# Guidelines for Population Level Management Plans for Large Carnivores

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# 1. Introduction

Europe is home to four species of large carnivore – the brown bear (*Ursus arctos*), the wolf (*Canis lupus*), the wolverine (*Gulo gulo*), and the Eurasian lynx (*Lynx lynx*)[1]. Conserving these species is a real challenge in landscapes which are as crowded and modified as those that we have in Europe. The main challenges stem from their most fundamental characteristic – as top predators these species need a lot of space. Home range sizes of individual large carnivores in Europe tend to vary between 100 and 1000 $km^2$ – depending on habitat characteristics and environmental productivity (Nilsen *et al.* 2005; Herfindal *et al.* 2005). This implies that they never reach very high densities – typically ranging from 0.1 to 3 per 100 $km^2$. In addition to these characteristics of resident, adult individuals, juvenile large carnivores often range widely during their dispersal phase, with some individuals moving over hundreds of kilometres. A consequence of this is that populations of these species do not fit into protected areas – in fact very few European protected areas are able to embrace the home ranges of more than a few individuals of any large carnivore species (Linnell *et al.* 2001a). This implies that their conservation depends on their presence in both protected areas and in the matrix of multi-use habitats that surround these protected areas, and in fact constitute most of the European landscape. Luckily all four species have proven to be relatively adaptable to these modern European landscapes (Breitenmoser 1998; Kaczensky 2000; Linnell *et al.* 2001b), which makes it possible to imagine a viable future for their conservation. However, their presence in these multi-use landscapes leads to a number of conflicts with human interests (which we shall explore later).

Another consequence of their low densities and wide ranging behaviour is that we are forced to reconsider the appropriate scale at which they should be managed. From a biological point of view a population of large carnivores extends of hundreds, thousands and often tens of thousands of square kilometres. Such a huge area is always fragmented by many types of administrative borders, including those of protected areas, municipalities, counties, states, countries, and super-national entities like the European Union. On the scales that we are talking about here there are few administrative units that are able to contain a viable population of any large carnivore species on their own. Therefore, it is vital that conservation planning for large carnivores occurs in a coordinated and cooperative manner between all the administrative units that share populations. A first attempt to achieve this occurred in 1999 when the Bern Convention endorsed a series of action plans for bears, wolves, Eurasian lynx and wolverines (Boitani 2000; Breitenmoser *et al.* 2000; Landa *et al.* 2000; Swenson *et al.* 2000) produced by the Large Carnivore Initiative for Europe (www.lcie.org). These strategic documents started a process to change the way we think about managing these species. However, with the continue growth of the European Union there is a need to integrate this way of thinking when implementing the Habitats Directive in a more formal and structured manner.

Two fundamental concepts need to be understood. The first is that the unit for conservation planning should not be just the portion of a population that falls within a given state's or country's boundaries. Rather it should be the entire biological unit, involving all administrative units within its distribution. The second concept is that conservation of large carnivore requires their integration with human activities in human-dominated landscapes. This means coexistence between large carnivores and humans, which is not always easy to achieve. It almost always requires active management (such as reintroduction, translocation, hunting,

[1] A fifth species that is often counted as a large carnivore, the Iberian lynx (*Lynx pardinus*), occurs in southern Spain, but this is not dealt with further in this report, as its distribution is very limited and the conservation issues differ greatly from the other four species. This specific conservation issue is currently being dealt by LIFE-Nature project LIFE02NAT/E/008617 and LIFE02NAT/E/008609

lethal control) of large carnivore populations and coordinated planning with conflicting land-uses and activities. However, the need, and the acceptance for, different management options will vary greatly throughout Europe (Boitani 2003). Therefore, there is a need to establish a conservation system which is both coordinated and flexible – to permit local adaptation of the means needed to achieve a global vision. The present lack of such a system is reflected by the many conflicts that large carnivores cause and the amount of time that both the Bern Convention Secretariat and the European Commission spend on large carnivore issues.

In response to this need the European Commission launched a call for tenders (ENV.B.2/SER/2005/0085r) in 2005 for the development of "Guidelines for population level management plans for large carnivores in Europe". The contract was won by the Istituto di Ecologia Applicata (Italy) in cooperation with the Norwegian Institute for Nature Research (Norway), Callisto (Greece) and KORA (Switzerland). In addition, during the process of developing this report we have utilised a wide range of expertise from across Europe, mainly from within the IUCN SSC's working group – the Large Carnivore Initiative for Europe, and the Wolf, Bear and Cat Specialist Groups. In addition, as the report has progressed we have received much valuable feedback from various member states as well as presenting the various drafts at meetings of the Habitats Committee.

Following the initiation of the first project, the Commission launched a call for tenders for a second, follow-up project (ENV.B.2/SER/2006/0059). This contract was won by the same consortium. The project organised a series of workshops that were held in most member countries[2] that host large carnivore populations. These workshops have served to channel comments on the guidelines from responsible authorities and key interest groups to the Commission. The process has culminated with a pan-European congress of from 10$^{th}$ to 11$^{th}$ June, 2008, in Slovenia where a final version of the guidelines was presented.

This document is one of the products of these contracts. Its intention is to present a discussion of the technical background required for developing conservation management plans for large carnivores at the population level. It contains the following elements, (1) a conceptual discussion about populations and some operational proposals for defining large carnivore population units, (2) an overview of the European carnivore populations, (3) an exploration about the potential linkages between population viability and favourable conservation status, and the development of an operational proposal on defining favourable conservation status relevant for large carnivores, (4) an outline of good practice guidelines for certain aspects of large carnivore management, and (5) recommendations on the process for developing a population level management plan and an outline for what such a plan should contain.

Our brief was also to include all European countries west of 35 degrees east. This includes many countries that are not members of the European Union, and therefore not bound by the Habitats Directive. As adopting a population approach will often require cooperation between EU and non-EU countries, the total range of management situations and legislative constraints will vary to a greater extent than if we only considered the EU countries.

[2] Workshops have been held for: Sweden, Finland, Latvia / Estonia (joint workshop), Lithuania, Slovakia / Czech Republic (joint workshop), Slovenia, Spain, Italy, Portugal, Romania, Bulgaria, Germany, Austria. In addition to these EU countries, workshops were held in Switzerland and Croatia, and the guidelines were presented to the Nordic Council. Norwegian management authorities have also been orientated on the development of the guidelines. Comments from a range of regional management authorities, individuals and organisations have also been received and considered.

# 2. What is a population? Defining concepts and developing an operational understanding

The population concept is one of the most basic concepts in biology – yet it remains one of the least defined concepts in current usage. The basic idea refers to a group of individuals that live in the same area and can potentially interbreed. However, reality is often fuzzy and things rarely come in neat packages. For animals that have many different movement and social organisation patterns, it can often be hard to tell where one population ends and another begins. The result has been many discussions about both the operational (how to define it in practice) and the conceptual (what do we actually try to describe) nature of populations (Camus & Lima 2002; Berryman 2002; Baguette & Stevens 2003; Schaefer 2006). As a result many different approaches have been used, including those that focus on taxonomy (e.g. subspecies or Evolutionary Significant Units), genetics, distribution (continuous vs. discontinuous), behaviour (home-range, seasonal migration, dispersal), ecosystems (embracing energy flow), demographics (the degree of synchrony in fluctuations of population size), and even economics (Waples & Gaggiotti 2006). In the absence of any generally accepted definitions, researchers and managers have usually defined their own *ad hoc* borders to suit their particular situation.

Despite the ongoing debate, there is a movement towards the idea that a population is actually a hierarchical concept where different elements and processes function at different spatial and temporal levels (review in Linnell 2005; Schaefer 2006). At the largest spatial scale we have a species which can be viewed as a population in evolutionary time. At the smallest scale we can have an isolated group of a few tens of individuals that temporarily occupy a discrete habitat patch which may be ephemeral. In between these extremes there is a wide range of potential distributions and processes. In general, for conservation purposes we must consider two processes: genetics and demographics. The genetic elements of the population processes occur at larger spatial and temporal scales than the demographic because the occasional movement of animals between two discrete patches or clumps will be enough to prevent genetic differentiation, but will not be sufficient to have any significant influence on demographic processes. As we shall discuss below, maintaining genetic diversity is a long term conservation issue that requires much larger numbers of individuals than the short term maintenance of numbers that are needed to avoid demographic extinction.

Therefore, to operationalise these concepts, we suggest that populations be viewed simultaneously as a nested hierarchy of entities. We suggest that the word "*metapopulation*"[3] be used to refer to the large scale phenomena that embrace the distribution of individuals with a broadly similar genetic structure. This distribution may be spatially discontinuous – but there should be sufficient connectivity, in both space and time, to permit the dispersal of animals that ensures gene flow and some degree of demographic stabilisation. This may be on the level of a few individuals per generation. Within this metapopulation there may be a number of "*subpopulations*" that consist of individuals within a reasonably continuous distribution that interact with much greater frequency such that the demography of the group is mainly influenced by birth and death rates rather than by the immigration of animals from outside (from neighbouring subpopulations within the metapopulation). Within a subpopulation there may also be some fine scale spatial structuring that results in individuals being clustered into non-uniform clusters. For the purposes of this report we call these

[3] In this context we do not use metapopulation in its strictest sense that requires the extinction and recolonisation of subpopulations. Rather we use it in its more widespread context of a fragmented / patchy distribution where subpopulations have independent demographic patterns. See Elmhagen & Angerbjörn (2001) for a discussion explicitly focusing on the application of metapopulation for large mammals.

clusters "*population segments*"[4]. Finally, there may be some individuals or very small groups of animals that occur outside the distribution of any subpopulation. If they are mobile, and do not occupy a discrete and predictable area, and do not reproduce, these individuals are termed "*vagrants*". If they are stable and occupy a predictable location over several years they can be called an "*occurrence*". Typically reproduction will only be sporadically documented in an occurrence. The subpopulation is the formal biological term for the unit that we discuss in this document, however for the sake of simplicity and to harmonise with the usage already employed within the Habitats Directive we will hereafter refer to a subpopulation simply as a "*population*".

Deciding where geographic borders should be drawn between different subpopulations will in practice be best done using data on animal distribution combined with knowledge about the potential quality of habitat, the existence of barriers, and the dispersal ability of the species. As distributions change over time these boundaries are likely to be dynamic. This dynamism, combined with our imperfect information concerning species distribution will sometimes require that boundaries are drawn using subjective, though pragmatic, criteria. In such cases geographical knowledge of habitat configuration may serve as the best surrogate. If two different areas are very large, have very different ecologies (different habitat or climate) or have very different management regimes, conflict levels, or conservation statuses, it may also be most pragmatic in some situations to distinguish them as distinct populations.

We should stress that these are merely definitions that we have developed to operationalise the population concept for large carnivore conservation purposes and other species may well need another structure with different definitions. The important factor for conservation is that we accept that there is not just one thing called a population that only occurs at one level and where we try to focus all management actions and decisions. A population is a multi-level structured concept, hence management decisions should take this into account. By accepting the hierarchical nature of the population concept we open for the potential to make different decisions at different spatial (and temporal) scales. Decisions concerning overall policy objectives can be made at the largest spatial scales[5]. This will apply to an area equal to, or larger than, any population (e.g. Europe, the Alps, or the Carpathians). However, the actions needed to achieve these overall objectives may well differ within different regions (e.g. different countries or states) or populations that make up this population. In fact, many actions will need to be distributed in a spatially structured manner (e.g. compensation payments, hunting quotas), requiring that large populations be divided into smaller "*management units*". This lowest level is not so much used for decision making, but is a way of distributing actions in space. This hierarchical structure is in accordance with the EU's principle of subsidiarity and the Malawi principles of the Convention on Biological Diversity (Prins 1999) that recommend that as much decision making freedom is transferred to the lowest possible level within the wider frames imposed by more central decision making bodies. We call this the concept of "freedom within frames".

[4] Not to be confused with legal term of "distinct population segment" used in the US endangered species act and as a result much of the scientific literature.

[5] For example, under current Norwegian management procedures, the national parliament has decided that large carnivores should exist in Norway, and has determined the desired population size for each of 8 management regions. Within these regions, authority to set hunting quotas and decide where in the region they want to have each carnivore species has been delegated to a local board. These local boards have a great deal of influence on the day to day management of carnivores, but are constrained by the principle decisions and numerical goals set by the national government and central management agencies.

# 3. European large carnivore populations and the need for population level management

## *3.1 Background and definitions*

Large carnivores are widely distributed in Europe – with various species distributed from the Atlantic seaboard of Spain in the west to the Russian taiga in the east, from the Mediterranean forests of Greece to the tundra of northern Norway. Due to centuries of persecution and habitat conversion their distribution is far from continuous. Instead, they have a very fragmented distribution, with various patches of occurrence scattered across the European landscape. Some of the patches are large and contain thousands of individuals, while others contain ten or less. Some are isolated by hundreds of kilometres, while others are located closely together. Sometimes the intervening habitat is of good quality for large carnivores, while in other cases it is hostile. The situation is complex, and to make matters harder still, it is dynamic, with natural and assisted expansion on one hand, and population decline on the other.

In order to systematise this complexity we have collected the best available data on large carnivore distribution and status from across Europe (see Appendix 1 and the online information systems available at www.lcie.org). Based on these distribution data we have attempted to identify, for each species, a series of units that we call *populations*. As explained in section 2, these populations are units where a given species has a more or less continuous distribution such that individuals can interact often enough for the unit to constitute a demographic unit. Borders between populations are drawn primarily based on discontinuity in distribution. Geographic features have also been utilised here. Species specific differences in dispersal have also been taken into account. Wolves have by far the greatest dispersal ability of the four species, with individuals of both sexes able to disperse over hundreds of kilometres (Linnell *et al.* 2005). Lynx and wolverines have intermediate dispersal ability. Studies have shown individual records of dispersal distances of several hundred kilometres in both species, but on average males disperse more than females, and overall dispersal distances can be highly context-dependent and quite limited in some highly fragmented landscapes (Andersen *et al.* 2005; Flagstad *et al.* 2004; Schmidt 1998; Vangen *et al.* 2001; Zimmermann *et al.* 2005). Bears have the greatest sex bias in dispersal ability. While males may travel many hundreds kilometres, females rarely disperse from their natal areas (Støen *et al.* 2006; Swenson *et al.* 1998). In cases where a very large area of distribution contains areas where the species is exposed to very different management or ecological conditions we have chosen to split it into two or more populations in an effort to identify units which have relatively homogenous demography. This was especially necessary when it came to eastern countries bordering onto Russia. For Eurasian lynx, bears and wolves Russia represents a massive population, stretching from the Baltic Sea to the Pacific Ocean. In order to limit our scope we have only considered the provinces ("oblasts") from Moscow (35 degrees east) and westwards. In addition to this east-west truncation we have made a north-south truncation, grouping the oblasts of Murmansk and Karelia with Finland and Norway into a population and separating these from the oblasts bordering the Baltic States, Belarus and Ukraine into another. Although there is a set of natural geographic features marking this border (Lakes Onega and Ladoga and the White Sea) the carnivore populations extend continuously across the region, and our separation is intended to be pragmatic rather than biological.

In some other cases where species distribution is somewhat clumped (non-uniform) within a population we have also recognised some distinct population segments. Further research on population genetics, movement ecology of marked individuals, or simply better mapping of species distribution may change these designations. This is most likely to lead to the reclassification of some population segments as populations. Furthermore, the expansions or contractions of the ranges of the species in different areas will require a constant revision of their population structuring.

## *3.2 Summary of results*

The following set of tables (Tables 1-4) summarises the results from Appendix 1, listing the populations that we have identified for each species. For the sake of orientation we have grouped populations into their general geographic regions and provided a list of any population segments that occur within these populations. For each population we also indicate its approximate size and the countries (both EU and non EU) that it occurs in. Caution should be used concerning both the size and distribution of these populations as the quality of data vary greatly from country to country. For countries with federal systems we list the autonomous regions and states that it covers as footnotes. It should be underlined that this is a first attempt at making such a classification and is merely intended to provide a framework for discussion. As more fine-scale and up-to-date data become available it is likely that some borders will change.

Of the 33 populations that we identified, only four occur within a single country, implying that 88% are transboundary in nature. Some of the populations span 8 countries. The four populations that do not span international borders occur in countries with federal systems where responsibility for the environment has been delegated to the regions – that requires an intra-national form of transboundary cooperation. Furthermore, it is clear that there is massive variation in the size of these populations – from less than 20 to many thousand individuals. Conserving the small populations will require the maintenance of a high degree of connectivity between populations. These simple statistics underline the premise for this report – that population based management of large carnivores requires large scale inter-administrational cooperation.

This principle has already been recognised by Commission documents. For example, page 17 of the "Guidance document on the strict protection of animal species of Community interest under the Habitats Directive 92/43/EEC", February 2007 states "Harmonised, transboundary approaches are valuable for the implementation of the Directive when for example two Member States share one population of a certain species and can only assess the full situation (and consequently define effective measures) when taking the situation ‘on the other side of the border’ into account".

## *3.3 What is meant by the population approach?*

Clearly the vast majority of the demographic units (i.e. populations) of European large carnivores span the borders between many intra-national and international administrative borders. In order to ensure that they are managed in a sustainable manner it is imperative that the scale of their management should correspond to the scale of their distribution. Therefore, there is a clear need to develop management plans at the appropriate scale. From the point of view of biology, management should be on as large a scale as possible, however, from the point of view of practicality there are limits to how large a scale can be considered. We therefore feel that it is at the level of the population that it is most appropriate to go through the formal process of formulating management plans. However, because population is a multi-scale concept (see section 2) it is clearly necessary to consider both the within population connectivity among population segments and the external connectivity between populations. As we shall also argue later, it is at the scale of the population that we feel it is most appropriate to focus conservation status assessment (see section 5.6).[6]

[6] This is in keeping with the recommendations made under section 1.2.4a) of the *Guidance document on the strict protection of animal species of community interest provided by the "Habitats" Directive 92/43/EEC* (Draft version 5 April 2006) – "*The status of species should be determined on biogeographical level in Member States (for overview, national/regional strategies, targets and reporting purposes) and on population level where appropriate (for purpose of definition of requisite measures, management and derogations). In the case of transboundary populations and regarding species which migrate between inside and outside the frontiers of the EU, their overall natural range, including the migration zones outside the EU, should be considered as well where this is feasible*.". This section further goes on to make the following definitions – "*Regarding the definition of population, 'local' population or a set of 'local populations' (e.g. meta-populations), which are in close contact with each other might be used as a biologically meaningful reference unit. This approach needs to be adapted to the species in question, taking account of its biology/ecology*" – in footnote 33. In other words, what we consider population here corresponds to the local populations in the reference EC document.

# 4. Good practice guidelines for large carnivore conservation

Large carnivores are charismatic species but represent a special challenge for conservation in a crowded continent like Europe because of the potential they have to cause conflicts with human interests. These include damage to livestock and crops, competition with hunters for game species, and even in extreme cases the risk they represent to human safety (Kaczensky 1999; Linnell *et al.* 2002, 2005; Skogen 2003; Skogen & Krange 2003; Swenson et al. 1999). Also, the return of large carnivores can provoke dramatic social protests among rural communities, which can potentially have negative consequences for biodiversity conservation in general. This requires that a very pragmatic approach be taken to large carnivore management (Breitenmoser 1998; Boitani 2003; Linnell *et al*. 2005; Skogen *et al.* 2003). It is therefore constructive to examine the main objectives of the Directive 92/43/EEC (Habitats Directive). These clearly state the overall goal is to restore and maintain biodiversity in the Community and to target favourable conservation status of species and habitats. However, it clearly states that the context of other economic, social and cultural requirements, especially that of achieving sustainable development, should be considered when deciding on measures to be used. We interpret this to imply that it is possible to make certain compromises concerning the measures adopted to achieve conservation of large carnivores in order to take human interests into accounts, although the main goal of the Directive is clearly to conserve biodiversity.

When considering large carnivores it is important to reflect where we are with respect to their conservation in Europe. In the 1960's and 1970's, carnivore populations were generally at all time low throughout Europe, and conservation at that stage consisted of saving remnant populations from extinction. Thankfully, we have passed that stage for many, but not all, populations and are now trying to develop management models that will secure a sustainable coexistence of large carnivores and humans within multi-use landscapes. As many populations are expanding the challenge becomes that of living with success (Swenson *et al*. 1998). The key point is that in order to achieve the European-wide goal of conserving large carnivores there is a need for a flexible and pragmatic approach concerning the mechanisms used to achieve this goal (Boitani 2003). In a culturally and environmentally diverse continent like Europe this will require adopting different approaches in different areas. We therefore advocate the principle of "freedom within frames" (Linnell 2005). If overall objectives and policy frames are set at a central European level, and population-specific management plans are developed, it should be possible to allow a great deal of flexibility at the level of the sub-population or management unit to implement this in a manner compatible with local traditions, conditions, and conflicts. In other words, as long as the goals are decided on a large scale, there should be some flexibility to modify the means that are used at a more local scale. Within large populations there is far more room for different approaches and freedom of action than within small populations, and the consequences of making mistakes are far smaller in the large populations. However, the bottom line will always be the need to comply with the Habitat Directive and to achieve and maintain favourable conservation status.

The recovery of many large carnivore populations during recent decades has shown that they are quite resilient with respect to many human activities. Their conservation does not require that every individual be protected or that all human activities be excluded from their habitat. However, there are limits to both the level of exploitation and the way humans use their habitats that large carnivores can tolerate. In order to guide decision makers in the process of designing their locally-adapted management systems the Large Carnivore Initiative for Europe (LCIE) has prepared a series of policy support statements (see Appendix

2) that cover our recommendations concerning a wide range of issues relevant for large carnivore conservation. Combined, these provide an overview of the management options that exist and which are compatible with large carnivore conservation. These statements are based on a combination of the latest scientific research and the considerable body of experience that exists in Europe about conserving, managing and restoring large carnivore populations.
The topics that we have provided guidance on at this stage include:

- Lethal control and hunting of large carnivores;
- Wolf – dog hybridisation;
- Forestry;
- Translocation;
- The release of captive-bred large carnivores;
- Compensation systems;
- Monitoring methods.

