduce locally high levels of depredation,
  - reduce the total level of depredation at the national level,
  - insure funding of preventative measures

- **Formulate a management strategy that also takes the following into consideration:**
  - rural people that are not directly affected by conflicts between livestock/reindeer and large predators.
  - fear, anxiety and social conflicts must be taken seriously,
  - reduce the conflicts with hunting interests,
  - maintain the possibility for positive experiences related to large predators.

- **Insure a favorable conservation status for large predators in Fennoscandia, where Norway takes its share of responsibility.**
  - insure good population monitoring of large predators,
  - insure that harvest and lethal control is conducted within the biological tolerances for each species, respectively,
  - continue to develop cooperation and establish goals for viability for large predator management in close collaboration with our neighboring countries.

Stortingsarkivet/ foto: Teigens fotoatelier as.

Footnotes

1 ”Large predators” in the context of this document includes brown bear (*Ursus arctos*), wolf (*Canis lupus*), lynx (*Lynx lynx*), wolverine (*Gulo gulo*) and golden eagle (*Aquila chrysaetos*).

2 The term ”carnivore” includes lynx, wolverine, wolf and brown bear. The golden eagle was not included in earlier policy papers voted upon in parliament.

3 Special permit hunts are special hunts with specific seasons and quotas that are designed to regulate population numbers and distribution in order to limit depredation caused by protected predator species.

4 In Norwegian, the term ”quota hunt” is formally distinguished semantically from “permit hunt” since the former is conducted on a species regarded formally as viable and thus harvestable by the criteria specified by the Wildlife Act. Permit hunts, on the other hand, are limited take of species populations that are formally protected and considered vulnerable or threatened.

5 Fennoscandia includes Norway, Sweden, Finland as well as the Kola Peninsula and the district of Karelia in northwestern Russia.

6 In Scandinavia hunting is an important economic activity. Hunting rights are often leased to hunting teams that gladly pay landowners for the right to harvest large game species, including moose, wild reindeer, roe deer and red deer. Even though game belongs to the state, landowners can sell hunting permits, or game products harvested, from their own property. Game meat is sold on the open market and commands high prices. This is often sold at a profit, either by the landowner or by the hunters themselves. Given the large numbers of wild ungulates harvested annually in Norway, this represents a substantial economic value, both for the hunters themselves and for those holding hunting rights. The traditional and recreational value for hunters is also considered to be very important in this context.

7 In Norway, ”normal loss” is a term to indicate the level of natural mortality which is generally accepted during the summer grazing season. This loss is usually characterized as the mortality due to natural causes where there are no large predators.

8 In Norway these are defined in terms of local grazing organizations that have common rights to allotments.

9 Here the conflict is based primarily on direct conflicts with hunters due to wolves killing or injuring hunting dogs, as well as a general anxiety and uncertainty in the local population due to the fact that the area is relatively densely populated, such that human-wolf interactions are relatively common.

10 These are local people employed by the State Mature Inspectorate to validate observation, tracks and depredated livestock.

NINA Temahefte 25

ISSN: 0804-421X
ISBN: 82-426-1454-7

"There is always a compromise"

Tony Soprano

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