# 5. Operationalising Favourable Conservation Status for large carnivores

## *5.1 Background and sources*

Since its introduction as the general goal for species conservation within the EU, the concept of Favourable Conservation Status (FCS) has been much discussed. The main discussion concerns how to operationalise it for species as diverse as lichens and lynx throughout the diversity of conditions that constitute European nature. The following section is our attempt to operationalise the FCS concept for large carnivores. The rationale is based on a combination of science and expert assessment. To ensure harmony with other conservation activities ongoing within the Habitats Directive, we have attempted to build this on the latest definitions and interpretations being used by the EU that we have obtained from the following documents:

- *Assessment, monitoring and reporting of conservation status – preparing the 2001-2007 report under article 17 of the Habitats Directive* (DocHab-04-03/03 rev3).
- *Assessment, monitoring and reporting under article 17 of the Habitats Directive: explanatory notes and guidelines* (Final draft November 2006).
- *Guidance document on the strict protection of animal species of community interest provided by the "Habitats" Directive 92/43/EEC*. (Draft version 5 April 2006).
- *Final report of the article 12 working group "Contribution to the interpretation of the strict protection of species – Habitats Directive article 12"* (Final version April 2005).

We have also drawn heavily on the following discussion document concerning the Habitats Directive "*Towards European Biodiversity Monitoring*" by the European Habitats Forum http://www.panda.org/about_wwf/what_we_do/species/news/index.cfm?uNewsID=70720

However, the Habitats Directive is not the only piece of conservation legislation in effect in Europe, as all EU members and most other European countries are also signatories to the Bern Convention (*Convention on the Conservation of European Wildlife and Natural Habitats*), Bonn Convention (*Convention on Migratory Species*) and the Convention on Biological Diversity. Furthermore, most European countries have adopted the IUCN's red listing procedures. In order to remove any potential contradictions between different legislations and facilitate cooperation with neighbouring states that are not EU members, we have attempted to develop operational guidelines that are in harmony with all existing bodies of international conservation legislation.

The central challenge associated with operationalising FCS is to make a link between the philosophical / political / legal concept of FCS, the biological concepts of population viability, other existing forms of categorising species status (e.g. IUCN red lists), and the specific distribution patterns and biology of the large carnivores.

## *5.2 The concepts of population viability*

The concept of population viability consists of two well recognised and interacting components: the genetic and the demographic (Beissinger & McCullough 2002). "*Demographic viability*" deals with calculating the probability that a population of a given size will become extinct within a specified number of years. The theory of demographic viability analysis is very well developed, a wide range of mathematical models exists, and there are many published examples where empirical data derived from field studies have been run through these models. However, as yet there are no agreed-upon standards concerning the best models to use, and on the probability thresholds and time horizons that should be considered for "viability", apart from those included in the IUCN's red list guidelines. Even for these standards, model details can influence the outcome; including the manner in which density dependence is considered, aspects of uncertainty in parameter estimation, and the way that demographic and environmental variability are incorporated into the models (Bessinger & McCullough 2002; Sjögren-Gulve & Ebenhard 2000; Sæther & Engen 2002). Even with the same input parameters, different software packages can produce very different outputs (Mills *et al*. 1996). Furthermore, there is an ongoing debate within the scientific community concerning the extent to which population viability analysis should be used to actually set real-world goals or to set levels for minimum viable populations (MVP) (Allendorf & Ryman 2002; Brook *et al.* 2000, 2002; Coulson *et al.* 2001; Ellner *et al.* 2002; Morris *et al.* 2002; Ralls *et al.* 2002; Reed *et al.* 2002). As a result, many conservation biologists regard PVA as being most useful for exploring the relative effect of different scenarios, rather than as a way of setting absolute goals except in general terms. However, the accumulation of case studies and field data is constantly strengthening the foundation for using PVA in conservation planning. Also, conducting a PVA provides a transparent process where assumptions are made clear and can be open to testing and falsification, and therefore revision (Chapron & Arlettaz 2006). A large part of the risk associated with PVAs involves making predictions too far into the future. This problem can be minimised if a population is continually monitored, either through census or index methods, such that it is possible to adopt an adaptive management process where management is adapted to changes in population status (Ludwig & Walters 2002). This provides greater stability to the management system and allows goals and management actions to be adjusted as experience accumulates or as the situations change. Therefore, if a flawed PVA provided a poor estimate for an MVP it is possible to adjust management before the population approaches extinction (Soulé 1987). Overall, there are many precedents for using PVA in the setting of conservation goals (Carroll *et al.* 2006; Tear *et al*. 2005), but one must never forget all the caveats that accompany their use for this purpose.

*"Genetic viability"* is associated with the long term persistence of genetic variation and evolutionary potential, and the avoidance of inbreeding (Allendorf & Ryman 2002). Although the theory of this concept is well developed there are few empirical examples, and parameter estimates are few. However, the existence of some well documented cases of inbreeding depression in large carnivores both in captivity and the wild (Bensch *et al*. 2006; Laikre & Ryman 1991, Laikre *et al.* 1993, 1996; Liberg *et al.* 2005) implies that it is a crucial issue when considering long term aspects of viability. In the absence of good empirical data, some experts still refer to the so called 50 / 500 rule of thumb (the effective population size[7] required to avoid loss of genetic variation and inbreeding in the short and long term), although the foundation for this is weak (based mainly on studies of livestock and fruit flies), and some experts believe that the values should be an order of magnitude greater (Franklin & Frankham 1998; Lynch & Lande 1998). Another complex issue relates to the relationship between effective population size and total population size, which has been estimated for very few large mammal populations – but can be expected to lie between 10% and 20% of the total population size (Frankham 1995, Tallmon *et al.* 2004). Despite these many uncertainties, the important conclusion is that a far larger population is normally needed to maintain genetic viability than demographic viability. Given the enormous space requirements and low densities of large carnivores the most important practical consideration

[7] Effective population size is a concept in population genetics that basically refers to number of individuals (of both sexes) that actually contribute genetic variation to the population size; this number is then affected by many other factors (sex ratio, overlapping generations, variation in reproductive success, population fluctuations). Therefore, it is normally substantially less than total population size, and even less than the number of mature individuals, as these are only individuals that can potentially contribute genetic variation.

in maintaining genetic viability is to ensure as much connectivity as possible between populations (Liberg *et al.* 2006; Miller & Waits 2003).

In addition to the genetic and demographic components of viability there is one less recognised component. In keeping with modern definitions of biodiversity that focus on the three levels of genes, species and ecosystems (for example as defined in the Convention on Biological Diversity[8]), the concept of *ecological viability* refers to the interaction between a species and its environment. For large carnivores this embraces both the need for the environment to contain all the elements the carnivore needs to survive (e.g. prey species, cover, den-sites for bears), but it also refers to the degree to which the species affect their environment. For carnivores this implies at least some impact upon their prey populations. The need to maintain species interactions has received much focus in North America in recent years, and the conclusion is that maintaining ecological viability requires far larger numbers of animals than a simple minimum viable population (Soulé *et al.*2003, 2005; Tear *et al.* 2005). This is more a conceptual than quantitative aspect of viability, especially in a continent like Europe where no processes can be considered to be purely "natural", however, it does focus on the need for species to have habitat and forces the consideration of the impact that these species may have on other components of that habitat (Andersen *et al.* 2006). Most importantly it recognises that predation is a natural process that is worthy of being a conservation goal (Linnell *et al.* 2005) rather than just keep an absolute minimum number of animals alive isolated from their ecological role. In other words, conservation is more than preventing a species from becoming extinct.

Within the hierarchical view of the population concept that we present above, the issue of demographic and ecological viability will mainly be associated with the population whereas genetic viability would be ensured at the metapopulation (with the possible exception of some of the largest populations).

## *5.3 Linking the concepts of Favourable Conservation Status and Viability*

Favourable Conservation Status (FCS) is defined in article 1 of the Habitats Directive as follows:

"*Conservation status of a species means the sum of the influences acting on the species concerned that may affect the long term distribution and abundance of its populations within the territory referred to in article 2. The conservation status will be taken as "favourable" when:*

- *population dynamics data on the species concerned indicate that it is maintaining itself on a long term basis as a viable component of its natural habitat, and*
- *the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and*
- *there is, and will probably continue to be, a sufficiently large habitat to maintain its population on a long-term basis*."

DocHab-04-03/03 rev3 and the guidance documents call for FCS to be based around the status of two major Favourable Reference Values (FRV) – that of *Favourable Reference Range* (FRR) and *Favourable Reference Population* (FRP) which are explained as follows:

[8] *"Biological diversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems"*

Favourable Reference Range = The "*range within which all significant ecological variations of the habitat / species are included for a given biogeographical region and which is sufficiently large to allow the long term survival of the species; favourable reference values must be at least the range when the Directive came into force, if the range was insufficient to support favourable status the reference for favourable range should take into account of that and should be larger (in such a case information on historic distribution may be found useful when defining the favourable reference range); best expert judgement may be used to define it in the absence of other data*"

And

Favourable Reference Population = The "*population in a given biogeographical region considered the minimum necessary to ensure the long-term viability of the species; favourable reference value must be at least the size of the population when the Directive came into force; information on historic distribution / population may be found useful when defining the favourable reference population; best expert judgement may be used to define it in absence of other data*"

Although the definitions of FCS and FRVs contain much of the language associated with viability analyses there are some major challenges for operationalising the concept as the Directive does not define the number of years it means by "long-term" or "foreseeable future", or the exact percentage probability associated with "probably continue". This is hardly surprising as a Directive text, like any legal text, is not based on scientific definitions, but is meant to refer to a statement of general principle – in this case that the EU intends to conserve its species and habitats for the future. Furthermore, it is a common statement for all the species of plants and animals occupying the European continent. While scientists may lament this fact it would hardly be realistic to have it otherwise.

The guidance document "Assessment, monitoring and reporting under article 17 of the Habitats Directive" does go further and indicates the potential connection between the formal concept of a minimum viable population (MVP) and favourable reference population. The document states that (p19) "*However, as concepts to estimate MVP are rather used to evaluate the risk of extinction they can only provide a proxy for the lowest tolerable population size. MVP is by definition different – and in practice lower – from the population level considered at favourable conservation status*". In other words, this means that for a population to be at its favourable reference range it must be at least greater than a MVP, but there is a clear intention within the Directive to maintain populations at levels significantly larger than those needed to prevent extinction. The guidance document goes on to suggest that it may also be useful to estimate the size of the population "*when the potential range is fully occupied at an optimum population density*", which in many cases may be far greater than a MVP – but there may also be cases, where suitable habitat is lacking, where the potential range is less than that needed to contain a MVP. Therefore, this would indicate that the Habitats Directive requires a FRP to be greater than a MVP and potentially up to what the potential habitat can support (at an "*optimum density*"). It should also be no smaller than when the Directive came into effect.

Although the Directive and its guidance documents do not explicitly specify if they are considering demographic or genetic components of viability, we will base our proposal on the assumption that the Habitats Directive's definitions of biodiversity accord with those of the Convention on Biological Diversity (to which the EU is a signatory). Therefore, we base this proposal on the assumption that the form of viability that the Directive aims for considers both short term demographic and long term genetic components, and that the importance of species interactions (i.e. their ecological viability) is recognised. This form of viability requires very large population sizes – although as we have discussed earlier, the state of science has not yet come far enough to provide more than general guidelines beyond the need for effective population sizes in the order of many hundreds of reproducing individuals.

## *5.4 An operational proposal to define Favourable Reference Population*

Based on the above discussion the absolute bottom line for a Favourable Reference Population (FRP) appears to be something greater than a Minimum Viable Population (MVP). It is therefore important to specify this bottom line in more detail. One of the most widespread international standards for the extinction risk and time line for expressing a MVP at this time is that of the IUCN red list criteria E. Under IUCN red list criteria E a population is regarded as not being threatened with extinction if its probability for extinction is less than 10% over 100 years (IUCN 2003, 2006). This implies that the population is no longer within one of the major threat categories (Critically Endangered, Endangered, Vulnerable) and instead corresponds to the IUCN categories of "*Near Threatened*" or "*Least Concern*". "Near Threatened" is not formally a threat category and maintaining species at this, or better, status should provide a robust benchmark for a minimum population size. While this is the most widely accepted standard, it is important to note that many conservation biologists regard it as being too liberal and instead recommend that the acceptable level of risk should be placed at 5% or less over a 100 year period (Soulé 2002). A brief survey of the PVA literature indicates that the 5% in 100 year criteria is far more widespread than the IUCN value of 10%.

However, conducting a robust PVA to calculate extinction probability requires a vast amount of data, including demographic stochasticity, inbreeding depression, environmental fluctuations and the effect of rare catastrophes; these data can normally only be obtained after many years or decades of expensive and invasive field work. This is reflected in the fact that to date there have been very few PVAs conducted for European large carnivores based on actual field data. Examples using individual- based demographic data include: Andrén & Liberg 1999 for lynx in Scandinavia; Sæther *et al.* 1998 for Scandinavian bears; Sæther *et al.* 2005 for wolverines in Scandinavia; and Wiegand *et al.* 1998 for an example using a time series of count data on Cantabrian bears. Apart from these few examples the other PVAs have been based on using a range of reasonable values, or values taken from other study sites or from captive animals (e.g. Chapron *et al.* 2003a,b; Ebenhard 2000; Kramer-Schadt *et al.* 2005; Nilsson 2003). As such these efforts should only be really considered as very informative, robust, thought experiments about what might be possible – rather than a population explicit analysis that is needed as a basis for management of small threatened populations. Demographic parameters can vary between populations and between years depending on climate, habitat, food supply, population density, local adaptations and management actions (Mech & Boitani 2003; Sæther *et al.* 1998). The PVA analyses that have been conducted to date indicate that carnivore populations are very sensitive to changes in adult survival. Field studies indicate that this parameter is often very heavily influenced by human activities, including poaching. Quantifying the level of poaching is very difficult, even when intensive studies are conducted, and it varies dramatically between regions (e.g. Andrén *et al.* 2006). Therefore, transferring data from one situation to another may be risky. Running a set of scenarios will produce a more informative output where the consequence of variation in parameter estimates will be more transparent (e.g. Chapron *et al.* 2003a,b). Given that species distribution and species potential distribution may be non-continuous within a populations range – it would add considerable realism to a PVA if it could be conducted in a spatially explicit manner (e.g. Kramer-Schadt *et al.* 2005).

In the absence of sufficient species and population specific data to conduct a robust PVA it is possible to use another IUCN viability criteria (criteria D) which is based upon the estimated number of mature individuals[9] in the population. Under criteria D, the threshold under global criteria for Near Threatened is to have more than 1000 mature individuals in the population. This value is estimated based on a large body of analysis and experience from a wide range of species and the estimates are considered to be robust for many species. In general the IUCN criteria are intended for global level assessments. When applied to a regional assessment the procedure is to use the global criteria on each regional population and then to consider whether the population under consideration is connected to a neighbouring population to such an extent that immigration can have a significant demographic effect on the extinction probability of the population (Gärdenfors *et al.* 2000, 2001; IUCN 2003). If a population is connected to such an extent and the resulting combined population exceeds the minimum threat level (i.e. it does not qualify for VU categories), then the threat category can be downgraded by one level. In other words, a population that would have been categorised as vulnerable in isolation becomes near threatened / least concern if it is connected to another and the sum of both populations exceeds the minimum required for the VU category. However, if a population borders onto an area that could function as a sink[10] the threat category could potentially be upgraded, or at least not changed. For classifications based on criteria D the appropriate downgrading would imply that if a population has sufficient connectivity to allow enough immigrants to have a demographic impact there would in principle only need to be more than 250 mature individuals in the population for it to be of "least concern". However, for classifications based on criteria E (PVA approach) it would seem crude to conduct a refined analysis and then make a broad sweeping correction. Rather the global criteria of <10% extinction risk in 100 years should be maintained, but the model should allow for a realistic number of immigrants.

When considering connectivity it is important to consider the individual dispersal ecology of the four species in question (see section 3). These differences need to be considered when estimating the degree to which distinct populations are connected. One special case of connection is where animals are translocated to improve population viability between areas where there is little, or no, possibility for natural connectivity in the near future (too far, or too poor habitat in between). We suggest that this form of connectivity be acceptable as long as it is formally included in a management plan at a level that is sufficient for its purpose, and is conducted in a responsible manner that is in accordance with the current best practice guidelines (at present those provided by the IUCN's Reintroduction Specialist Group).

A MVP should be enough to ensure (demographic and genetic) viability for any given population of a species such as large carnivores (the approach may be less successful for species with very different life histories) in the short to medium term given that data are accurate and conditions are constant. The Habitats Directive guidance documents state that a MVP is only "*a proxy for the lowest tolerable population size*" that can be considered. Therefore, a MVP must be regarded as the absolute minimum population size that can be tolerated as a preliminary level for favourable reference population. This reflects the facts that most PVAs do not always include genetic information and catastrophic events as, for example, outbreaks of diseases such as parvovirus or rabies which have been well documented to have potential impact on large carnivore populations (Wilmers *et al.* 2006). Another reason to not place too much security in minimum numbers lies in the difficulty of accounting for, in all PVAs, the direction and rate of changes of environmental conditions and demographic parameters throughout the entire period for which predictions are made (Soulé 2002). Given the predicted impact of climate change, the ongoing dramatic changes in the European environment (e.g. infrastructure development, land use changes) and in human socio-economics, attitudes and values (that will influence poaching and other demographic

[9] Note that this is not equivalent to the concept of effective population size. Number of mature individuals includes individuals of both sexes that are potentially of reproductive age, but does not require that all are actively reproducing.

[10] A sink is a population that cannot survive without immigration – i.e. in isolation its trend would be negative. Such populations do not make a positive contribution to overall population growth – in fact they drain animals that could otherwise have made a contribution.

rates), this assumption is likely to be false. It is therefore crucial to monitor several parameters that reflect population size and population status to permit the adjustment of goals through an adaptive management approach. This requirement already exists within existing definitions as Article 11 of the Habitats Directive calls for constant monitoring. Furthermore, MVPs that are mainly based on demographic considerations are unlikely to be sufficient to achieve the levels of genetic viability or ecological viability that we assume are implied in the intentions of the Habitats Directive.

Therefore, we strongly recommend that FRP be defined at significantly higher levels than the minimum levels predicted by a PVA. This recommendation is based both on the best available science and on the intention of the Habitats Directive as clarified in (1) the various guidance documents that underline that FCS is intended to represent a positive goal, not just a minimum, (2) that true long term consideration requires attention to genetic issues, and (3) the Directive's statement that species should be viable components of their habitat, which implies some degree of ecological functionality. However, we also realise that the alternative proposed approach of defining a maximal value of FCS, such as the level which would occur should all potential habitat be occupied, may also be impractical for large carnivores – especially for species like wolves that can occupy most habitats, but which are associated with a wide range of conflicts (see section 5.7 below).

In summary, we suggest that favourable reference population be defined as the sum of the following criteria:

(1) The population must be at least as large as when the Habitats Directive came into effect[11], and,
(2) The population must be at least as large (and preferably much larger) as a MVP, as defined by the IUCN criterion E (extinction risk based on a quantitative PVA with <10% extinction risk in 100 years), or criterion D (number of mature individuals).
(3) The population's status is constantly monitored using robust methodology.

## 5.5 An operational proposal to define Favourable Reference Range

The favourable reference range (FRR) is basically the area needed to contain the favourable reference population. While this may sound relatively simple there are a number of key issues that must be considered and addressed.

Firstly, there is the issue of habitat quality. Large carnivores are relatively tolerant of human activity and land-use patterns. However, they do have some basic requirements in terms of prey densities, den sites (especially for bears and wolverines) and cover. It is also important to be aware of the potential for transport infrastructure to be both a source of mortality and potential barrier to the movement of individuals (Kaczensky *et al.* 2003). Before any area is defined as being included in FRR it would be desirable to conduct a geographical assessment (through a geographic information system) of its suitability (Bessa-Gomes & Petrucci-Fonseca 2003; Corsi 1999; Doutaz & Koenig 2003; Kramer-Schadt *et al.* 2004; Lande *et al.* 2003; Molinari & Molinari-Jobin 2001; Posillico *et al.* 2004; Salvatori 2004; Zimmermann & Breitenmoser 2002).

[11] This requirement comes from the guidance documents, and is therefore formally non-binding. After much discussion we feel that this statement should remain a part of the general definition of favourable conservation status – but that exceptions should be possible on the condition that do not violate any of the other requirements for FRP, FRR and FCS – i.e. populations must be viable and connectivity must be maintained. Under carefully planned management actions it may be acceptable to reduce a population size as an exceptional action.

Secondly, is the issue of density. The level of viability achieved within a given region will depend on the number of carnivores within a given area. In general this will be determined by many factors. A wide range of ecological factors associated with habitat quality and prey density will determine the potential ecological carrying capacity of a region (Herfindal *et al.* 2005). However, a final factor of crucial importance for species such as large carnivores that cause a wide range of conflicts with human interests is the issue of *societal carrying capacity* (Decker *et al.* 2001). This refers to the willingness of local communities to accept the presence of large carnivores and pay the economic and social costs associated with their presence (e.g. damage to livestock, competition for game, fear). All of our experiences indicate that this is the most crucial element for large carnivore conservation in Europe, and in practice it is likely to be the overall limiting factor in determining the potential distribution and density of the species in the future (Linnell *et al.* 2005; Andersen *et al.* 2006). While it is expected that societal carrying capacity will be broadly related to conflict level, it will be highly variable across Europe, depending on local traditions, socio-economic situations, the experience that local people have of living with large carnivores, and the way in which large carnivores are managed (Bath & Majic 2001). While the amount of human-dimensions research focused on large carnivores in Europe is increasing, it has yet to become a precise predictive science, although some general principles for increased societal acceptance exist. Societal carrying capacity is likely to be below the ecological carrying capacity. Therefore, maximising local density should not automatically be regarded as a goal *per se*, as high density populations often generate greater conflicts with rural communities. In contrast, keeping populations at a density lower than what might be potentially achieved may reduce the intensity of local conflicts. A consequence of this policy is that it will reduce the ecological impact that large carnivores have on their prey populations, which strictly speaking will reduce their ecological viability. However, in the European context where little, if any, nature is truly wild we must adopt a pragmatic attitude towards setting goals – where the issue of ecological functionality is somewhat reduced in favour of achieving demographic and genetic viability. However, this effect may be context dependent, and it is possible to imagine scenarios where the overall level of conflict can be reduced by concentrating carnivores into a more limited area – hence limiting the number of people influenced by their presence (Linnell *et al.* 2005). The exact form of conflict and the priority attributed to different conflicts will influence the optimal strategy in a given region. A central ambition of these guidelines is that rigorous, but publicly sensitive, management should over time increase societal carrying capacity.

Thirdly, is the issue of connectivity. Achieving long term viability will be enhanced if populations are linked to each other (Liberg *et al.* 2006). Two populations of equal size that are connected will have a far greater pooled viability than either would have on their own. In other words connectivity increases the degree of viability achieved per unit of conservation effort that is expended. As a rule of thumb, the exchange of at least one genetically effective migrant per generation can be used as the quantification of the minimum connectivity required for purposes of preventing inbreeding, although higher rates of migration are needed to obtain significant demographic effects. The idea of avoiding maximum density and spreading populations out over larger areas to reduce the intensity of conflicts is also compatible with maintaining connectivity. However, expanding distribution to restore connectivity will often be associated with intense conflicts when carnivores return to areas from which they have been absent for decades (Ericsson & Heberlein 2003). This conflict is predicted to decrease over time (although it may initially increase in the short term). The long term viability benefits of restoring connectivity are so great that the advantages outweigh the disadvantages. As a result we generally recommend that Favourable Reference Range be considered larger than the area strictly necessary to support the Favourable Reference Population, and that it attempts to ensure (1) the continuity of distribution within a given population, and (2) the possibility for connectivity between populations. However, we also realise that some populations are very isolated by considerable distances and by large areas of totally unsuitable habitat such that it may be impossible, or at best require very long time periods, to restore connectivity (e.g. the small wolf population in Andalucía, bears in the Pyrenees). In such cases the potential to use translocation of individuals as a form of assisted connectivity should be considered as a potentially valuable conservation tool.

## *5.6 An operational definition for favourable conservation status for large carnivores*

Based on the reasoning presented in the previous sections we have tried to develop concrete recommendations for a measurable and operational definition for favourable conservation status that builds on scientific rigour, realistic expectations and the existing frames of EU legislation. We therefore suggest that a population can be regarded as having reached FCS if it satisfies all of the following criteria;

(1) "*Population dynamics data on the species concerned indicate that it is maintaining itself on a long term basis as a viable component of its natural habitat*" (Article 1 (i)). We interpret this as implying that monitoring data indicate the population has a stable or increasing trend. We believe that a slight reduction in population size may be permitted if it is a result of response to changes in prey density or habitat quality that are not the cause of direct human action, unless conditions for derogations apply (see 6.4). All segments of a population should have stable or positive trends, and not just the population as a whole. And,
(2) "*The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future*" (Article 1 (i)). We interpret this as implying that the overall distribution of the population is stable or increasing. And,
(3) "*There is, and will probably continue to be, a sufficiently large habitat to maintain its population on a long-term basis*" (Article 1 (i)). We interpret this to imply that the quality and continuity of habitat should be sufficient, and have a stable or increasing trend. And,
(4) The population size and range are equal to or greater than when the Directive came into force. And,
(5) The favourable reference population size has been reached. According to our proposal this will be set at levels greater than those regarded as being viable using the IUCN red list criteria E or D. And,
(6) The favourable reference range has been occupied. And,
(7) Connectivity within and between populations (at least one genetically effective migrant per generation) is being maintained or enhanced. And,
(8) *"Member States shall undertake surveillance of the conservation status of the natural habitats and species referred to in Article 2 with particular regard to priority natural habitat types and priority species"* (Article 11) and "*Member States shall establish a system to monitor the incidental capture and killing of the animal species listed in Annex IV (a)"* (Article 12.4). These statements combine to indicate that the population should be subject to a robust monitoring program.

Criteria 1-3 and 8 are taken from the text of the Directive, criteria 4 and 6 are taken from the guidance documents, while criteria 5 and 7 are based on our own recommendations.

A result of this approach is that the assessment of favourable conservation status, as required under articles 11 and 17, should be conducted on the level of the population. The present guidelines call for assessment on the level of the biogeographic region within a country if a country spans more than one region – but they also open for the provision of "complementary information" and explicitly mention the issue of transboundary populations of large carnivores[12] as a case where this should be considered. We recommend that this mechanism be formally exploited to allow the integration of the population approach into existing protocols. The Commission informed in the Conference in June 2008 in Slovenia that it will further clarify this issue when the guidance document "Assessment, monitoring and reporting under Article of the Habitats Directive" will be revised. Furthermore, the "Guidance document on the strict protection of animal species of community interest" indicates that the population may be the most realistic scale for assessment of wide ranging species[13].

One consequence of population level assessment would be that countries that share a population will be able to achieve FCS at the population level whereas they might not have done so considering their national segments in isolation. On the other hand, countries that contain, or share, two separate populations will have to ensure that each of them reaches FCS independently.

A final point to consider is that some populations of European carnivores are very small and isolated, and are far from approaching FCS under this definition. What is important for these populations is for managers to document the changing status of the populations in their care, as they hopefully begin a progression towards FCS.

## *5.7 Setting goals for large carnivore conservation in Europe*

In effect, achieving a minimum viable population is an absolute minimum requirement that must be met on the way to satisfy national obligations to community conservation goals of reaching favourable conservation status. However, the question remains, exactly how favourable does a species status need to be? In present day Europe we have countries whose carnivore populations are both very small (far below any conceivable FCS threshold) and others whose carnivore populations are very large (several times larger than any conceivable FCS threshold). Is it possible to find any consistent guiding principle?

From a strictly conservation perspective the preferred overall goal would be to establish a metapopulation of interconnected populations, each of which is at a level exceeding the minimum threshold for Favourable Conservation Status. This would involve both securing the existing populations, and fostering expansion to increase connectivity. The current status of habitat in Europe is such that there are many areas where large carnivores could survive but from which they are currently absent, and in many areas, large carnivores are recolonising areas from which they have been absent for decades. Accommodating this expansion is a major challenge as conflict levels tend to be high in recently recolonised areas. As a result some countries seek to limit the level of expansion by setting maximum targets for large carnivore recovery.

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[12] Quote from *Assessment, monitoring and reporting under Article 17 of the Habitats Directive* - "*In many cases a species or habitats may have a population which is in two or more Member States, for example the Pyrenean Brown bear (Ursus arctos) population in France and Spain or the Tatra Chamois (Rupicapra rupicapra tatrica) in Slovakia and Poland. In such instances Member States are encouraged to undertake a common assessment but to report separately. In such cases the 'complementary information' heading of Annexes B & D can be used to indicate that a transfrontier approach has been adopted. In some cases it may be necessary to take into account populations shared with non EU countries, e.g. for Lynx lynx in Austria and Switzerland.*"

[13] This is in keeping with the recommendations made under section 1.2.4 a) of the *Guidance document on the strict protection of animal species of community interest provided by the "Habitats" Directive 92/43/EEC.* (Draft version 5 April 2006) – "*The status of species should be determined on biogeographical level in Member States (for overview, national/regional strategies, targets and reporting purposes) and on population level where appropriate (for purpose of definition of requisite measures, management and derogations). In the case of transboundary populations and regarding species which migrate between inside and outside the frontiers of the EU, their overall natural range, including the migration zones outside the EU, should be considered as well where this is feasible.*".

The guidance documents regard FCS as a positive goal, where the goal should be to make species status as favourable as possible – not just to have passed a minimum threshold of favourableness – "*Therefore, the obligation of a Member State is more than just avoiding extinctions*" (Guidance document on strict protection of species). In other words the intention of the Directive appears to be that countries should not set a limit on potential large carnivore expansion once they have reached a minimum level of FCS (in cooperation with any neighbouring countries with which they share a population). The guidance documents even mention the occupation of all potential range as one possible way of estimating Favourable Reference Population. This would therefore indicate an intention to foster the reintegration of large carnivores into as much of the Community's landscape as possible. However, the preamble to the Directive makes it clear that the Directive must be seen in the context of a wide range of other European goals, including sustainable development and social and economic interests, which may justify (in some circumstances) placing some artificial constraints on how favourable any species' status can actually become. And the guidance documents explicitly acknowledge that FRR can be less than the maximum potential range for wide-ranging species – "*in such cases it may not be necessary for all the historic range to be re-occupied to reach FRR, if long term survival and variability can be assured with less*". This implies that if conflicts are large and difficult to mitigate, countries may, in some cases, be justified to place limits on potential recovery, as well as use derogations to use lethal control in some circumstances (see section 6.1).

In order to produce an operational set of goals we recommend that by default large carnivores should be allowed to recolonise as many areas as possible, but accept that there may be limits to this. If the subsidiarity principle is invoked it would imply that it is up to the democratic process within each individual country to decide just how far beyond the minimum requirements of achieving FCS that they wish to go. Hopefully, the adoption of flexible and locally-adapted management practices will increase the area where their presence will be accepted. However, we also feel that it is important to underline that setting goals beyond the minimum levels required to fulfil community obligations is as much a matter of value judgements than science.

However, the absolute minimum requirements that member states must meet are:

(1) Countries sharing one population, or segments of a population, contribute to ensuring between them that the population reaches and maintains FCS, and

(2) They allow for connectivity between neighbouring populations and segments within the same population, and

(3) Management activities do not create a sink that can influence the FCS of a population or any of its segments, and

(4) Populations should in general not be allowed to go below the level they had when the Directive came into force on their territory[14].

A final issue concerns the active reintroduction of large carnivores to an area from which they are currently absent. In general our expert opinion favours fostering natural expansion and recolonisation as far as possible, because reintroduction is a very expensive and risky

[14] This requirement comes from the guidance documents, and is therefore formally non-binding. After much discussion we feel that this statement should remain a part of the general definition of favourable conservation status – but that exceptions should be possible. For example, if ecological carrying capacity decreases (through a natural decline in prey density) it should be acceptable to allow the population of large carnivores to decline accordingly. Furthermore, under carefully planned management actions it may be acceptable to reduce a population's size as an exceptional action. However, it is crucial that these changes do not violate any of the other requirements for FRP – i.e. populations must be viable and connectivity must be maintained.

process, and because public acceptance tends to be greater for natural recolonisation. We recommend that reintroduction of individuals into an area from which they are currently absent, but have been present in historic time (e.g. the British Isles, BENELUX countries) should not be regarded as a Community obligation under the Habitats Directive, although such countries are of course free to do so on their own initiative (as long as they satisfy the criteria suggested by the IUCN reintroduction specialist group). This view is also taken by the Article 12 working groups final report (p28) based on their reading of Article 22 of the Habitats Directive. However, it should be underlined that the translocation of individuals to support small populations (such as bears in the Pyrenees or the Alps) may actually be necessary to ensure that they reach or maintain favourable conservation status if they are geographically isolated from other populations, and that carefully planned and carefully targeted reintroduction may be a useful tool to enhance connectivity. This may also be the case where human assistance is needed to re-establish connectivity between isolated populations.

# 6. Legal and technical considerations for population level management plans

## *6.1 Large carnivores under the Habitats Directive and other conventions.*

By default all the large carnivore species are covered by annex II (requires Natura 2000 sites) and annex IV (strictly protected) of the Habitats Directive. Likewise, wolves, bears and wolverines are by default on appendix II (strictly protected) and Eurasian lynx are on appendix III (protected) of the Bern Convention. However, there is considerable variation among countries as many have taken exceptions in part or in all of their national area. The status of large carnivores under international legislation in 38 European countries where they occur is summarised in Table 5.

## *6.2 Legal aspects concerning population level management*

Formally the Habitats Directive does not explicitly specify that FCS should be achieved at the population level. Its reporting routines require that FCS be evaluated within each country (or within each biogeographical region present within each country), indicating that its intention is to operate on a national or sub-national scale. This scale of consideration may be suitable for a wide range of smaller species, but large carnivores present a wide range of very special challenges. As large bodied top-predators they naturally move over very large areas and occur at relatively low densities. This implies that many (maybe most) countries will never be able to host enough individuals to have a population that can reach FCS. In order for the intention of the Directive to be achieved for a species group like large carnivores it must consider spatial scales that span borders. This is actually specified in the Directive's preamble as one of the prime objectives of the Directive[15]. These population level management plans can simply be viewed as an instrument to achieve this goal. The Commission also says in its technical specifications for the tender of this project that "*coordinating the management across national boundaries might be the solution to maintain viable populations over the long-term, an approach that is also important to put large carnivore conservation into the broader context of biodiversity conservation*". A certain legal clarification is, however, required from the European Commission concerning the proposed practice of attaching favourable conservation status assessment to the population level, which in some cases may free member states from the obligation to achieve it on their own.

All EU countries are also signatories to the Bern Convention. The Bern Convention places considerable emphasis on the need to foster transboundary approaches in the preamble and in articles 1, 10 and 11. Recommendation 115 (2005) also calls for countries to work towards transboundary action plans for large carnivores, and the topic was given considerable attention in a workshop held in Slovenia in 2005 (Bath 2005). Furthermore, most EU countries are also signatories to the Bonn Convention which is specifically tailored for migratory species that cross international borders. The Bonn Convention even allows for states sharing migratory populations to sign legally binding treaties to govern the management of these species. Although the movements of large carnivores across borders do not follow the strict definition of seasonal migration, it may be worthwhile exploring the potential for use of this convention which has already been applied to several similar issues.

[15] "Whereas given that threatened habitats and species form part of the Community's natural heritage and the threats to them are often of a transboundary nature, it is necessary to take measures at Community level in order to conserve them"

The combined weight of the Habitats Directive and these two conservation conventions should be enough to motivate EU countries to develop population level management plans, especially if in so doing they will be permitted to adopt more flexible management practices than those allowed by a strictly national perspective. Furthermore, the Bern and Bonn Conventions should be useful frameworks to induce non-EU countries to take part in these plans. Although many Bern Convention signatories have taken reservations for wolves and bears concerning their placement on appendix II – these species are still covered under the conventions general goals as expressed in articles 1 and 2. Unfortunately, there are three key countries that are not bound by any of these conventions or Directives – Bosnia & Herzegovina, Montenegro and Russia. Involving these countries will require novel approaches to solve the many challenges. The only relevant international conservation legislation that these countries have signed is the Convention on Biological Diversity.

In cases where it is impossible to reach transboundary agreement on management with such neighbours, a minimum step would be to make national plans contingent on a given status (trend, numbers, distribution) of carnivores across the border. This would allow national plans to change to adapt to changing status on the other side of the border. Such coordination would simply require access to up-to-date monitoring or survey data which only requires cooperation between researchers and experts which usually functions well across borders.

## *6.3 Economics of large carnivore conservation*

Large carnivores can be expensive to conserve. Seemingly simple tasks like monitoring population size and distribution can be logistically very expensive. Other tasks like conducting ecological, genetic, or human-dimensions research, and paying compensation for damages or funding the development of conflict mitigation measures can potentially cost individual countries several millions euro per year. Currently there is a clear pattern where the poorer countries in eastern and southern Europe have the largest large carnivore populations. One possible mechanism to redress this imbalance would be for member states to include large carnivore issues into the plans for use of EU Rural Development Program funds and to apply for funds from LIFE+. The LIFE-Nature program has supported many projects that have developed best practice guidelines for dealing with large carnivore conflicts.. The Commission has internal discussions between its environmental and agricultural departments when it is evaluating national programmes for rural development funds before the discussions with member states begin. These discussions focus on cross compliance, include making sure that Natura 2000 and wider biodiversity issues are covered in national programmes. However, in the end it is up to the national authorities to decide what kind of measures will be financed. The Commission has also organised Natura 2000 financing workshops in all member states to discuss EU financing possibilities for implementing the two (Birds and Habitats) nature directives.

## *6.4 Derogations for strictly protected species under the Habitats Directive*

As we have seen large carnivores as a species group represent a number of unique challenges when we try to conserve them in crowded, human-dominated, and heavily modified ecosystems like Europe’s. These challenges include their potential to have locally severe impacts on (1) livestock, (2) prey species which represent valuable game resources for hunters, (3) the fear they induce in many people, (4) their association with a wide range of social conflicts, and (5) the fact that in very rare events wolves and bears can represent a threat to human safety by attacking people and where wolves can act as vectors for diseases such as rabies (Kaczensky 1999; Linnell *et al.* 2002, 2005; Skogen 2003; Skogen & Krange 2003; Swenson *et al.* 1999). For many conflicts there are a wide range of potential mitigation measures that may serve to reduce conflict levels. For example, there are many modern and traditional methods to help protect livestock against depredation from large carnivores. Electric fences and the use of shepherds with livestock guarding dogs are two methods that have been shown to be particularly effective under a wide range of conditions. Social conflicts and fear may be, at least in part, reduced through the development of education campaigns and various forms of communication structure. Under the derogation text of the Habitats Directive it is essential that member states evaluate the potential utility of the mitigation measures that exist.

However, the potential for these conflicts requires that in some exceptional circumstances it is considered to be both compatible with their conservation, and even desirable for gaining public acceptance for their management to either selectively remove specific individuals or to limit their numbers and / or distribution at certain levels through management actions. Apart from some very specific circumstances where translocation and scaring away potentially dangerous animals may be an option, lethal control remains the only practical method for this task (Linnell *et al.* 1997). The Habitats Directive recognises under the “derogation” article that lethal killing is possible when the 3 conditions of this article are fulfilled: 1) no other solutions exist, 2) the impact to FCS is not detrimental, and 3) one of the 5 derogation reasons is satisfied. Furthermore, in many European cultures where large carnivores are relatively abundant there is a tradition for hunters to hunt large carnivores for recreation or trophies. In various settings carnivore hunting (but also carnivore-related ecotourism) is associated with significant economic benefits, and in many contexts is regarded as being crucial for achieving local acceptance of the presence of these species (Hofer 2002; Knapp 2006).

From a conservation point of view there is no principle reason why large carnivore populations cannot tolerate some levels of lethal control or be managed under the same type of harvest system as wild ungulates or game birds, provided that the harvest is well managed. Proper management in this case requires <u>effective monitoring of the population size</u>, the setting of appropriate quotas and hunting seasons, and careful enforcement of these regulations. In other words, if properly organised, well managed harvest can potentially be sustainable. In addition to sustainability, modern ethical norms require that harvest methods be as humane as possible. The Court ruling C-342/05 also confirmed (paragraph 45) that the use of maximum regional limit to kill individual wolves in game management district is not contrary to art 16(1) of the Habitats Directive. The example is from Finnish practise where this limit is set according to the number of individuals which may be killed without endangering the species in question (the quota is assessed by a national research institution). It is considered as a framework within which the game management districts may issue lethal control permits where in addition the conditions of art 16(1) of the Directive are fulfilled.

However, in most of Europe all four of the large carnivore species which we are concerned with here are listed on annex IV which implies that they are subject to strict protection under article 12 of the Habitats Directive which prohibits “*all forms of deliberate capture or killing of specimens of these species in the wild*” (Article 12.1(a)). Article 16 of the Habitats Directive provides the possibility for derogations from Article 12 to permit activities that would otherwise have been prohibited. The extent to which these derogations can be used to control or hunt large carnivores has long been a matter of contention. Recently two documents have been presented by the Commission that should clarify some of these issues. These are the Final report from the Article 12 Working Group “Contribution to the interpretation of the strict protection of species” and the “Guidance document on the strict protection of animal species of community interest provided by the Habitats Directive 92/43/EEC – draft version 5”; both dated April 2005.

The final report underlines in its introductory sections the need for the Habitats Directive to adopt a pragmatic and flexible approach "*It is necessary to ensure a practical implementation, which is based on public support and which will avoid unnecessary conflicts which can counteract the overall objective of the Directive*". The relevance of this for the type of issue that we are discussing here was further underlined by the statement that "*The working group must thoroughly investigate the possibilities of a flexible approach to the protection of Annex IV species which are e.g. regionally or nationally common or abundant*".

Using a derogation depends on competent national authorities determining that three conditions are being met. The first condition is to demonstrate a reason for wanting derogation. The crux of this pretext hinges on the interpretation of the five potential situations that Article 16 permits for derogation. These include:

(a) "In the interest of protecting wild fauna and flora and conserving natural habitats";
(b) "To prevent serious damage, in particular to crops, livestock, forests, fisheries and water and other types of property";
(c) "In the interests of public health and public safety, or for other imperative reasons of overriding public interest, including those of a social or economic nature and beneficial consequences of primary importance for the environment";
(d) "For the purpose of research and education, of repopulating and re-introducing these species and for the breeding operations necessary for these purposes, including the artificial propagation of plants";
(e) "To allow, under strictly supervised conditions, on a selective basis and to a limited extent, the taking or keeping of certain specimens of the species listed in Annex IV in limited numbers specified by the competent national authorities".

Given our understanding of large carnivore conservation issues it is possible to see all of these arguments being present under some situations within Europe. Justification (a) is likely to be rarely used, but there are potential situations where a rare prey species could be locally threatened by a more common carnivore species (e.g. Kojola *et al.* 2004). Justification (d) is only likely to be relevant when individuals are to be used for conservation translocation purposes (Breitenmoser *et al.* 2001) or when captured for radio-collaring (which is also formally a derogation). Killing large carnivores explicitly for research purposes is unlikely to be regarded as being acceptable by research ethics committees in modern Europe – but of course does not preclude the research use of carcasses and samples from animals killed under other justifications. In fact the maximal use of these individuals should be encouraged. Justification (b) is likely to be most commonly used because of the potential for large carnivores to depredate livestock species (especially sheep and semi-domestic reindeer) and pets. A crucial element here is the statement that the justification is to <u>prevent</u> serious damage, not just respond to damage that has occurred. The working group has confirmed this interpretation[16]. Therefore, this justification could be used to both try and selectively remove specific individuals that are believed to be responsible for disproportionate depredation on livestock (so called "problem individuals") and to either keep carnivores out of some areas with many livestock or limit the carnivore population at a level that keeps depredation at acceptable levels (Linnell *et al.* 1999, 2005; Odden *et al*. 2002; Sagør *et al.* 1997; Stahl *et al.* 2001). The issue of how much damage constitutes serious damage is hard to define as it will depend on local acceptance levels, but it must be of a serious nature. The Birds Directive also has the same provision "*to prevent serious damage to..crops....*". The Guidance document on hunting under the Birds Directive says on point 3.5.11 "In the implementation of the Birds Directive a Court ruling 247/85 notes that the aim of the provision of "preventing serious damage" under the Birds Directive is not to prevent the threat of minor

[16] This view was supported in a recent European court ruling in a case (C-342/05) ruling (June 14th 2007) against Finland.

damage. Mere nuisance and normal business risk should not fall under this derogation". Justification (c) could potentially be used to limit predation on wild game species if these could ever be shown to be activities of overriding public interest. However, it is more likely to be used for the removal of rabid, aggressive, habituated or other specific individual animals that demonstrate unwanted behaviour. Finally, justification (e) could be used to justify a carefully regulated harvest of some animals. Justification (c) and (e) could cover cases where a *de facto* hunter harvest is needed to obtain local acceptance for large carnivores among the rural population. This situation is clearly present in many Nordic and Eastern European countries, and has been well documented in social science research. In fact, Latvia has justified its continued hunter harvest of lynx under justification (e) (Ozolins 2001), and the example has been held up as a successful demonstration of a well justified use of derogation point (e) by the Article 12 working group. However, it seems unlikely that simply the "wish" to continue hunting could be a justification in accordance with the original intentions of the Directive. In summary, there are likely to be many situations where one or more of these justifications is present.

The second condition is the need to demonstrate that there is "no other satisfactory alternative" than a derogation, in this case, lethal control. This issue is most likely to be debated in the cases where derogations are desired to limit depredation on livestock. Many tried and trusted methods exist that have a well documented ability to reduce depredation on livestock to very low levels (Linnell *et al.* 1996; Breitenmoser *et al.* 2005). However, introducing these to many livestock raising systems may require a major and very expensive change to husbandry practices if it must be applied on a large scale. Whether economic barriers can be considered as an argument for "no satisfactory alternative" is an open question. The article 12 working group has stated clearly that under the principle of subsidiarity it is up to the individual nations' legal systems to rule on what is considered satisfactory ("*In conformity with the principle of subsidiarity, it rests with the competent national authorities to make the necessary comparisons and evaluate those alternative solutions*". p60). However, the working group has underlined that derogation is a last resort and a limited solution to a problem ("*As regards the factors on which the existence of another satisfactory solution should be evaluated, it is recognised that this is a matter for the national court. The appraisal of the - satisfactory or not - character of an alternative, in a given factual situation, must be founded on objectively verifiable factors, such as the scientific and technical considerations. In addition, the solution finally selected, even if it involves derogation, must be objectively limited to the extent necessary to resolve the specific problem or situation*" (p60)).

The third condition is the need to demonstrate that a derogation will have no detrimental impact on the conservation status of the species. The working group indicated that this process should first clarify the conservation status of the species and secondly analyse the impact of the derogation on this status. The guidance documents also underline that this assessment should be aware of several scales, but that the population level should be prioritised – explicitly giving the example of wide-ranging vertebrates with transboundary populations. An issue which is very relevant for large carnivore conservation is that the working group also concludes that it is not strictly necessary for the target population of the species to be at favourable conservation status[17] for a derogation to be given, but that under the principle of proportionality the arguments must be very strong, and the action very limited, under such circumstances. It is crucial that the impacts of such actions should be very closely monitored. The Article 12 working group also underlined that it is highly desirable to have a detailed conservation / management plan in place for ensuring that there is no detrimental effect. This is a major argument for developing transboundary population level management plans given their recommendation that the population is the most relevant scale for assessing this effect and the fact that many European large carnivore populations

[17] This view was supported in a recent European court ruling in a case (C-342/05) ruling (June 14$^{th}$ 2007) against Finland

are transboundary in nature. In fact, having a population level management plan is virtually essential to ensure that the sum of all derogations given does not have a detrimental effect. For populations where favourable conservation status has been assessed with the aid of a quantitative PVA approach it may be useful to model the impact of proposed management actions on extinction risk.

In summary, Article 16 provides a scope for permitting the use of lethal control, and even the maintenance of *de facto* hunting activities for annex IV species as long as the three conditions can be met. In 2003 a joint meeting of the European Commission and the Junta de Castilla y Léon in Spain concluded the following in response to a request to allow harvest of wolves that were formally on annex IV – "*Where Action Plans are established which ensure a favourable conservation status of wolf populations art. 16 of the Habitats Directive provides sufficient flexibility to allow for the required population management. This can include allowance for controlled hunting quotas*". This is very similar to the Bern Convention which also allows such flexibility (Shine 2005).

# 7. Developing population level management plans

In this section we will provide some guidelines on both the process that should be used and the product that should be produced. The need for transboundary cooperation will concern both international boundaries and those between individual states / autonomous regions within federal nations (e.g. Spain, Italy, Germany, Austria). However, for the sake of brevity in the text we will consider just the international case, although everything that applies for international cross border cooperation also applies to intra-national cases.

## *7.1 The process*

• The most important element is to integrate the process with the product. The idea of the process is to develop the product, and participants in the process should have some real influence on the form that the product takes. Experience from across Europe shows that a good process can help people accept a controversial product, and that even the best product may not be accepted if the process has been flawed. Providing scope for public and / or stakeholder participation is crucial, although there are many models of participation, and different models will be appropriate for different situations. In general it can be said that the more controversial the topic, the more need there is for an open process.

• Although public / stakeholder involvement is needed, it is not possible to offer them a blank slate to negotiate from. The Habitats Directive, other international treaties like the Bern and Bonn Conventions, and a wide range of national and local laws provide a precondition for the conservation of large carnivores. Therefore, the discussion is not about whether carnivores should be conserved, it should be about how to go about achieving this goal in the best possible way.

• It should be underlined that the goal is to produce a technical instrument for management – i.e. a management plan, not a policy document, because policy already exists.

• There will need to be two parallel processes. The external international process will need to be conducted in parallel with internal national processes. However, in cases where a good national process has already been completed to produce an existing national management plan, it may not be necessary to conduct as extensive a process as in cases where no national level process has previously been conducted. An international process should seek to harmonise existing national plans, and then return to their respective stakeholders for consultation about any required changes. For nations with a federal structure it is crucial that all the relevant states are included in the process of dealing with an international neighbour.

• Many European large carnivore populations are currently expanding. In addition, there are some regions of Europe which currently lack large carnivores, but which will need to play key roles in ensuring the connectivity between adjacent populations in the future. It is therefore important to involve management agencies from areas adjacent to current distribution range as these areas may soon receive dispersing individuals.

• Facilitation is crucial. Any discussion forum involving the public, stakeholders, or different management agencies must be facilitated by a skilled, and neutral, facilitator. In cases where there are some disagreements about basic facts or their interpretation it may be desirable to convene a small group of international experts to evaluate the available data.

• Within each large carnivore population one country, or state, should take the lead. This could either be the country that has the largest share of the carnivores, or else the country which has the most to gain from cooperation.

• Reaching agreement will be eased if incentives are provided by the Commission. The incentive that is likely to be most attractive is the idea that cooperation will give greater management flexibility and freedom and the Commission strongly encourages to work on population level, as evidenced by the initiative to prepare these guidelines. For example, if the population can be managed as a whole, it will enhance FCS and allow participating countries more locally-adapted flexibility in managing their segment(s) of the population. The possibility of changing the annex designation (e.g. changes between annex IV and V) of specific species in specific populations, or of clarifying the acceptable management practices within existing designations would also encourage cooperation. Furthermore, the provision of central funds (i.e. through Rural Development or LIFE+ Programmes) to offset some of the high costs of conserving large carnivores would also foster cooperation if these funds were conditional on the adoption of population level management plans.

• Large carnivore conservation requires cooperation between different sectors. Any effective planning process must therefore include representatives covering environment, agriculture, forestry, tourism and infrastructure / transport.

• Most of the main large carnivore populations in Europe contain countries that are not EU members. These countries need to be involved in the process through novel diplomatic approaches as their cooperation can only be requested rather than required. For countries that are signatories to the Bern Convention it should be possible to encourage participation if this convention could also adopt these guidelines. Recommendation No.115 (2005) on the conservation and management of transboundary populations of large carnivores from the Bern Convention secretariat already goes a long way towards encouraging this process. For key countries that are not signatories of the Bern Convention it may be necessary to find other incentives to encourage their voluntary participation. The Bonn Convention may be one suitable platform to exploit, as is the Convention on Biological Diversity.

• It may be useful to help participants visualise the consequences of different decisions or management alternatives to ensure that at each workshop there are some GIS-based visual aids that can show the distribution of large carnivores and of potential habitat. It may also be useful to have some basic population models in use that can show the consequences of different population sizes and management scenarios. Finally, these combined modelling exercises could be integrated with some basic data on infrastructure development plans, human land-use and human population trends (e.g. Westley & Miller 2003). This total modelling environment could help visualise the impact of alternative management strategies and scenarios. The effective use of these tools requires a certain amount of pre-workshop planning – but should be very effective to integrate the many different considerations that effective planning must balance. This approach should also help communicate the science to decision makers and managers.

• Whereas these plans can be single species affairs, in areas where two or more large carnivore species occur, it would be logical to consider making a multi-species plan. At the very least, possible synergies should be considered. However, the different species are associated with different ecological requirements and different conflicts, with wolves usually being most controversial and lynx the least.

• It should be underlined that these population level management plans represent a set of minimum issues that must be agreed upon between responsible agencies sharing a population to ensure an effective population level approach. It should be stressed that within any given population there can be considerable variation in management system, and this is acceptable as long as the overall plan (which can also be in the form of an agreement between neighbouring administrations) is coordinated to work towards a common goal of maintaining and enhancing the favourable conservation status of the populations in question. The potential to allow flexible management should be a great aid in building compromises.

• It is most important to achieve this type of management plan for the discrete populations (defined in tables 1-4) that have a more or less continuous distribution across borders. However, it is also important to consider the connectivity between populations into the wider metapopulation. Therefore, the different processes for different populations should be coordinated. In cases where a number of different discrete populations fall within the range of an already existing umbrella with existing traditions of cooperation – such as the Alpine Convention and the SCALP[18] concept for lynx – it may be an idea to coordinate the process for all populations that fall within this umbrella.

[18] SCALP = the "Status and Conservation of the Alpine Lynx Population" is an existing concept that attempts to coordinate monitoring and conservation efforts for Eurasian lynx throughout the Alpine nations.

## *7.2 The product*

The following is a draft template for the topics that a transboundary management plan should contain. There should be three sections, focusing on background information, a formulation of measurable, time specific and spatially explicit objectives and targets, and a set of actions that are needed to achieve these objectives.

| *Title* | *Explanatory notes* |
|---|---|
| **1.Background** | This section summarises the background information about the specific population and its metapopulation context. It is intended to serve as a reference for justifying the objectives and associated actions that come later in the document, and to increase the transparency, credibility and robustness of the overall plan. Outlining the similarities and differences in circumstances between different management units is important. It will include the following sub-sections. |
| 1.1 Population definition | Describes the geographic limits of the population, where possible separating between (1) the distribution of the reproductive portion of the population, (2) the total area of regular occurrence of resident individuals and (3) the areas where individuals, such as dispersers, occasionally occur. If the distribution of animals within a population is clumped, then these population segments need to be described. |
| 1.2 Management units | Describes the existing management units – such as national, state or county borders, wildlife management unit borders, or protected area borders that overlay this distribution. |
| 1.3 Population description | Describes the history, status, trend, and ecology of the population. If any data are available on demographic parameters (reproduction or mortality) they should be gathered and presented. Likewise, as detailed as possible time series data on population trends and eventual human harvest should be gathered on as fine a spatial scale as possible. Special emphasis should be placed on describing the survey / monitoring / census methods that have been used such that the quality of the data can be evaluated. |
| 1.4 Habitat description | Describes the quality of the habitat within the geographic limits of the populations and in surrounding areas where expansion is possible. Presents data on anthropogenic (human population, infrastructure, agriculture, land use) and biological (forest cover, prey distribution) parameters. |
| 1.5 Continental context | Describes the existing and potential connections to neighbouring populations within the metapopulation. Evaluates the importance of this population inside the European context – both in terms of numbers and connectivity. |
| 1.6 Current management | |
| 1.6.1 Legal status and management regime | Describes the current management practices within each of the management units. |
| 1.6.2 Damage and conflicts | Summarises data on the different conflicts that occur and on ways in which these have been mitigated. |
| 1.6.3 Obstacles to conservation | Identifies the major threats, limiting factors and obstacles to successful conservation in the region. A SWOT or DSPIR method could be used to structure this debate. |
| 1.6.4 Conservation status | Summarise the conservation status of the population and any conservation measures that have been taken recently to improve this status. |
| **2. Definition of goals and objectives** | This section develops both the overall vision and the temporally- and spatially-specific, measurable, objectives and targets that the plan seeks to reach. It contains the following sub-sections. |

| | |
|---|---|
| 2.1 Statement of overall vision | Develops a common overall vision for large carnivore conservation in the region[19]. It could also include statements about large carnivore conservation and should relate to other conservation and social economic objectives for the same region. |
| 2.2 Measurable objectives | This is the section where specific and measurable objectives are developed within the frames of the overall vision. These objectives should be impact-orientated (represent desired end points), measurable, time-limited, specific and credible. These objectives should be based on the best available science, be tailored to the specific species and region, include both short-term and long-term objectives, and make uncertainties transparent (Tear *et al*. 2005). |
| 2.2.1 Favourable reference population | Develops a common understanding of what the threshold favourable reference population value will be for this population. |
| 2.2.2 Favourable reference range | Develops a common understanding of what the threshold favourable reference range distribution will be for this population. |
| 2.2.3 Population goals | Explores how far beyond the threshold levels required to satisfy community obligations it is desirable to go for this population. |
| 2.2.4 Success criteria | Develops a set of measurable parameters, such as population size or trend, harvest rates, damage levels, poaching levels, that can be used to measure the success of management actions. |
| 2.2.5 Connectivity and expansion | Specifically develops a plan to maintain or enhance the connectivity both within this population and with neighbouring populations. Areas where expansion is to be encouraged or favoured, and corridors crucial for connectivity should be identified. |
| 2.2.6 Spatial aspects of management | The overall objectives developed in the previous sections should be distributed in space between various management units such as countries, states, counties, wildlife management units or protected areas. The relationship between this plan and any protected areas, especially Natura2000 sites, should be considered in detail. Particular attention should be paid to integration of the needs for population connectivity in the national infrastructure and industrial development plans. |
| **3. Actions** | These are specific action points that need to be considered. They focus on the actions that mainly apply to population level management planning – other national actions may also exist but not all need to be repeated. It is not automatic that the actions should be identical in all management units – but they should be coordinated and compatible with each other. Sharp boundaries between widely different actions should be avoided. |
| 3.1 Maintaining range and population size | Outlines concrete actions that will act on the population to ensure that its conservation status is maintained or enhanced (as appropriate). Outlines steps that will be made to maintain or enhance internal connectivity within the population, especially if there are a number of population segments. |
| 3.2 Maintaining and enhancing connectivity | Outlines any specific actions that will be taken to maintain or enhance external connectivity to neighbouring populations. Develops clear land-use plans for crucial corridors. If translocation or reintroduction is to be considered, these need to be described in detail. |
| 3.3 Adapting legislation | Describes any changes in legislation that are needed to bring about the population level management plan. Sharp boundaries between management units with widely different legislations should be avoided. |
| 3.4 Ensuring adequate wild prey base, natural food supply and habitat quality | Describes measures that will be taken to ensure that adequate prey and habitat are available for large carnivores. For bears it is important that forestry maintains food trees and that presence of hunting and forestry practices do not disturb denning bears during winter. For lynx and wolf it is crucial that wild ungulate harvest takes into account the presence of predators when setting quotas. |

[19] By region we refer to both the internal structure of the population in question and its external connectivity to neighbouring populations.

| | |
|---|---|
| 3.5 Damage control and conflict resolution | Describes how the various conflicts will be mitigated and how this mitigation will be funded. In order to foster a sense of fairness and justice it would be beneficial if the same, or at least similar, incentive measures and levels of support could be obtained in all management units sharing a population. |
| 3.6 Coordinating harvest / control of carnivores | It is crucial that the removal of large carnivores be coordinated between all management units that share a population. A population level limit for the number of individuals that can be removed per year should be set. Development of the logic behind the application of derogations is based on a consistent, but locally relevant, logic. Ensure that evaluation of "no detrimental effect" when applying for derogations is conducted on the population level. |
| 3.7 Enforcement | Reports that enforcement (anti-poaching) is seriously planned and coordinated between management units to ensure that poaching in one unit cannot be passed off as legal harvest in another. |
| 3.8 Cross-border exchange of experience among stakeholders and interest groups | Establishes a forum for stakeholders and interest groups from all management units to meet and discuss large carnivore management related issues together. |
| 3.9 Institutional coordination of management authorities | Establishes a contact forum for all management authorities sharing a population to exchange information and meet periodically. |
| 3.10 Coordination of monitoring and scientific research programs | It is crucial that population monitoring be conducted in a comparable and coordinated manner. Different management units may use some different methods and focus on different parameters, but there must be a minimum of overlap in data collected to permit population level evaluation of population status and trend. Describes how transboundary research cooperation will be stimulated. |
| 3.11 Ensuring sectorial coordination within and between countries. | Establishes a contact forum for coordination between sectorial interests (e.g. environment, tourism, agriculture, forestry, infrastructure) between all management authorities within the relevant region. This forum should ensure that planning of other sectorial activities does not increase conflicts in carnivore range or fragment habitat within carnivore range or in connectivity corridors. |
| 3.12 Monitoring efficacy of implemented management measures | A system for assessing the effects of management measures adopted must be in place in order to allow revision of the management plan and its eventual adaptation/modification. |

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# Table 1. Overview of the population structure of brown bears (*Ursus arctos*) in Europe.

| Region | Population | EU countries | Non-EU countries | Population segments | Size |
|---|---|---|---|---|---|
| **Iberia** | Cantabrian | Spain[1] | | • Western<br>• Eastern | 120 |
| **Pyrenees** | Pyrenees | France, Spain[2] | Andorra | • Western<br>• Central | 15-21 |
| **Apennines** | Apennines | Italy[3] | | | 40-50 |
| **Alps** | Alps | Italy[4], Austria, Slovenia | Switzerland | • Trentino<br>• Central Austria[5]<br>• Southern Austria[6] & Slovenian Alps | 30-50 |
| **Dinaric Pindos** | Dinaric Pindos | Slovenia, Greece | Bosnia & Herzegovina, Croatia, Serbia, Montenegro, FYR Macedonia, Albania | • Northern Dinarics[7]<br>• Central Dinaric[8]<br>• Pindos[9] | 2,100 – 2,500 |
| **East Balkan** | East Balkan | Bulgaria, Greece | Serbia | • Rila Rhodope<br>• Stara Planina<br>• Eastern Serbia – northwest Bulgaria | 720 |
| **Carpathian** | Carpathian Mts | Czech Republic, Poland, Slovakia, Romania | Ukraine, Serbia | • Western[10]<br>• Main chain[11]<br>• Apuseni Mts. | 8,000 |
| **Scandinavia** | Scandinavia | Sweden | Norway | • South<br>• Central<br>• Northern | 2,600 |
| **Northeastern Europe** | Karelian | Finland | Norway, Russia[12] | | 4,300 |
| | Baltic | Estonia, Latvia | Russia[13], Belarus | | 6,800 |

1. The distribution covers that of 4 autonomous regions – Asturias, Cantabria, Castilla y Leon and Galicia.
2. The distribution covers 3 autonomous regions – Navarra, Aragon and Catalonia.
3. In the Apennines the distribution covers that of 3 regions: Lazio, Abruzzo, Molise.
4. The distribution covers that of 5 autonomous areas: Province of Trento, Province of Bolzano, Regions: Veneto, Lombardia, Friuli.
5. The Austrian states of Lower Austria, Styria and Upper Austria.
6. The Austrian state of Carinthia.
7. Southern Slovenia, Croatia, Bosnia & Herzegovina, western Serbia, Montenegro.
8. Northern Albania – the distribution of bears in this region is not well known hence the exact location of the discontinuities is poorly known.
9. Eastern Albania, FYR Macedonia, northern and central Greece.
10. Includes south-central Poland and central Slovakia.
11. Includes south-eastern Poland, far eastern Slovakia, Ukraine and the main chain of the Carpathians through Romania and into eastern Serbia.
12. Russian oblasts of Leningrad, Novgorod, Pskov, Tver, Smolensk, Bryansk, Moscow, Kalinigrad, Kaluzh, Tula, Kursk, Belgorod & Orel. This division has been made mainly to achieve units of manageable size with a common biogeographic and ecological context. The distribution of carnivores is continuous across this division.
13. Russian oblasts of Murmansk, and Karelia. The southern and eastern border coincides with the natural geographic structures of Lakes Onega and Ladoga and the White Sea. This division has been made mainly to achieve units of manageable size with a common biogeographic and ecological context. The distribution of carnivores is continuous across this division.

# Table 2. Overview of the population structure of Eurasian lynx (*Lynx lynx*) in Europe.

| Region | Population[1] | EU countries | Non-EU countries | Population segments | Size |
|---|---|---|---|---|---|
| **Bohemian – Bavarian** | Bohemian – Bavarian | Germany, Austria, Czech Republic | | | 75 |
| **Vosges** | Vosges | France, Germany | | • South & Central Vosges,<br>• North Vosges & Palatinian forest | 30-40 |
| **Jura** | Jura | France | Switzerland | | 80 |
| **Alps** | Western Alps | France, Italy, Germany (?) | Switzerland | | 80 |
| | Eastern Alps | Italy, Austria, Slovenia | | | 30-40 |
| **Dinaric** | Dinaric | Slovenia | Croatia, Bosnia & Herzegovina | | 130 |
| **Balkan** | Balkans | Greece (?) | Albania, FYR Macedonia, Serbia, Montenegro | | <100 |
| **Carpathian** | Carpathian Mts | Poland, Slovakia, Czech Republic, Romania, Hungary | Ukraine, Serbia | | 2,500 |
| **Scandinavia** | Scandinavia | Sweden Finland | Norway, | | 2,000 |
| **Northeastern Europe** | Karelian | Finland | Russia[2] | | 1,500 |
| | Baltic | Estonia, Latvia, Lithuania, Poland | Russia[3], Belarus, Ukraine | | 3,400 |

[1] In addition to these populations there are a number of small "occurrences" of lynx. The most prominent example is that of captive lynx that have been reintroduced to the Harz mountains of central Germany. The future status of this occurrence may need to be updated as its development is monitored.

[2] Russian oblasts of Murmansk, and Karelia. The southern and eastern borders coincide with the natural geographic structures of Lakes Onega and Ladoga and the White Sea. This division has been made mainly to achieve units of manageable size with a common biogeographic and ecological context. The distribution of carnivores is continuous across this division.

[3] Russian oblasts of Leningrad, Novgorod, Pskov, Tver, Smolensk, Bryansk, Moscow, Kaliningrad, Kaluzh, Tula, Kursk, Belgorod & Orel. This division has been made mainly to achieve units of manageable size with a common biogeographic and ecological context. The distribution of carnivores is continuous across this division.

# Table 3. Overview of the population structure of wolverine (*Gulo gulo*) in Europe.

| Region | Population | EU countries | Non-EU countries | Population segments | Size |
|---|---|---|---|---|---|
| **Northern Europe** | Scandinavian | Sweden, Finland | Norway | • South Norway[1],<br>• Central Scandes[2],<br>• Northern Fennoscandian[3]<br>• Swedish forest | 750 |
| | Karelian | Finland | Russia[4] | • Karelian,<br>• Western Finland | 450 |

[1] Norwegian counties of Sør-Trøndelag (west of river Gaula), Hedmark (west of river Glomma), Møre & Romsdal, Oppland and further southwest.

[2] Norwegian counties of Sør-Trøndelag (east of river Gaula), Hedmark (east of river Glomma), Nord-Trøndelag, Nordland and Swedish counties of Jämtland, Dalarna, Norrbotten and Västerbotten

[3] Norwegian counties of Troms and Finnmark and northwestern and northern parts of the Finnish county of Lappland.

[4] Russian oblasts of Murmansk & Karelia

# Table 4. Overview of the population structure of wolves (*Canis lupus*) in Europe.

| Region | Population | EU countries | Non-EU countries | Population segments | Size |
|---|---|---|---|---|---|
| **Iberia** | Northwestern | Spain[1], Portugal | | • North of Duero, • South of Duero in Portugal, • South of Duero in Spain | 2400 (at least 325 packs) |
| | Sierra Morena | Spain | | | 50 |
| **Alpine / Italian** | Western Alps | France, Italy[2] | Switzerland | | 100-120 |
| | Italian peninsula | Italy[3] | | | 500-800 |
| **Dinaric – Balkan**[6] | Dinaric Balkan | Slovenia, Greece, Bulgaria | Croatia, Bosnia & Herzegovina, Serbia, Montenegro, FYR Macedonia, Albania | | 5,000 |
| **Carpathian** | Carpathian Mts | Czech Republic, Slovakia, Poland, Romania, Hungary | Ukraine, Serbia | | 4,000 |
| **Scandinavia** | Scandinavia | Sweden | Norway | | 130-150 |
| **Northeastern Europe** | Karelian | Finland | Russia[4] | | 750 |
| | Baltic | Estonia, Latvia, Lithuania, Poland | Russia[5], Belarus, Ukraine | | 3,600 |
| **Central Europe** | Germany / Western Poland | Germany / Poland | | | <50 |

[1] The distribution area covers 8 autonomous regions – Galicia, Asturias, Cantabria, Castilla y León, País Vasco, La Rioja, Castilla-La Mancha.

[2] The distribution area covers 3 regions: Val d'Aosta, Piemonte, western Liguria. In Lombardia the presence is not confirmed.

[3] The distribution area covers 11 regions: Lombardia, central-eastern Liguria, Emilia-Romagna, Toscana, Marche, Lazio, Abruzzo, Molise, Campania, Basilicata, Puglia, Calabria.

[4] Russian oblasts of Murmansk, and Karelia. The southern and eastern borders coincide with the natural geographic structures of Lakes Onega and Ladoga and the White Sea. This division has been made mainly to achieve units of manageable size with a common biogeographic and ecological context. The distribution of carnivores is continuous across this division.

[5] Russian oblasts of Leningrad, Novgorod, Pskov, Tver, Smolensk, Bryansk, Moscow, Kaliningrad, Kaluzh, Tula, Kursk, Belgorod & Orel. This division has been made mainly to achieve units of manageable size with a common biogeographic and ecological context. The distribution of carnivores is continuous across this division.

[6] There is highly likely to be high degree of segmentation within this massive population, however, existing distribution data are too coarse grained to recognise these discontinuities in distribution.

# Table 5. Overview of the international conventions and treaties that the various countries of continental Europe have signed, with details of any species-specific exceptions.

| Country | Habitats Directive[1] | Bern[12] | Bonn | CBD |
|---|---|---|---|---|
| Albania | | Y | Y | Y |
| Andorra | | Y | | |
| Austria | Y | Y | Y | Y |
| Belarus | | | Y | Y |
| Belgium | Y | Y | Y | Y |
| Bosnia and Herzegovina | | | | Y |
| Bulgaria | Y[2] | Y[13] | Y | Y |
| Croatia | A | Y[14] | Y | Y |
| Czech Republic | Y | Y[15] | Y | Y |
| Denmark | Y | Y | Y | Y |
| Estonia | Y[3] | Y | | Y |
| Finland | Y[4] | Y[16] | Y | Y |
| France | Y | Y | Y | Y |
| Germany | Y | Y | Y | Y |
| Greece | Y[5] | Y | Y | Y |
| Hungary | Y | Y | Y | Y |
| Italy | Y | Y | Y | Y |
| Latvia | Y[6] | Y[17] | Y | Y |
| Liechtenstein | | Y | Y | Y |
| Lithuania | Y[7] | Y[18] | Y | Y |
| Luxembourg | Y | Y | Y | Y |
| Moldova | | Y | Y | Y |
| Montenegro | | | | Y |
| Netherlands | Y | Y | Y | Y |
| Norway | | Y | Y | Y |
| Poland | Y[8] | Y[19] | Y | Y |
| Portugal | Y | Y | Y | Y |
| Romania | Y | Y | Y | Y |
| Russian Federation | | | MoU | Y |
| San Marino | | | | Y |
| Serbia | | Y | Y | Y |
| Slovakia | Y[9] | Y[20] | Y | Y |
| Slovenia | Y | Y[21] | Y | Y |
| Spain | Y[10] | Y[22] | Y | Y |
| Sweden | Y[11] | Y | Y | Y |
| Switzerland | | Y | Y | Y |
| The former Yugoslav Republic of Macedonia | | Y[23] | Y | Y |
| Turkey | | Y[24] | | Y |
| Ukraine | | Y[25] | Y | Y |

Y = yes, A = accession country that will soon be member, MoU = has not ratified but takes part in some specific agreements through a memorandum of understanding.

## Footnotes

1. By default wolf, bear, lynx and wolverine are on annex II and annex IV under the Habitats Directive.
2. Bulgaria: wolf both in annex II and annex V, but no exception.
3. Estonia: exception for wolf, bear and lynx from annex II; wolf and lynx are on annex V.
4. Finland: exception for wolf, bear and lynx from annex II; wolf in reindeer husbandry area are on annex V.
5. Greece: exception for wolf north of the 39th parallel from annex II; wolf north of 39th parallel are on annex V.
6. Latvia: exception for wolf and lynx from annex II; wolf on annex V.
7. Lithuania: exception for wolf from annex II; wolf on annex V.
8. Poland: exception so that wolf is placed on annex V.
9. Slovakia: exception so that wolf is placed on annex V.

10. Spain: exception north of river Duero so that wolves are placed on annex V.
11. Sweden: exception for bears from annex II.
12. By default wolves, bears and wolverines are on appendix II, lynx are on appendix III under the Bern Convention.
13. Bulgaria: wolves excluded from appendix II.
14. Croatia: bears will be treated as appendix III.
15. Czech Republic: wolves and bears excluded from appendix II.
16. Finland: wolves and bears excluded from appendix II.
17. Latvia: wolves excluded from appendix II.
18. Lithuania: wolves will be treated as appendix III.
19. Poland: wolves excluded from appendix II.
20. Slovakia: wolves and bears excluded from appendix II.
21. Slovenia: wolves and bears excluded from appendix II
22. Spain: wolves will be treated as appendix III.
23. Macedonia: wolves excluded from appendix II.
24. Turkey: wolves and bears excluded from appendix II.
25. Ukraine: wolves and bears remain on appendix II, but Ukraine reserves the right to exercise population control to limit damage.

# Appendix 1. Large carnivore populations in Europe

The following tables report on the description of each population for the four species including its naming, the geographical description, the genetic structure, the connectivity with other populations, the current management, the pressures and responses and the IUCN red listing assessment. It should be noted that the borders have been mainly drawn on the basis of continuity of distribution, although in some cases we have made pragmatic decisions to separate areas with very different social, political and ecological situations. Distributions will constantly change and need to be reassessed as carnivore populations expand and contract and more fine scaled data become available. As such, these are simply a working proposal based on existing knowledge that can serve as the basis for future discussions.

Brown Bear (*Ursus arctos*)

Eurasian Lynx (*Lynx lynx*)

Wolf (*Canis lupus*)

Wolverine (*Gulo gulo*)

# BROWN BEAR (*Ursus arctos*)

| Name | Geographical description | Genetic and demographic structure | Connectivity with other populations | Current management | Pressures and Responses | IUCN red listing |
|---|---|---|---|---|---|---|
| Scandinavia (2,600 bears) | The population is shared between Sweden and Norway, but more than 95% of the individuals are in Sweden. In Norway, the bears are found mostly along the Swedish border. The northern limit is at approximately 60°N where Norway, Sweden and Finland meet. Bears in Norway north and east of this line (in Finnmark county) are in the North-eastern Europe population. The area between the Scandinavian and North-eastern Europe populations is very sparsely inhabited by bears. | After heavy persecution in both countries, the once numerous brown bear population in Scandinavia was reduced to about 130 individuals in four areas where they have survived since 1930. The population has increased to about 2,550 in Sweden, with approximately 50 bears in Norway. This breeding portion of the population consists of four relatively discrete population segments. Males move between these segments, but female movement is currently limited. In Sweden, the distribution of bears now resembles that of 1800, with bears occurring in 50% or more of the country. The population is one of the most productive in the world and is increasing at a rate of about 5.5% annually. This population is considered to be viable, both genetically and demographically, but low gene flow has been identified between the southernmost population segment and the other segments In Norway, the distribution of bears corresponds to the western edges of these four population segments. As a result most bears in Norway are young dispersing males with only 1.6-2.4 females with cubs being reported each year, which means that there are about 2-6 adult females in the country. | The population is potentially connected with the North-eastern European population through dispersing males, but probably not by dispersing females. | There is a quota hunting regime in Sweden. The harvest rate has slowed, but not halted, the population's growth. Norway kills a number of bears each year in connection with damage prevention. The kill in Norway is probably only sustained because of the influx of bears from Sweden. | The major pressure in Norway is related to damages on unguarded free-ranging sheep.<br><br>Although conflicts have been low in Sweden, new conflicts are appearing as bears expand into more densely populated areas. | Although there is controlled harvesting, the population is growing at a steady and relatively rapid rate. As there is no ongoing decline, this population cannot qualify as threatened under Criterion C. It is classed as "Least Concern". |
| North-eastern European populations (11,100 bears)<br><br>Karelian population (4300 bears) & Baltic population (6800 bears) | The North-eastern European populations constitute a part of the largest continuous brown bear population in the world. In its full extent it joins with other bear populations to form a more or less continuous population stretching from the Baltic Sea to the Pacific Ocean. However, we have limited this evaluation to the area west of 35°E. This includes the eastern parts of Finnmark county in Norway, Finland, western Russia, Estonia, Belarus and Latvia. For the purposes of management we propose splitting this large population into two administrational populations. In the Karelian population we include bears from Norway, Finland and the Russian oblasts of Murmansk and Karelia. In the Baltic population we include bears from Estonia, Latvia, Belarus and the | Densities are generally low, with the highest densities in the south-eastern part of the population and the lowest densities in the north and southwest. The distribution of bears is more or less continuous, although at the western and southern edges it becomes somewhat fragmented. In Norway the distribution of bears in the Karelian population is restricted to the Sør-Varanger Municipality (especially the Pasvik Valley) and in the eastern part of the Finnmark Plateau, both in Finnmark County. In the Norwegian portion, an average of 2 litters of cubs are produced per year, which corresponds to about 3-5 adult females. Thirty to fifty bears have been estimated from DNA in feces in a small area in north-eastern Norway, between Russia and Finland, but most of these are probably transients. Finland has about 810-860 bears (2005 estimate) distributed throughout the mainland of the country. The number of bears is increasing at about 10% annually in the south and is stable in the north. The distribution of bears throughout western Russia is fairly continuous, although the connections to Estonia and Belarus are somewhat fragmented (in Pskov and Smolensk oblasts). The number of bears in western Russia appears to be relatively stable. Estonia has a large number of bears (440-600) at | The Karelian population probably has some level of genetic exchange with the Scandinavian population to the south and west. Both the Karelian and Baltic populations are connected to the main distribution area of Russian bears to the east and with each other. The separation between the two populations is made here only as an administrative decision to produce units of practical size and with more homogenous internal conditions. | Bears are managed either as game animals, or treated as *de facto* game animals in most of this area, hunted under various quota systems. The exception is Latvia and Belarus where bears are protected. Although bears are protected in Norway, several are killed each year following depredation on livestock, and a form of licensed hunting was started intended to regulate population size. | Due to a large total size and large area the population is in favorable conservation status. The main conflicts are associated with depredation on livestock in Norway. | The red list status is "Least Concern". However, due to low densities in peripheral areas, bears may be locally vulnerable, and in some places even endangered. |

| Name | Geographical description | Genetic and demographic structure | Connectivity with other populations | Current management | Pressures and Responses | IUCN red listing |
|---|---|---|---|---|---|---|
| | Russian oblasts of Lenningrad, Novgorod, Pskov, Tver, Smolensk, Bryansk, Moscow, Kalinigrad, Kaluzh, Tula, Kursk, Belgorod & Orel. The border between these two populations falls along the Lakes Onega and Ladoga along with the White Sea. To the east these populations are continuous with other bear populations. | relatively high densities, whereas Latvia has only a few bears at the eastern edge of the country. Belarus has 100-200 bears, mainly in the northeastern part of the country. | | | | |
| Carpathian Mountains (8,100 bears) | The Carpathian mountains stretch from the eastern part of the Czech Republic through Slovakia, Poland, Ukraine and Romania to Serbia. Bears can be found throughout this mountain range. However, it appears that the distribution of females is not continuous. Therefore we recognize 3 population segments within this population. A Western segment on the border between north central Slovakia and south central Poland, the Main Carpathian chain segment stretching from southeastern Poland and eastern Slovakia, through Ukraine and Romania to eastern Serbia, and the Apuseni Mountains to the west of the main Carpathian chain in Romania | The total number of bears in the Carpathian Mountains is estimated to about 8,100 bears making it the second largest in Europe. Apart from an apparent gap in breeding females in eastern Slovakia and from the Apuseni Mountains in the western part of Romania the distribution is more or less continuous. Recent estimations of the Romanian population indicate that in Romania occur about 6,000 bears, population trend being stable. During the last 50 years, the Romanian bear population recovered from less than 1,000 individuals to about 6000 individuals. This recovery process was influenced by both habitat conditions and wildlife management. | The closest population is in northern Bulgaria and southeastern Serbia, but the movement of individual bears may be very restricted due to the Danube which acts as a physical barrier. The fact that in the area bears occur sporadically led to the conclusion that bears migration is very uncertain. | In Romania and Slovakia bears are a hunted species, while in other countries they are under various regimes, mostly related to the damage control system. Annually, in Romania up to 250 bears are shot that represents about 4% of the estimated population. Since 2005 there is a national bear management plan approved by the authorities, its implementation being started by the Ministry of Environment and Water Management together with the Ministry of Agriculture, Forests and Rural Development. One of the first initiated actions is related to population estimations on larger areas (geographical criteria) and setting up hunting quotas based on the analysis at national level. Compensations for damages caused by bears are paid by the game administrators, being foreseen that in areas where bears are not hunted, these compensations to be paid by the Ministry of Environment and Water Management (the authority for protected species). | The socio-economic developments in Romania have a certain influence on bear population on medium and long term and it is considered that Romanian bear population is vulnerable. The new developments have a certain negative impact on bears, starting from behavior changes (habituated bears) to habitat fragmentation and reproductive isolation. Several areas (corridor between Apuseni Mountains and the main ridge of Carpathians, Prahova Valley, southern part of Carpathians – close to Danube) started to be affected by isolation processes but there is still connectivity within the entire Romanian Carpathian population. | Generally the whole population is "Vulnerable", with some local portions endangered. |
| Dinaric - Pindos (2100 - 2500 bears) | This population extends from central and southern Slovenia, Croatia, Bosnia & Herzegovina, eastern Serbia, Montenegro, Albania, FYR Macedonia and northern Greece. There are some | The population as a whole is recently stable with steady growth in Slovenia and Croatia, a marked drop in Bosnia & Herzegovina in 1990s due to war situation, and probably stable or slight decrease in the south of the Dinaric Alps. In the Pindos range it is characterized as stable (150-200) with locally positive | In Slovenia in the north this population is close to the one of the Alps and to bears in central Austria. There is not a continuous distribution of | In the largest part of the population range (Slovenia, Croatia, Bosnia & Herzegovina, Serbia and Macedonia) bears are a game species. | Political instability and the lack of financial resource represent a pressure in the central part of the range. The | It has a structure such that each subpopulation contains fewer |

| Name | Geographical description | Genetic and demographic structure | Connectivity with other populations | Current management | Pressures and Responses | IUCN red listing |
|---|---|---|---|---|---|---|
| | small areas where our information indicates that gaps may be appearing in Albania, Montenegro, western Serbia and Kosovo such that we recognize 2-3 segments. | trends and recolonisation of former range. Low rates of genetic variability have been detected in the NE Pindos. The quality of population estimates vary widely between countries. The forested areas in these countries are less contiguous than in the Carpathian area, separating to some degree the functional habitat into more or less isolated sub areas, although there are corridors. Currently our fine scale knowledge is not sufficient to determine definitively whether this population should be divided into smaller units. The northern block consisting of southern Slovenia, Croatia and Bosnia & Herzegovina is continuous, as is the southern block consisting of the Greek Pindos mountains, western and central FYR Macedonia and eastern Albania. However, the distribution in northern Albania, Montenegro, western Serbia and Kosovo may be fragmented. | female bears with the Alps, but there is movement of male bears. In Greece the nearest population is the Rila-Rhodope population segment along the border of Greece and Bulgaria, but there is no evidence of connection. | Management plan for bear exist in Croatia (developed in 2005, revised in 2007).Brown bears in Slovenia are hunted under protected status. In Albania and Greece bears are under a total protection status. | lack of recent data from the central portion of the range – Montenegro, Kosovo province of Serbia and Albania – means it is hard to assess the internal connectivity. There is a need to standardize census methods. | than 1,000 individuals. Population trends are poorly known, and although the population seems more or less stable, it is possible that there is a slight continuing decline. Consequently it is classed as "Vulnerable" |
| Alps (35-40 bears) | Presently bears are found in three regions of the Alps. The Central Austria segment is a small nucleus originated from three bears released in 1989-1993, into an area with a naturally occurring male bear.<br>The Southern Alps segment is located in the Central Italian Alps, centered in the province of Trento. This nucleus (20-25 individuals, originated from the animals translocated in the 1999-2003 period) occupies an area of about 1500 km², of which only 240 km² is used regularly. Finally, there is the southern Austrian / Slovenian Alps segment. | The Alpine population covers a large area with very few bears. The bears are clustered into 3 segments that are separated by large areas with no permanent bear presence, although individuals have shown their ability to freely move between these segments. As such it is not a homogenous population, however we have chosen to designate it as a population because its future viability is totally dependent on improving the connectivity between these segments. The Central Austrian population now consists of <10 bears. After the initial increase following reintroduction and local reproductions, the recent years have seen the numbers decline.<br>No more than 4 bears survived in north-eastern Italy until 10 were reintroduced from Slovenia in 1999-2003. With subsequent reproduction the population now exceeds 20 bears, and continues to grow; in 2006 there was a population of about 6-7 adults and 16-17 sub-adults and cubs. The original bears in the Italian Alps were genetically like the ones from the Dinaric Alps, and after recent reintroductions they are now identical. Both the Central Austrian and Southern Alps population segments are dependent on the arrival of fresh individuals to boost their genetic variability. A question remains if there will be enough natural immigration or if more individuals will need to be translocated. | At least three individuals from the Trentino nuclei have dispersed in the direction of Austria, Switzerland and Germany. None established a new home range but their movements have demonstrated the connectivity of habitat within the Alps and the potential for recolonisation. Occasionally individuals dispersing from the Eastern Alpine nucleus have reached the Central Italian Alps, confirming a potential connectivity among all the alpine nuclei. | The Italian and Austrian bear nuclei are under strict protection. The removal of the bear in Germany caused a great public outcry and a controversy between different national and international Governmental Organisations and Non-Governmental Organisations. Fortunately the case also raised awareness for the need of a bear management on the population level. Initiatives to coordinate and harmonize bear management between Italy, Switzerland, Austria and Germany are currently under way. | Damages caused by bears have the potential to reduce the public acceptance, especially by the problem making individuals. Intensive management of all bear related problems is under way.<br>Loss of more than 15 bears of the central Austrian bear population and 2 dispersers from Italy suggest an unnatural high mortality rate among bears in the Alps. Unfortunately, illegal removals seem to be the most likely explanation. One bear was legally shot in Germany in July 2006 because of the potential threat it posed to human safety (the bear repeatedly entered villages and broke into barns), whereas the | Despite the constant increase of the Central Italian nucleus, the limited numbers of individuals characterizing all the alpine range show that these bears are "Critically Endangered". |

| Name | Geographical description | Genetic and demographic structure | Connectivity with other populations | Current management | Pressures and Responses | IUCN red listing |
|---|---|---|---|---|---|---|
| | | | | | other two bears disappeared without leaving any tracks. | |
| Eastern Balkans (720 bears) | We recognize three population segments in the Eastern Balkans populations. Firstly is the Rila Rhodope segment that includes the Bulgarian Rila Mountains and Pirin Mountains and the western Rhodope Mountains on both sides of the national border. Of the total of about 520 bears, only 25-30 are found in Greece. The connection between the bears in Greece and Bulgaria is likely to consist of dispersing males from Bulgaria, as well as of family groups seasonally dispersing from Greece into Bulgaria.<br>The Stara Planina segment is located from the Kotlenska mountains in the east to Zlatitsa-Teteven in the West, along 120 km of the Stara Planina mountain range (Balkan Range). The western end stretches into Serbia and a few bears are shared over the border, forming a small segment. | Little is known about genetic structure. The connections between segments were only recently proven, and may be a sign of recent recolonisation. In the early 1980's Carpathian bears were released in the Rhodope and Stara Planina Mountains. The numbers are not known since there is restricted access to this data. The Stara Planina population was believed to be totally isolated from the populations to the south and west but there is recent evidence of bears in the corridors to the south towards Rila-Rhodopean Mountains, including family groups. This is why the Stara Planina and Rila Rhodope segments have lost their identity as independent populations as used in earlier reports. | The Greek part of the Rila-Rhodope segment is near the Dinaric – Pindos population but there is no demonstrated connection between these two populations To the north of the Stara-Planina population there is a potential, but unproven, connection to the Carpathian population. | Bears in Bulgaria are under protected status that allows the removal of problem individuals. The Greek portion is strictly protected, as well as the few specimens in Serbia. Bulgaria is currently developing a new management plan. | Presently in Bulgaria there is liberal (not well functioning) system of declaring the problem individuals assigned for removal, as well as poorly controlled poaching. The forecoming developments may cause a significant loss/fragmentation of natural habitat. | The population is "Vulnerable", but the connections are very fragile and their disruption may turn/list the species to "Endangered". |
| Apennine Mountains (40-50 bears) | The population is located mainly in the Abruzzo National Park and the surrounding areas of the Apennine Mountains in central Italy. | A survey yielded a population estimate of 70-80 bears in 1985. However, since then there has probably been a population decrease and 40-50 bears may be a more realistic estimate. Some expect this population to increase as poaching has been reduced in recent years, and areas surrounding Abruzzo National Park have been protected to secure suitable habitats. However, this population exists within a densely populated area and there are potential conflicts between bear conservation and development and recreation activities. | It has been totally isolated for over a century. There is no possibility of reestablishing connectivity in the short term. | It is strictly protected but occasional losses due to poaching or other human related accidents do occur. | The main pressure is the loss of adult individuals due to human interference. | The population is "Critically Endangered". |
| Cantabrian (130 bears) | Presently there are two bear nuclei in the Cantabrian Mountain population in northern Spain. They are defined as the western and eastern population segments. | The population segments have apparently been separated since the beginning of the 20th century and now show genetic differences. Today, they are separated by 30-50 km of mountainous terrain and interchange between the population segments is thought to be difficult, mainly due to lower quality habitat and a transport corridor that includes a motorway. In spite of recorded movements of individuals from Western to Eastern segments, no reproduction events were recorded between individuals from the 2 segments. Nevertheless, we regard them as one population because their future is totally | It has been totally isolated for over a century. There is no possibility of reestablishing connectivity in the short term. | It is strictly protected but losses due to poaching or other human related accidents do occur. | The main pressure is the loss of adult individuals due to human-induced mortality. Potential habitat destruction both in western and eastern segments due to infrastructure and ski resort development | The population is "Critically Endangered". |

| Name | Geographical description | Genetic and demographic structure | Connectivity with other populations | Current management | Pressures and Responses | IUCN red listing |
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| | | dependent on restoring this connection, which requires a holistic management approach. The western population segment (100 bears) seems to be increasing during the last decade and is distributed over an area of 2,600 km². The last census with genetic methods (García-Garitagoitia *et al.* 2004, unpublished report) estimated 85-143 bears in the western nucleus, with an average of 107.<br>The eastern population segment (25-30 bears) is showing less potential for recovery unless the corridor with the western segment is reestablished. | | | plan. | |
| Cantabrian (130 bears) | Presently there are two bear nuclei in the Cantabrian Mountain population in northern Spain. They are defined as the western and eastern population segments. | The population segments have apparently been separated since the beginning of the 20th century and now show genetic differences. Today, they are separated by 30-50 km of mountainous terrain and interchange between the population segments is thought to be difficult, mainly due to lower quality habitat and a transport corridor that includes a motorway. In spite of recorded movements of individuals from Western to Eastern segments, no reproduction events were recorded between individuals from the 2 segments. Nevertheless, we regard them as one population because their future is totally dependent on restoring this connection, which requires a holistic management approach. The western population segment (100 bears) seems to be increasing during the last decade and is distributed over an area of 2,600 km². The last census with genetic methods (García-Garitagoitia *et al.* 2004, unpublished report) estimated 85-143 bears in the western nucleus, with an average of 107.<br>The eastern population segment (25-30 bears) is showing less potential for recovery unless the corridor with the western segment is reestablished. | It has been totally isolated for over a century. There is no possibility of reestablishing connectivity in the short term. | It is strictly protected but losses due to poaching or other human related accidents do occur. | The main pressure is the loss of adult individuals due to human-induced mortality. Potential habitat destruction both in western and eastern segments due to infrastructure and ski resort development plan. | The population is "Critically Endangered". |
| Pyrenees (15-17 bears) | The Pyrenean bear population consists of two population segments. The Western Pyrenees segment (4 bears) is found in a 1000 km² area located on both sides of the national border between France and Spain in the western portion of the Pyrenees Mountain Range. However, only one half of this area is used regularly.<br>The Central Pyrenees segment (11-17 bears) is on both sides of the national border between France and Spain in the central portion of the Pyrenees Mountain Range. | The autochthonous western population was estimated to consist of 2 individuals. The last documented reproductions occurred in 1995 and 1998.<br>The autochthonous central population segment was extinct before the last decade of the 20th century. In 1996-1997 three bears and in 2006 five new bears were reintroduced from Slovenia. There was subsequent reproduction, including one male who dispersed to the Western Pyrenees segment. Until recently the Western and Central Pyrenees segments were treated as separate units. The dispersal of one male bear demonstrated the potential for connectivity. | It has been totally isolated for over a century. There is no possibility of reestablishing connectivity in the short term. | It is strictly protected but occasional losses due to poaching or other human related accidents do occur. | The main pressure is the loss of adult individuals due to conflicts with humans. Bear conservation in the Pyrenees is extremely controversial, mainly due to depredation on extensive livestock. | The population is "Critically Endangered". |

# EURASIAN LYNX (*Lynx lynx*)

| Name | Geographical description | Genetic and demographic structure | Connectivity with other populations | Current management | Pressures and Responses | IUCN red listing |
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| Scandinavian population (2,000 lynx) | Lynx occur throughout Norway and Sweden, with the exception of the south-western coast of Norway. The population in southern Sweden is in a colonisation phase. | On a population scale the size seems at present to be more or less stable with a number of around 2,000 individuals. The population in Norway has been fluctuating during the last 10 years as management has attempted to establish sustainable hunting quotas. Recent data indicate some degree of stabilisation. In northern Sweden, lynx numbers have significantly declined in recent years as a result of management actions, but there has been a clear expansion to the south. Within the Scandinavian peninsula recent genetic analysis show that there appears to be more crossborder connection in an east-west direction than in a within country north-south direction. However, both genetic data and dispersal data indicate that lynx movements are such that the whole peninsula can be considered as a single population unit. | Although there is some connection to the Karelian population this is probably quite restricted because there are few lynx in the reindeer husbandry area of northern Finland. Genetic data confirm this pattern with Finnish lynx being more closely related to Baltic lynx than to Scandinavian lynx. | In Norway, lynx are managed as game species for which an annual quota is determined within a fixed hunting season. In Sweden, lynx are protected under the Habitats Directive, but limited hunting quotas are issued in the centre and south under derogation. Inside the reindeer husbandry area of northern Sweden, lethal control is practiced to limit depredation. Livestock depredation is intense: Up to 10'000 sheep in Norway, and 100-200 in Sweden, and several thousand semi-domestic reindeer in both countries are killed annually. In both countries, the state pays for domestic animals killed. In Norway, semi-domestic reindeer are compensated when killed, whereas in Sweden reindeer herders are paid for the presence of lynx, not for losses. Sweden has implemented a management plan in 2000, In Norway parliament has presented a white paper in 2004 which determines management goals. | Threats: Illegal killing has been documented to be a significant cause of mortality throughout Scandinavia. Harvest rates have also been too high during some periods in Norway.<br><br>Most important conservation measures needed: Changing sheep husbandry in Norway, set the hunting quotas at sustainable level. | "Near Threatened". Large, continuous and connected. PVA results indicate population size has low chance of extinction. |
| Northeastern European populations (4900) lynx<br><br>Karelian population (1,500 lynx) & Baltic population (3,400 lynx) | The North-eastern European populations constitute a part of the largest continuous lynx population in the world. In its full extent it joins with other lynx populations to form a more or less continuous population stretching from the Baltic Sea to the Pacific Ocean. However, we have limited this evaluation to the area west of 35°E. For the purposes of management we propose splitting this large | Karelian population: In Finland, there were no animals left by 1950, before recolonisation from Russia started. Since then, the population has been increasing and expanding, especially during the past two decades. The estimation in Finland was 1,050-1,100 animals in 2004 with an increasing and expanding trend. The 2005 estimate for Karelia oblast was 510 and appears to be stable.<br><br>Baltic population: The population consists of around 3,400 lynx, or which 1,600 are found in the Russian portion. Although there was | Karelian population: The Karelian population is genetically close to the Baltic population and their distributions are more or less continuous. Connection to the Scandinavian population is likely to be limited although dispersers have been documented using genetic tools. To the east the Karelian population connects to the continuous Siberian population.<br><br>Baltic population: To the east the Baltic population connects to the | Karelian population: Lynx are officially protected in Finland since 1995 under the EU's Habitats Directive. Complete protection can however be derogated in accordance with article 16 of the EU Habitat Directive (resulting in a kind of quota hunting). As a matter of fact, the country has maintained the level of harvest at the end of the 1990s compared to the beginning of the 90s. The level (68 lynx annually in 2004-05) is sustainable. A new management plan is being developed. Lynx are a game species in Russia, but there has | Karelian population: Threats: Potentially harvest, although current levels are low. Depredation on livestock is very low in this region, although depredation on semi-domestic reindeer excludes them from the northern areas. Finnish hunters perceive lynx as serious competitors for game, especially roe deer and white-tailed deer. | Karelian population: "Least Concern". Although the number of adult animals is below 1000, our separation of this population is somewhat artificial as it connects to the wider Baltic and Siberian |

| Name | Geographical description | Genetic and demographic structure | Connectivity with other populations | Current management | Pressures and Responses | IUCN red listing |
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| | population into two administrational populations.<br><br>The Karelian population extends across Finland and the Russian oblasts of Murmansk and Karelia. In Finland, lynx are found throughout the whole country, with the highest densities in the southeast. Very few lynx occur in the reindeer husbandry area of northern Finland. Lynx are widespread in Karelia oblast, but only occasionally occur in the forested areas of Murmansk oblast.<br><br>There is a more or less continuous distribution of lynx within the Baltic population across all Estonia (including the large islands), all Latvia, much of Belarus and the Russian oblasts of Leningrad, Novgorod, Pskov, Tver and Smolensk. However, the distribution becomes highly fragmented across Lithuania, northeastern Poland, Kaliningrad oblast and northern Ukraine. | some reduction in numbers in Estonia and Latvia during the 1990's, numbers appear to have stabilised following the adjustment of hunting quotas. The numbers in Russia appear to be stable. The highly fragmented distribution of animals throughout Lithuania, northern and western Belarus and northeastern Poland is a cause of concern. | continuous Siberian populations, and to the north there is good connection to the Karelian population, with which it shares genetic similarity. The population is very fragmented in its southern part. It is very unlikely that any connection remains with the Carpathian population to the south.<br><br>The separation between the two populations is made here only as an administrative decision to produce units of practical size and with more homogenous internal conditions. | been no harvest in Karelia since 1995.<br><br>Baltic population: Lynx are managed as a game species in Estonia and Latvia (reservation for including the lynx in Annex IV of the EU Habitats Directive), with 100 – 150 lynx being shot each year. They are also a game species in the neighbouring Russian oblasts – but annual harvest appears to be very limited (<50). In Poland, Belarus, Lithuania and Ukraine lynx are protected. Both Estonia and Latvia have prepared and implemented a lynx management plan. Regional coordination among researchers is good – and a regional assessment of lynx status and management was completed in 2006. | Most important conservation measures needed: Establish a reliable monitoring system in Russia. Find solutions to mitigate human-livestock-carnivore conflicts in Finland, set the annual quotas on the basis of good census data, establish co-operation between the countries<br><br>Baltic population: Threats: Population fragmentation (especially in the south) enhanced by potentially illegal killing.<br>Most important conservation measures needed: Restore connectivity between the fragments along its western and southern edge. Improve and coordinate the monitoring of the species, develop a comprehensive conservation strategy based on a metapopulation concept and considering habitat quality and connectivity. | populations.<br><br>Baltic population: "Least Concern". The population is very large and connected. |
| Carpathian population (2,500 lynx) | The distribution area covers at present almost the entire area of the Carpathian mountains. This includes the eastern Czech Republic, southern Poland, Slovakia, western Ukraine, Romania and eastern Serbia. It is also possible that some individuals just extend into Bulgaria. | The overall number for the population is about 2,500 lynx. However, it is likely that certain countries overestimate their numbers. Population trends are usually easier to assess than absolute size and densities. There are differing tendencies in the north-western and south-eastern part of the population. In Slovakia, Poland, and Ukraine a negative population trend was observed, whereas in Romania numbers were reported increasing and the range expanding further south. More than half of | Although very large, the Carpathian population appears to be isolated from other populations. To the north the connection to the Baltic population appears to have been broken as lynx are absent from the lowlands of western Ukraine and in eastern Poland lynx occurrences are exceptionally fragmented. To the west there may be a potential to establish connection with the Bavarian – Bohemian population. | In all countries but Romania, lynx is completely protected by law, though since only recently in Slovakia (2001). Until 2000, the annual legal harvest was almost 150 animals in Slovakia and considered a threat to the population. In Poland, lynx has received full protection in 1995. Of the Carpathian population, Romania is therefore the only country left where lynx are legally hunted. Yet the number of lynx shot has been very | Threats: Potentially illegal killing and habitat fragmentation due to infrastructure developments and wood cutting.<br>Most important conservation measures needed: Improve the monitoring and census systems, habitat conservation, public | "Least Concern". The population is large. |

| Name | Geographical description | Genetic and demographic structure | Connectivity with other populations | Current management | Pressures and Responses | IUCN red listing |
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| | | the Carpathian population is situated within Romania, followed by Slovakia. The distribution appears to be more or less continuous, although the range becomes rather narrow in the eastern part of the Polish / Slovak Carpathians. Furthermore, the quality of data from Ukraine is poor making it hard to assess the overall internal connectivity – however, the data that we do have indicate that lynx are present. | | modest compared to the number of lynx estimated and the potential quota set per year. It is however assumed that there is no control over the real extent of hunting, as numbers differ in the literature found. | education, conduct some field research in different parts of the Carpathians to find out more about the species biology in this region, develop a general strategy for the lynx in the entire Carpathians. Action plans are also needed. | |
| Bohemian-Bavarian population (75 lynx) | The population stretches in the triangle where the Czech republic, Germany and Austria meet, including the area of; in the western Czech Republic (Sumava Mts., NW-part of the Cesky les Mts. = Oberpfälzerwald, the Sumava foothills, S-Novohradske Mts.; in the north more isolated, small but constant occurrence in the Brdy highlands in connection with the core population), eastern Germany (Bayerischer and Oberpfälzer Forest, Fichtelgebirge, Frankenwald), and northern Austria (Böhmerwald, Mühlviertel, Waldviertel). | Although there may have been events of natural colonisation from the Carpathians, the origins of this population mainly stem from 5-9 lynx introduced into the German Bavarian forest in 1970-72 and 18 lynx introduced into the Czech Sumava Mountains in 1982-89. The source of the animals was the Slovak Carpathians. The current estimate is around 75 animals. Whereas the population was increasing and expanding until the mid 1990s, since 1999, a marked decrease has been recently noticed in all three countries, but particularly in the Czech Republic, which hosts around 60% of the entire population. | In the northern part of the range, the distribution is less coherent than in the south. Therefore, internal fragmentation could become a problem, particularly in the north-west. This influences the viability of a potential link with the Carpathian population through the Laberiver Sandstone Mts. There seem to be suitable corridors at least as far east as the Laberiver Sandstone Mts. So far, there is no confirmed evidence of movements between the Bohemian-Bavarian and the Alpine populations. In Austria, occupied areas are actually quite close, but the Danube River and a motorway separate them. On the German side, several motorways in the plain between the Bavarian forest and the Alps make it very unlikely for the lynx to expand to the south and south-west. To the west (towards the Black Forest) the infrastructure barriers are even stronger. | Lynx of the Bohemian-Bavarian population are fully protected by law. Cooperation and exchange of information amongst scientists has started some years ago, and the establishment of a discussion platform for management issues was suggested (CELTIC – Conservation of the European Lynx: Management and International Cooperation). However, there is no common management approach yet. In Germany and Austria, wildlife management is in the responsibilities of the federal states (Bundesländer), and as there are no national management strategies for lynx, it is difficult to implement international cooperation. | Threats: Illegal killing, habitat fragmentation due to road constructions. Most important conservation measures needed: Find solutions to the widespread illegal killing, improve connectivity first within the population, but then also to neighbouring occurrences, get a clear commitment and a more strenuous involvement of the authorities. | "Critically Endangered". The population is small and isolated and it has not shown signs of growth. |
| Balkan population (<100 lynx) | This population has a scattered distribution along the borders of Albania, FYR Macedonia, Serbia (especially Kosovo province), Montenegro, and potentially Greece. Lynx occur in the Albanian Alps & central-central east Albania, in western FYR Macedonia | The Balkan lynx population experienced a severe bottleneck in 1935-1940 with an estimated number of only 15-20 individuals left. After World War II the population started to recover, especially in Kosovo and the FYR Macedonia. In the 1960-70s, it also reappeared in Montenegro. The population estimate was some 280 lynx in 1974. Currently, the total size of the population is estimated to be about 100 individuals at | The Dinaric population in Bosnia-Herzegovina has recently spread south as has the Carpathian population in Serbia and Bulgaria, respectively. These could both potentially lead to a merging with the Balkan population. This would, on one hand, be welcome as a support for this Critically Endangered population; on the other hand, the assumed unique | The species is fully protected by law in all range countries. No national management plans exist, however it is one of the aims of an ongoing cross-border conservation project to develop a recovery strategy for the Balkan lynx from which national actions can be derived. | Threats: Small population number, limited prey base and habitat degradation (especially in Albania), probably illegal killing, lack of knowledge about numbers, distribution and ecology. Most important conservation measures | "Critically Endangered". A very small number of animals that are isolated. There are no signs of population growth. |

| Name | Geographical description | Genetic and demographic structure | Connectivity with other populations | Current management | Pressures and Responses | IUCN red listing |
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| | (mainly in the areas in and between Mavrovo, Galicica & Pelister National Parks, but most probably also in the Shar Planina Mts. bordering with Kosovo), as well as in Serbia (Kosovo and Metohija provinces) and Montenegro. From time to time single, unconfirmed observations in the border regions of Greece with FYR Macedonia and Albania are reported. | best, distributed over different patches, indicating a strong internal fragmentation. It is impossible to assess the recent trend in population size or distribution, however local experts indicated a decrease for both 1990-1995 and 1996-2001. | taxonomic status of the Balkan lynx might be influenced through immigrating lynx from the north and/or west. Both of these potential connections are with lynx that are genetically of Carpathian origin. | | needed: Conduct a systematic field survey covering the whole potential distribution area, establish a standardised monitoring of lynx and prey species, research on the ecology and life history of the Balkan lynx, define taxonomic status, rise public awareness, law enforcement, habitat and prey base enhancement. | |
| Dinaric population (130 lynx) | This population extends from Slovenia, through Croatia, to Bosnia-Herzegovina. From central-southern Slovenia (S and SE of the Jesenice-Ljubljana-Triest highway) across Croatia (Gorski Kotar and Lika regions) to western Bosnia (no data available for sporadically present areas). | This population is genetically based on 6 individuals reintroduced to Slovenia from the Carpathians in 1973. Currently, the population seems to inhabit almost the whole range of the Dinaric mountain chain, although the situation in southern Croatia and south-east Bosnia-Herzegovina is not clear, i.e. information on sporadically occupied areas is missing. The size of the population is roughly estimated to be about 130 animals. In Bosnia-Herzegovina, the population is thought to be stable at presence, in Croatia and Slovenia, a slight decrease was reported in 2001. The estimation for the entire population indicates a decrease compared to the beginning of the 1990s. Since in the larger part of the range, sound monitoring has only been established recently, the long-term trend is difficult to assess. Earlier reports are likely to have overestimated the population size. | According to the present information the population occupies a cohesive range, and is connected with the Slovenian part of the Alpine population, although it is not yet clear how well the connection between the two populations across the Jesenice-Ljubljana-Triest highway actually is. There is a potential connection with the Balkan population to the south. Signs of lynx presence are sporadically reported just at the border between Serbia and Montenegro / Bosnia-Herzegovina. | Lynx were granted legal protection in Croatia in 1995. By becoming a member state of the European Union in 2004, Slovenia has ratified the EU Habitats Directive and hence legally protected lynx. Their legal status in Bosnia-Herzegovina is unclear. Croatia is the only range country to have a management plan and an ongoing initiative is aiming at the development of transnational management plan for Croatia and Slovenia. | Threats: Illegal shooting, collisions with vehicles/trains, inbreeding, limited prey base and general habitat loss. Most important conservation measures needed: Develop a cross-border conservation strategy (including defining the legislation in Bosnia-Herzegovina), improve and continue the monitoring of lynx and prey, increase prey base. | "Endangered". A small population, which is isolated from other populations. |
| Western Alps population (80 lynx) | This population is centred on the Swiss Alps (mainly in the cantons of Valais, Vaud, Fribourg and Berne) and the French Alps,<br>Outside this area a more scattered distribution with no permanent lynx presence exists in France (south-east of the country, from Lake | The lynx in the Alps became extinct during the 19th century, with the last specimens surviving in the western Alps of Italy and France until the 1930s. The taxonomic status of the original lynx of the Alps is a matter of discussion. The lynx brought back to the Alps after 1970 were all taken from the Carpathians, the nearest autochthonous population. Today, the Alpine population consists of several occurrences all | The observed rate of development will most likely not allow for a natural fusion of the western and eastern Alpine populations within the next decades. The capacity for expansion is limited as a result of the strong habitat fragmentation in the Alps. Nevertheless, the Alps are the area in Western and Central Europe, which potentially hosts the most viable lynx | Lynx are at present protected in all Alpine countries. In Switzerland, and France individual lynx causing too much damage on livestock, can be removed. National environmental agencies have the authority for lynx management. Except for Switzerland, national management plans are still lacking.<br>In the early 1990s, scientists from all | Threats: Illegal killing, infrastructure development (especially road constructions), vehicle and train collisions, limited dispersal, genetics.<br>Most important conservation measures needed: Promote the expansion of the area | "Endangered". A small population, which is relatively isolated from other populations. |

| Name | Geographical description | Genetic and demographic structure | Connectivity with other populations | Current management | Pressures and Responses | IUCN red listing |
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| | Geneva as far south as to the department of Hautes-Alpes and in the Italian Alps. | originating from re-introductions in the 1970s (Switzerland 1970-76). Although lynx immigrated into neighbouring countries (France, Italy) during the 30 years following the first releases they have not yet established a continuous population throughout the Alps. The total lynx population size in the Alps has been estimated at about 120 (mature) individuals in 2001. The total number has been more or less stable for the past 10 years, however with strongly differing trends in the regions. There has been a slight expansion of the range in France, eastern Italy, and Switzerland (in the latter through translocations of animals from the western Alps and the Jura Mts. to the eastern Alps). | population – habitat models predict a potential capacity of 960-1,800 lynx, depending on the density assumed. There is potential connection between the western Alpine population and the Jura population, which in turn has potential connections with the Vosges population. | Alpine countries formed an expert group to survey the status of and co-ordinate actions for the Alpine lynx population. The SCALP (*Status and Conservation of the Alpine Lynx Population*) defined common standards to interpret the monitoring data collected, and has developed a Pan-Alpine Conservation Strategy (PACS), which was adopted by the Standing Committee of the Bern Convention. | occupied, improve law enforcement, continue monitoring of demographic and genetic parameters, and increase acceptance of local people. | |
| Eastern Alps population (30-40 lynx) | This is a small and scattered population located in the north-western part of Slovenia (Slovenian Alps), stretching into the adjacent regions of Italy (Tarvisiano, Friuli VG, Veneto Bellunese) and Austria (Carinthia, northern Kalkalpen, Upper Carinthia, Niedere Tauern). | This population is derived from animals reintroduced from the Carpathians to Slovenia in 1973 and Austria 1977-79 | The observed rate of development will most likely not allow for a natural fusion of the western and eastern Alpine populations within the next decades. The capacity for expansion is limited as a result of the strong habitat fragmentation in the Alps. Nevertheless, the Alps are the area in Western and Central Europe, which potentially hosts the most viable lynx population – habitat models predict a potential capacity of 960-1800 lynx, depending on the density assumed. There is good potential connectivity between the lynx in eastern Alps with the Dinaric Population. | Lynx are protected in all Alpine counties, although individual lynx causing damage can be removed. In Austria, the owners of the hunting grounds are responsible for the management of the species, but are supervised by the individual states (Bundesländer), which have the legal power. National management plans are lacking. The population is covered by the SCALP cooperation (see above). | Threats: Illegal killing, infrastructure development (especially road constructions), vehicle and train collisions, limited dispersal, genetics. Most important conservation measures needed: Promote the expansion of the area occupied, improve law enforcement, continue monitoring of demographic and genetic parameters, and increase acceptance of local people. | "Critically Endangered". A small population. |
| Jura population (80 lynx) | This population is distributed throughout the Jura mountains along the border between western Switzerland and France. | The Jura population originated from re-introductions in the Swiss Jura Mts. during the years 1974/75. Already the same years some first animals were observed in the French Jura Mts. and from then on they spread further along the chain. Currently, the population makes up around 80 animals, distributed over nearly the entire mountain chain. France hosts roughly two thirds of the population. From 1996-2001 the population was expanding, an ongoing tendency in the | According to a habitat model, it is predicted that the Jura Mountains could host about 74-101 resident lynx. The total population size will hence be limited. Potential corridors to neighbouring lynx occurrences (Alps, Vosges-Palatinian and Black Forest) exist, but there are some barriers like highways and rivers that need to be crossed. Connections to the Chartreuse (French Alps) are the | Lynx are legally protected in all these countries. Stock-raiding animals can however be removed. For this, similar criteria have been established in France and Switzerland. In practice, depredation is much more pronounced in the French than in the Swiss Jura. The Ministries of Environment are responsible for the management of the species. There is co-operation on scientific and administrative level, but | Threats: Illegal killing, traffic accidents, limited dispersal. Most important conservation measures needed: Continuation and improvement of the monitoring, genetic surveillance of the population, law enforcement, improvement | "Endangered". A small population. |

| Name | Geographical description | Genetic and demographic structure | Connectivity with other populations | Current management | Pressures and Responses | IUCN red listing |
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| | | north-eastern Swiss Jura Mts. The numbers are presently more or less stable with some local fluctuations. | easiest and may indeed have been used, as indicated by signs of lynx presence. For genetic reasons an exchange with other populations would be important as the Jura population turned out to have lost part of its original variability compared to the source population from the Slovak Carpathians. | no systematic common monitoring and no common management plan for the entire population. | of connectivity to other lynx populations or occurrences. | |
| Vosges-Palatinian population (30-40 lynx) | This population consists of two population segments, one in the south-central Vosges mountains of France, the second in the northern Vosges mountains and stretching into south-western Germany (Palatinian forest). | Lynx in the Vosges Mts population segment are descended from 21 individuals released in 1983-93. The population now covers a more or less continuous area of 3,000 km². The arrival of the lynx in the Palatinian Forest population segment differs according to the reference: 1980 or 1986. The origin of these animals is not known, but natural immigration seems to be unlikely. The northern Vosges Mts. are separated from the central Vosges Mts. by a main road and the canal de la Marne au Rhin in the district of Saverne, and it is not known how regularly animals actually cross. According to the current estimations, about 30 (at most 40) animals exist in the area of the Vosges Mts.-Palatinian forest. Whereas the most recent tendencies indicate a slight expansion of the range in the south, it has been decreasing in the north. | It might be still too optimistic to define the Vosges-Palatinian as a single population, as the connection of the south/central Vosges segment and the north Vosges/Palatinian segment is apparently not well established yet. An expansion to the east across the Rhine valley is unlikely, and to the west probably also limited due to lack of forest habitats. Along the left shore of the Rhine River, however, a chain of secondary mountain ranges offers the potential for a larger meta-population. There is an obvious connection to the Jura Mts., however with some barriers not easy to overcome. Nevertheless, since 1997 some indications were reported from the Haute-Saône, which lies in between the two massifs. | Lynx are legally protected in all these countries. Stock-raiding animals can however be removed in France. The Ministries of Environment are responsible for the management of the species. There is co-operation on scientific and administrative level, but no systematic common monitoring and no common management plan for the entire population. | Threats: Illegal killing, traffic accidents, limited dispersal.<br>Most important conservation measures needed: Continuation and improvement of the monitoring, genetic surveillance of the population, law enforcement, improvement of connectivity to other lynx populations or occurrences. | "Critically Endangered". A small population. |

## WOLF (*Canis lupus*)

| Name | Geographical description | Genetic and demographic structure | Relations with other populations | Current management | Pressures and Responses | IUCN red listing |
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| Iberia (2,500 wolves)<br><br>Northwestern population (2,400 wolves) | We recognize two populations on the Iberian peninsula. The largest population lies in the north-western quadrant of Iberia (in both Spain and Portugal) including the western Basque country. Not in the Pyrenees, but south as far as Ávila. . The wolves south of Duero river in Portugal are a distinct segment (about 30 individuals) and there is no evidence of connection with wolves north of the river.. | The Iberian wolf (*Canis lupus signatus*) may be a distinct subspecies. After the population reduction up to the 60s', it is currently increasing in numbers and expanding its range across central Spain. The northwestern population is expanding,. There are 2 distinct population segments within this population. The largest is that north of the river Duero in both countries. South of the Duero in Portugal there is a small population segment of about 30 wolves which seems to be currently isolated from the main continuous NW population as suggested by field and genetic results and its conservation is dependent on re-establishing connectivity with the main population, namely with Spanish portion south of the Duero. | The nearest wolf population is in the Western Alps and connections between the two are non existent. In Cataluña 6 individual wolves were recoded from 2000 to 2007. In the French Pyrenees, in the last 10 years, 3 wolves different from those of Cataluña have been detected. So, 9 different wolves have been detected in the French and Spanish Pyrenees in the last decade. | Wolves are fully protected in the whole of Portugal, and in Spain only south of the river Duero (although now subject to some control in response to depredation) (Habitats Directive Annex IV in both situations). North of the Duero in Spain, wolves are game species (Habitats Directive Annex V) under various management regimes depending on legislation of 8 autonomous regional governments. Asturias and Castilla y León have a Wolf management Plan and Galicia is about to approve its plan. In Portugal compensation paid for wolf damages is among the highest in Europe. | Illegal killing is still common and poison baits are used. The autonomous regions are gradually approving their action plans. However, management coordination among the regional governments and between Spain and Portugal is very limited. In some areas the persistence of the species seems to be highly dependent on human-related food sources, causing conflicts that are difficult to mitigate. | Main population is "Near Threatened". The Iberian population is large (about 2,500 wolves , although may not be much larger than 1000 mature animals) and expanding toward south and east. Therefore, it does not qualify for the category "Vulnerable". It is maintained in category "Near Threatened" because is close to the category Vulnerable due to the fragmentation in management regimes, the lack of a population level management plan, the occurrence of largely unpredictable events of human reaction against wolves (poison, shooting, etc.) that may threaten the population at local level. |
| Sierra Morena population (50 wolves) | A very small population of wolves is isolated in Southern Spain since the last 40-50 years on the Sierra Morena mountains of Andalucìa and Castilla-La Mancha. | The isolated population in the Sierra Morena appears to be stable. | The population is isolated from the North-western one by 270 kilometers. | Fully protected. | These wolves are illegally persecuted because of the perceived damages they cause to the game species (mainly, red deer) which are the main income in the large, private, estates of Sierra Morena where they live. In addition, their isolation might being constraining the viability of this population. | The small population of Sierra Morena is far from the main population in the North and should be classified as Critically Endangered. |
| Western-Central Alps | The population occupies an area that includes most of the Western | This population is of Italian origin and all wolves share the same Italian genetic | The genetic continuity with the Apennine population has been | The population is fully protected under French, | Several cases of illegal killings have been | "Endangered". The Alpine population is the recent |

| Name | Geographical description | Genetic and demographic structure | Relations with other populations | Current management | Pressures and Responses | IUCN red listing |
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| population (100-120 wolves) | Alps in France and Italy, many wolf territories being transboundary along the French-Italian border south of Valle d'Aosta. Individuals disperse regularly into Switzerland as far as Grisons but have failed, until now, to establish a permanent group. | haplotype. Individual wolves dispersing from the Apennines first colonized the Alps in 1992 and succeeded in establishing a permanent and expanding population which shows a highly dynamic spatial pattern spreading towards the west and north. The total number is estimated to be 100-120 wolves, increasing on average by 10% per year. | recently assessed at 2.5 individuals per generation, all of them moving from the Apennines to the Alpine population. In 2005, a young radio-marked wolf dispersed more than 1,000 km from Parma to Nice, providing evidence of the natural dispersal along the northern Apennines range. In spite of the continuity between the two populations, their ecological and socio-economic contexts are sufficiently different to justify a separation for management purposes. | Italian and Swiss law. In France and Switzerland the national Action Plans include provisions for legal take of a few wolves under strict conditions following depredation on livestock. The three countries have recently (2006) signed a formal agreement of cooperation for the management of the entire population, marking an innovative procedure based on the recognition that the biological population needs to be managed through a common and accepted approach. | reported in France and Italy, and the wolf presence is still far from being accepted by local farmers and livestock breeders. Conflicts with hunters are increasingly reported and remain unresolved. Both France and the Regional Gov. of Piemonte in Italy have carried out extensive and continuous research and monitoring of the population and the damages to livestock and excellent data are available for management purposes. | outgrowth of the Italian wolf population and it is still numerically small. Though it is increasing fast, it is currently estimated to be 120-150 animals, and it has limited genetic and demographic contacts with the adjacent population of the Apennines. Its small size justifies the assessment in category "Endangered". |
| Italian peninsula population (500 – 800 wolves) | This population occupies the whole Apennines range from Liguria to Calabria (Aspromonte) and extending into northern Lazio and central western Tuscany (provinces of Siena, Grosseto and Pisa). | The population has been described in 1921 (Altobello 1921) and confirmed in 1999 (Nowak 1999) as a distinct subspecies (*Canis lupus italicus*). Genetically recognized by the presence of a unique mtDNA haplotype. After the population bottleneck of the 1960s', when total numbers were estimated to be about 100 animals, the population has steadily recovered and expanded into the western Alps. In 2006, the population was estimated to be 500-800 wolves. | The nearest population (apart that in the Western Alps, see above) is in Slovenia (Dinaric-Balkan population). However, a large portion of the central Alps and the agricultural Po river valley effectively separate the Italian and the Dinaric populations | The population is fully protected by national law, while different levels of damage compensation are provided by 14 different regional laws. Compensation paid per wolf has been estimated to be the highest among EU countries, but the effectiveness of compensation programs has never been assessed and it is increasingly questioned. Apart from formal protection the population is not actively managed. The species occurs in several protected areas throughout its range but the size of these areas is far too small to protect a viable population. In spite of formal protection, illegal | The population is protected on paper but the law is poorly enforced and illegal killing is very common throughout the range. Poison baits are increasingly used against dogs, foxes and wolves. Hybridization with dogs has been found and it appears to account for at least 5% of the total wolf population. A national Action Plan sets the broad strategic ground for management but is not being implemented by the national and regional governments. | "Vulnerable". The Italian wolf population is estimated to be 500-800 individuals distributed along the Apennines. The shape of the range is narrow and elongated, restricted to the Apennines. The population has limited exchanges with the population of the Western Alps and recent genetic evidence indicates a flow of genes only in the direction toward the Alps. In spite of the recent increase in numbers and range, the Italian wolf population is still highly vulnerable to local extermination from human pressures (poison, shooting, car accidents) and the stochastic nature of these events suggest to maintain a cautionary assessment. The population does not qualify for the category "Endangered", but |

| Name | Geographical description | Genetic and demographic structure | Relations with other populations | Current management | Pressures and Responses | IUCN red listing |
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| | | | | killing is estimated to take a substantial portion of the population every year (up to 15-20%). | | it may easily reverse its current favourable status. |
| Dinaric-Balkan population (5,000 wolves) | This population covers a vast area from Slovenia to north-central Greece and includes the whole Dinaric mountain range through Croatia, Bosnia-Herzegovina, western Serbia (and Kosovo province), Montenegro, FYR Macedonia, Albania, western and southern Bulgaria. | The population appears to be more less continuous throughout this region, although for some countries data are poor. The population is roughly estimated to exceed 5,000 individuals, though locally the densities may vary greatly and its overall demographic trend is largely unknown. In Croatia and Slovenia, the population has recovered significantly following active management started in the 1990s'.<br><br>At present our knowledge of much of this massive population is too poor to divide it into segments or even accurately assess the whole distribution. It is possible that more fine-grained surveys will allow a finer scale classification. | To the north, the population has no contact with the nearest population in Italy, although dispersing animals are reported in Austria and eastern Italy. To the east, the population may exchange individuals with the large wolf population of the Carpathians which extends into northern Bulgaria. | Management is fragmented by several different national laws. It is a game species in almost all countries, except for Slovenia, Croatia and Greece south of 39° latitude where wolves are fully protected. In Croatia, an effective Action Plan is in place and implemented (revised in 2007), and this allows for some limited harvest. In most of the countries, law enforcement is weak or totally absent even in protected populations. | Legal hunting and illegal killing are taking an unknown number of wolves throughout most of the range. Other pressures are commonly reported: habitat fragmentation due to construction of fenced highways, shortage of wild preys, widespread use of poison and conflicts with human interests. | "Least Concern". This large wolf population (more than 5,000 animals) appears to be in favourable conservation status mainly due to the limited management caused by the recent political instability of large areas of the region. However, the more marginal parts of the range may be subject to excessive pressure from human disturbance (Slovenia, central Greece) and ad-hoc management actions should be implemented. |
| Carpathian population 3-4,000 wolves) | The central Carpathian mountains are home to one of the largest wolf population in Europe. This population extends across several countries, from northern Bulgaria to eastern Serbia, Romania, south-western Ukraine, Slovakia and southern Poland. A few wolves are occasionally reported in the east of the Czech Republic. | This population is estimated to exceed 5,000 animals, the majority of them living in Romania and Ukraine. Slovakia hosts about 4-500 wolves and southern Poland contributes with good wolf habitat in the areas along the south-eastern borders | It is likely that some level of genetic exchange occurs with the Dinaric-Balkan population in western Bulgaria, and with the Baltic population through eastern Poland, although this connection is fragmented. | Wolves are fully protected in the Czech Republic, and Poland. They are managed as *de facto* game species Romania and Slovakia despite Annex IV status on the Habitats Directive. Wolves in Ukraine are game species and a bounty has been operational in recent years. Wolves are a game species in Serbia. | In spite of its large size, fragmentation of the management regime is a potential threat in the marginal parts of the range and it should be addressed. The use of poison baits and illegal killing is widespread throughout the range. | "Least Concern". This large wolf population (more than 5,000 animals) appears to be viable mainly due to the conservation implemented in Romania. However, some of the marginal areas of the range may be subject to excessive pressure (southern Poland, Slovakia) and may require *ad-hoc* conservation measures. |
| Northeastern European populations (4,350 wolves)<br><br>Karelian population | The North-eastern European populations constitute a part of the largest continuous wolf population in the world. In its full extent it joins with other wolf populations to form a more or less continuous population stretching from the Baltic Sea to | Karelian population: Following widespread control of the population in the first part of 20th century, the population recovered after the 80s' and 90s'. The current estimates are based on counts of family groups in Finland (about 200 wolves in Finland) and the population has been expanding. In Karelia wolf numbers | The Karelian population is a portion of the large Russian population and it connects with Baltic population in the south. Some occasional exchange with the Scandinavian population occurs.<br><br>Baltic population: This population is | Karelian population: In Finland, wolves occurring in the reindeer herding area fall under Annex V of the Habitats Directive; those outside the reindeer herding area fall under Annex IV. Because of | Karelian population: In Finland, wolves cause very limited damage to livestock; predation on domestic dogs is the most frequent damage that causes strong resentment from the | Karelian population: "Near Threatened". The number of wolves in Russian Karelia is poorly known but assumed to be high. In view of this uncertainty and the management in Finland where the species is kept at low |

| Name | Geographical description | Genetic and demographic structure | Relations with other populations | Current management | Pressures and Responses | IUCN red listing |
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| (750 wolves) & Baltic population (3,600 wolves) | the Pacific Ocean. However, we have limited this evaluation to the area west of 35°E. For the purposes of management we propose splitting this large population into two administrational populations.<br><br>The Karelian population occurs in Finland and the Russian oblasts of Karelia and Murmansk. Wolves are widespread in Russian Karelia, but scattered in Murmansk. In Finland wolves occur at highest densities in the southeast, but breeding packs have appeared in recent years in the centre and west.<br><br>The Baltic population covers eastern Poland, Lithuania, Latvia, Estonia, Belarus, northern Ukraine and the Russian oblasts of Kaliningrad, Lenningrad, Novgorod, Pskov, Tver, Smolensk, Bryansk, Moscow, Kursk, Belgorod and Orel. | appear to be stable.<br><br>Baltic population: The trend throughout the region appears to have been very consistent. At the start of the 20th century populations were reduced, but still widely present, these increased during and after World War I. In the period between the wars, populations were greatly reduced again, but recovered to peak levels during and after Word War II, only to be heavily persecuted in the 1950's such that they again reached very low levels in the 1960's and early 1970's. The populations appear to have then increased, peaking in the early 1990's – before being shot down again in the late 1990's. Trends appear to have stabilized now in the EU countries, but are still declining in western Russia. There are about 1,000 wolves in Poland and the Baltic States, about 1,000 in Belarus, and 1,600 in the neighboring Russian oblasts. | the westernmost portion of the large Russian population and it connects with the Karelian population. In Poland, although the distribution is not continuous, dispersal might be still possible between the Baltic and Carpathian populations.<br><br>The separation between the Karelian and Baltic populations is made here only as an administrative decision to produce units of practical size and with more homogenous internal conditions. | conflicts with reindeer herding the presence of wolves in northern Finland will not be tolerated. However, wolves are also killed outside the reindeer herding area in order to reduce conflicts. Finland has recently approved a National Management Plan that includes removal of some wolves under controlled circumstances. In Russian Karelia, wolves are killed throughout the range and anytime.<br><br>Baltic population: The standard management practice for most of the 20th century was open harvest, often with bounty incentives, all with the view of exterminating wolves, or at least seriously reducing their numbers. This situation persisted until the 1990's, when restrictions on their harvest gradually came into place in all countries. They are currently protected in Poland, but harvested in the 3 Baltic States (Habitats Directive Appendix V) and in Belarus and Ukraine. | public opinion. Finland has approved a plan to maintain the population at its current size. Continuous flow of dispersing wolves from Russia allows a reasonable positive forecast on the conservation of this population.<br><br>Baltic population: Latvian wolves appear to be on the way to being divided into two – with the area south of Riga starting to appear as a carnivore free area. This development will greatly increase the vulnerability of carnivore populations in western Latvia. Wolves in Lithuania and northeastern Poland also occupy a highly fragmented landscape. | numbers, it appears justified to assess the population in this category. Assuming that management will be implemented at population level, the category could be downgraded; however, in the event of no collaboration between Finland and Russia on the joint management of this population, the Finnish side of the population should be upgraded to "Vulnerable".<br><br>Baltic population: "Least Concern". The number of wolves and the continuity of the range into Russia support its assessment in the category of "no concern". However, the small portions of the population in Poland and some of the Baltic States may require conservation measures to ensure their long term persistence. |
| Germany / Western Poland (<50 wolves) | This population consists of scattered packs living in eastern Germany (Saxony) and western Poland. | Wolves were exterminated in Germany during the 19th century, but individuals that were dispersing from Poland were shot occasionally throughout the 20th century. In the mid 1990's a pack began breeding in Saxony, and there are currently (2008) four packs breeding. Wolves in western Poland have had a dynamic history, but presently there are only a few widely | This population is extremely fragmented internally. Potential connections exist to both the Baltic and Carpathian populations, but the distances are in the order of several hundred kilometers. | Wolves are protected in both countries, but the extent to which protection is enforced in western Poland is questionable. | The main risk for this population is its very small size, highly fragmented internal structure, and long distance from any other source. Coordination between Germany and western Poland is | "Critically Endangered". The population is very small, fragmented and isolated. |

| Name | Geographical description | Genetic and demographic structure | Relations with other populations | Current management | Pressures and Responses | IUCN red listing |
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| | | scattered packs throughout the region. | | | crucial. A single litter of wolf-dog hybrid pups was born in 2003. | |
| Scandinavian (130-150 wolves) | The distribution range of the population is in central Sweden and south-eastern Norway. | The population derives from a pair that immigrated from Finland and first reproduced in Sweden in 1983. A third immigrant in 1991 boosted the reproduction and the population is now estimated to be about 130-150 wolves (about 15% in Norway), with as much as 15 litters produced in 2006. The population has been steadily increasing from 1983-2001, then slightly decreased in 2002-3, and is currently increasing again. | There is evidence of very limited genetic exchanges with the Karelian wolf population. Immigration from the Karelian population is the only possible mechanism to increase the genetic variability of the population. With the exception of an occasional route across the Baltic Ice, all immigrants must pass through the reindeer herding areas of northern Finland, Sweden and Norway where wolves are rarely tolerated. | Formally, wolves are fully protected in Sweden and Norway. However, Norway applies a strict zoning system that includes culling of wolf numbers in the areas outside this zone where damages are considered unacceptable. Sweden has been more restrictive in issuing permits to kill wolves. | The inbreeding coefficient is very high, in some cases higher than for full sibling mating. Depredation on domestic dogs, sheep in Norway and reindeer in Sweden are the most frequent damages that cause continuing debate on wolf conservation. Both Norway and Sweden provide full compensation of damages to livestock. Sweden applies a preventive compensation system to reindeer breeders that operate in areas where wolves live. | “Endangered”. The number of mature individuals is estimated to be less than 250. The population has low genetic variability and its genetic exchanges with the Finnish population are estimated to be very limited. |

## WOLVERINE (*Gulo gulo*)

| Name | Geographical description | Genetic and demographic structure | Relations with other populations | Current management | Pressures and Responses | IUCN red listing |
|---|---|---|---|---|---|---|
| Scandinavian (750 wolverines) | This population is distributed mainly along the border of Norway and Sweden, with extensions into the southern Norwegian mountains, and the northern Norwegian county of Finnmark and adjacent areas of northwest Finland (the region of Lappland). Within this range we recognise 4 population segments, the south Norwegian, the central Scandes population segment along the Norwegian / Swedish border, the northern Fennoscandian segement in the Norwegian counties of Troms and Finnmark, and Finnish Lappland, and few animals breeding in the boreal forest areas of eastern Sweden. | Genetic surveys for the Scandinavian sub-population has shown a low genetic variability and subdivision among sub-populations indicating that the wolverine in Scandinavia has potentially lost variation due to a previous bottleneck event and that the current populations are the result of a recent common genetic background. The southern part of the population seems to form a sink with a few individuals emigrating from the northern continuous population. The southern Norwegian population segment was naturally re-established during the late 1970-ties and was a result of protective legalisation. This population segment has recently increased in numbers and distribution, but seems to have stabilized at around 100 individuals. Genetic surveys have shown that the southern Norwegian population segment is genetically distinct from the northern population segments (about 220 individuals in Norway), but the geographic gap between the southern and the main population to the north and east has decreased from 100 -200 km by the early 1990s to virtually connectivity by 2006. There are an estimated 380 individuals 1 year and older in the Swedish portion of the central population segment. Recently, during the 1990s a small and distinct reproducing population became established in the southern boreal region of the country. Population data for the past 9 years (1996-2004) suggest a fairly stable over all population trend, with a slight increase during the past 5 years. The demographic consequence of these spatial and genetic discontinuities needs to be assessed. | There is probably a connection to the Karelian population to the east, although better mapping is needed in northwestern Russia. | Wolverines are subject to both *de facto* hunting and the Government Authorities organised lethal control activities in Norway. The Norwegian national goal is to control the total population within the limits of 39 yearly active natal dens. Control measurements, killing of family groups in early spring and licensed harvest are used as management tools to restrict wolverine predation on unattended sheep during summer and domestic reindeer all year round.<br><br>The national goal in Sweden is to reach a minimum of 90 annual reproductions which equals approximately 550 individuals. Wolverines in Sweden are protected, although there is some limited use of lethal control following acute depredation events.<br><br>The Norwegian and Swedish population is monitored through annual den inventories and there is cooperation and data exchange between the two national programmes. In Finland the species is monitored through a national fauna monitoring programme based on tracks crossing fixed 4x4x4 km triangles. During the last decades, there has been an increase in population numbers and distribution of wolverines in the Fennoscandian countries, but decreasing trends in Russia. | High levels of depredation on domestic sheep in Norway, and on semi-domestic reindeer in Norway, Sweden and Finland, generate large conflicts. These lead to pressure for population reduction through both legal and illegal killing. Finding ways to reduce depredation on sheep are crucial. It is unclear whether the existing levels of harvest, especially in Norway, are sustainable. With respect to depredation on semi-domestic reindeer, solutions are harder to find as wolverines depend heavily on semi-domestic reindeer for food. | "Vulnerable". |
| Karelian population | This population extends across southern and central Finland (all | The western Finnish segment is the result of translocations of individuals from the northern | There is potential connectivity with both the Scandinavian | Wolverines are protected in Finland and Russian Karelia. | The Russian economic depression during the | "Endangered". |

| Name | Geographical description | Genetic and demographic structure | Relations with other populations | Current management | Pressures and Responses | IUCN red listing |
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| (450 individuals) | Finland excluding Lappland) and the Russian oblasts of Murmansk and Karelia. The main distribution appears to be continuous, but there is a relatively isolated population segment in western Finland. | reindeer husbandry area. The trend in the Finnish portion of this segment appears to be slowly increasing (60 individuals in 2004). The trend in Russia is poorly known (390 individuals in 1999), but is regarded as being in decline. | population, and the continuous northern Russian population of wolverines that extends eastwards, although better mapping is needed in northwestern Russia. | | 1990s is believed to have led to wide spread poaching of ungulate game species. Furthermore, there has been a reduction of the semi-domestic reindeer herding industry due to large calf/breeding losses. This is believed to have indirectly negatively affected wolverine populations western Russia. The wolverines main prey base (wild and domestic reindeer) became less abundant and the population has faced a decrease in numbers and distribution during the last decades. | |

# Appendix 2. Policy Support Statements of the Large Carnivore Initiative for Europe (LCIE)

These are policy guidelines prepared by the LCIE to help guide managers and decision makers when managing large carnivores. They are based on a combination of the latest research (both ecological and social sciences) and on the combined experience of researchers, conservationists and wildlife managers from across Europe. As such they constitute recommendations for "best practices" rather than any attempt at suggesting regulations.

1. Lethal control and hunting of large carnivores;
2. Forestry;
3. Translocation;
4. Wolf – dog hybridisation;
5. The release of captive-bred large carnivores
6. Compensation systems
7. Monitoring of large carnivore populations

# LCIE Policy Support Statement

## Lethal control and hunting of large carnivores

While large areas of Europe presently offer potentially suitable habitats for one or more of the large carnivore species beyond their present reduced distributions, there are no large wilderness areas left in Europe. Therefore, large carnivore conservation must often occur in multi-use landscapes. Within such landscapes a variety of real or perceived conflicts with humans can occur, including:

(1) Depredation on livestock and other productive units,
(2) Competition with hunters for wild ungulates,
(3) Fear for personal safety (especially from bears and wolves) and other psycho-social conflicts.

A pragmatic consequence of this is that in some situations coexistence may be more readily achieved if large carnivore populations were maintained at a lower density than that which an area could potentially support. There are a variety of non-lethal methods that can be used to remove individual large carnivores or limit their population growth rate (e.g. translocation). However, these are often impractical and too costly for large-scale application. In most situations lethal methods remain the most practical and effective in many parts of Europe.

Hunting of large carnivores has long been, and still remains, a tradition in many parts of Europe. The motivations vary from limiting damage and other conflicts, through recreation, to the desire for a trophy. In addition, lethal control of individuals to limit damages is currently practised in many areas where recreational hunting is prohibited. Although we are aware that hunting / lethal control of large carnivores may be controversial, the LCIE believes that it may be compatible with their conservation in many, but clearly not all, regions and situations. It is important to remember that carnivore conservation does not necessarily imply strict protection.

The potential benefits of large carnivore hunting / lethal control include:

(1) Allow the continuation of long-standing traditions in the rural areas where large carnivores occur.
(2) Increase the acceptance of large carnivore presence among hunters if they can regard them as rewarding game species or a source of income, rather than as competitors.
(3) Increase the sense of empowerment among local people that have to live in the same areas as large carnivores.
(4) Allow large carnivore populations to be maintained at densities where damage to livestock and predation on wild prey are kept at levels that can be tolerated. In addition, hunters may be able to assist in the lethal control of specific animals, for example those that become habitual livestock killers.
(5) Help maintain shyness among large carnivore populations thus reducing potential conflicts.
(6) Potentially provide an opportunity to sell trophy hunts, and thereby generate revenue in rural areas (thus giving an incentive to maintain healthy large carnivore populations).
(7) In areas where large carnivore populations are recovering, it may increase long term acceptance if the rate of recovery is slowed down.
(8) The LCIE strongly opposes poaching under any circumstances and realises it is a major threat to large carnivore population survival in many areas. However, the LCIE believes that allowing legal hunting of viable populations will help reduce poaching if the local people feel that they are involved in the management process.

(9) Reaching a population level that allows initiating hunting may provide a benchmark for the success of a conservation / restoration plan – this should also demonstrate the flexibility of a conservation plan to the various interest groups.

However, there are also a number of potential costs to allowing harvesting and lethal control, including;

(1) Some populations may not be able to tolerate additional human-caused mortality.
(2) In some species the perturbation of social structure may be unforeseen consequences, such as increased infanticide.
(3) Allowing the killing of carnivores may be very controversial with the wider public.
(4) It may be harder to separate between legal and illegal killing.

Therefore, there are a number of conditions that must be fulfilled to ensure that hunting / lethal control is compatible with large carnivore conservation. The LCIE accepts the hunting / lethal control of large carnivore populations <u>only</u> when the following circumstances are met:

(1) Hunting and lethal control are part of a comprehensive conservation management plan for the whole population and its habitat. This plan should be written by the appropriate management agency in appropriate consultation with the local human population and acknowledged wildlife interest groups (both governmental and non-governmental). The plan should be acceptable to a majority of the affected groups and a majority of the local population. These management plans should be fully compatible with national and international laws and agreements.

(2) In the conservation management plan, the large carnivore population must have been documented to be demographically viable and / or able to sustain the proposed level of hunting / lethal control without jeopardising its conservation status.

(3) The social organisation of the species, and how removing individuals will affect it, must be taken into account.

(4) Goals for the minimum size of carnivore populations must be stated in the plan. An adequate monitoring system must be implemented to ensure that the population is kept above the minimum level. In cases where population size cannot be estimated directly, monitoring could focus on indices that reflect distribution and population trend.

(5) Important biological data (sex, age, condition, body mass, reproductive organs, genetic samples, etc.) should be collected from all harvested individuals for monitoring and management purposes. The results of the hunting and monitoring must be reported annually and compared with the goals of the conservation management plan.

(6) The methods used must not contravene international, national or regional laws and killing should be carried out respecting the animal welfare principles. All those involved in the killing of large carnivores should be specifically trained unless highly experienced.

(7) Sufficient limitations must be imposed on hunting to ensure its sustainability. In effect this will require some form of closed seasons, and in most cases some form of quotas. The use of a female sub-quota is also strongly recommended to prevent over-harvest.

(8) All human-caused mortalities (including carnivores killed through hunting, depredation-control or poaching, in self-defence, or in traffic collisions) should be taken into account when setting quotas. In addition, animals wounded, but not recovered, should be assumed to have been killed.

(9) Mitigation measures should have been evaluated and implemented where possible before lethal control or hunting is initiated mainly to limit damage to livestock.

The LCIE also recognises that the acceptability of using state-employed personnel to lethally remove large carnivores as opposed to recreational hunters will vary from region to region. Therefore, the costs and coexistence benefits of this need to be carefully evaluated on a case by case basis.

This position statement is only intended to provide a general framework, to what the LCIE feels are acceptable management instruments, while explicitly stating that local societal and ecological factors will need to be discussed in order to find which approach works best locally. This position statement is not intended to state that large carnivores should be hunted, or that they should be prevented from becoming too dense, or that lethal methods are the only appropriate way to control their numbers should this be required. However, the LCIE does believe that hunting large carnivores is acceptable under some circumstances, and that there may be some advantages to this, and that in some situations it will benefit (and be compatible with) their conservation. Likewise, the LCIE strongly recommends the use of non-lethal mitigation measures to reduce conflicts, but accepts that lethal control may be required in some situations. Given the complex social issues surrounding large carnivore conservation the LCIE strongly recommends that appropriate attention be paid to studies of both the human dimension and ecology when making management decisions.

# LCIE Policy Support Statement

## Large carnivore conservation and forestry

European large carnivores are strongly associated with forested habitats. Therefore, there is a great potential for commercial forestry to influence their populations. Fortunately for large carnivores, none of the species is a habitat specialist and they are generally far more tolerant of forestry practices than many other species that depend heavily on a single tree species or specific forest structure. The LCIE believes that carefully planned commercial forestry and other non-timber related activities are generally compatible with large carnivore conservation. However, there are a number of considerations that need to be taken into account.

### Large carnivore prey

Large herbivores (primarily red deer, roe deer, moose, wild boar) are vital prey for wolves and Eurasian lynx (and wolverines through scavenging), and under some circumstances for bears. It is therefore vital that a commercially operated forest maintains a sufficient prey base for large carnivores. Most forms of sustainable forestry have a potentially positive effect on large herbivores by maintaining early successional habitats. However, the damage caused by herbivores browsing on regenerating trees often prompts foresters to control the numbers of large herbivores. While large carnivores are able to persist over a wide range of prey densities, there are lower limits. It is vital that forest-damage motivated control of large herbivore numbers does not reduce their population below a density which is sufficient to support the local large carnivore population. It is also important to bear in mind that the relative impact of large carnivores on large herbivore populations will increase with lower herbivore densities. If a forest's wild herbivore population is being managed for hunter harvest this implies that competition between hunters and carnivores will increase at lower herbivore densities. Furthermore, greatly reduced wild herbivore densities may also lead to an increase in other conflicts such as livestock depredation. It is therefore desirable that other non-lethal forest-damage reduction measures be employed where possible.

Bears feed extensively on a range of mast (e.g. acorns), berries and plants. In areas where these foods are important it is vital that forestry considers bear requirements when planning the species composition and cutting cycles of their forests.

Iberian lynx depend heavily on rabbits for their food. Rabbits occur over a wide range of habitats but do not thrive in plantations of exotic species, such as eucalyptus. Given the critically endangered status of this felid, it is imperative that forestry in the region of southern Iberia adopts practices that are compatible with maintaining healthy rabbit populations. This requires that the area of Mediterranean forest be maintained or restored rather than being converted to farmland or eucalyptus plantations. In addition, Iberian lynx frequently use hollow trees with large dimensions as den sites.

### Livestock grazing

Forests are used for grazing livestock in many countries. The important issues here relative for large carnivores are that grazing densities do not outcompete wild herbivores that are potential prey for large carnivores (rabbits for Iberian lynx), and that husbandry methods are adequate to protect livestock from depredation. A situation with low prey density and high livestock densities will automatically lead to high conflict levels.

**Disturbance**

Forestry activities may be a source of disturbance for large carnivores. However, large carnivores are highly mobile and under most circumstances it is of little consequence for them to move away from a localised disturbance such as cutting or planting. The exception is during certain periods when they have limited mobility, such as when raising young at a den, or when bears are in winter hibernation. During these periods any disturbance within a kilometre of a den may have greater consequences. Although we realise the difficulties associated with avoiding disturbance we recommend that wherever possible forestry activities should try to avoid any activity within close proximity of known den sites during critical periods of the year.

**Access**

The most serious impact of forestry for large carnivores lies with the roads that are often constructed to facilitate access for forestry-related activities. Once constructed, roads also allow access for a wide range of other users, allowing people to reach parts of the forest that would normally have been too distant or inaccessible. This leads to an increase in disturbance, from both pedestrian and mechanised sources, an increase in mortality risk through vehicle collisions, and an increase in poaching by providing better access. The LCIE recommends forestry practices that do not lead to increased road construction and regards it as being desirable that forest roads be closed to other vehicle traffic whenever possible.

# LCIE Policy Support Statement

## Translocation as a tool in large carnivore conservation.

Translocation is defined as the "deliberate and mediated movement of wild individuals or populations from one part of their range to another". There are many circumstances where translocation is a potentially important tool in the conservation and management of large carnivores. However, there are also many circumstances where translocation is not applicable.

The circumstances where the LCIE regards translocation as an appropriate conservation tool include:

- When assisting critically small populations by augmenting their genetic variation and / or numbers.
- As part of a well planned reintroduction.
- As a non-lethal way to locally and temporarily reduce high population density in occasional cases where popular opinion does not permit other methods.

The LCIE regards it as being unacceptable to translocate large carnivores as:

- A way to routinely deal with individuals involved in undesirable behaviour (such as livestock depredation by bears, wolverines, wolves or Eurasian lynx or with bears who become habituated to human foods).

Exceptions to the above may exist if at least one of the following criteria is met:

- A very large destination area is available where no similar sources of potential conflict exist (unlikely in most parts of Europe).
- The individual is a member of a critically endangered species (eg, Iberian lynx) or a very small population where all individuals are important.
- The individual is only moved within what can be regarded as its normal home range as a part of a structured aversive conditioning program.

Whenever a translocation is attempted it is imperative that the guidelines from the IUCN Reintroduction Specialist Group are followed, especially with respect to the following issues:

- The welfare of the animal and logistics involved with live capture and transportation of the animal.
- The fact that many translocated individuals attempt to return to their point of capture. These movements can extend over several hundred kilometres. Restraining the individual in a holding facility for a period of several weeks at the release site will partially reduce this homing behaviour but in turn involves a range of other logistical and welfare aspects.
- Careful evaluation of ecological suitability of the release site and consultation with the local population.

# LCIE Policy Support Statement

## Response to hybridisation between wild wolves and domestic dogs

Dogs were originally domesticated from wolves. Today the relationship between wolves and dogs is highly complex with at least five areas of interaction that are relevant for wolf conservation. Dogs are used to defend livestock from wolf depredation, wolves may kill dogs, dogs may transfer diseases to wolves, and feral dogs may compete with wolves for food. In addition, wild wolves and dogs (both domestic and feral) can interbreed and produce fertile offspring.

Hybridisation has been well documented from many parts of Europe – from Spain to Russia, with recent cases in Germany, Norway, Finland, Italy and Latvia. The available data indicate that hybridisation is most likely to occur in (1) areas with very low wolf density where the availability of potential mates is low such as in areas where wolves are colonising, or (2) in areas where the wolf population is subject to heavy perturbation, for example from intensive hunting. These are also the circumstances where hybridisation can have the greatest negative effects as the hybrids will constitute a relatively large portion of the population.

The potential negative effects of hybridisation are twofold:

*Genetics.* During the millennia since dogs were domesticated from wolves they have been selectively bred for a wide range of traits that humans consider desirable. These include early sexual maturation, two breeding cycles per year (in most breeds), delayed behavioural maturation, a wide range of physical traits involving size, coat, and skeletal modifications, and tameness. All of these traits will reduce the fitness of an individual in the wild.

*Behaviour.* We lack hard data on the behaviour of free-ranging wolf-dog hybrids, but there is reason to believe that they will show more undesirable behaviours than pure wolves because of their inferior adaptation. These behaviours could potentially include an even greater tendency than pure wolves to attack livestock and demonstrate bold behaviour.

**Response**

The LCIE acknowledges that it will probably be impossible to ensure that wolf populations are 100% free from domestic dog genes. In addition, it is likely that selection will remove these genes from the population. However, because of the high degree of public concern, the potential for even a few hybrid litters to swamp small recovering populations, and the general goals of conserving wild gene pools, the LCIE, supported by the IUCN Wolf Specialist Group's "Wolf Manifesto", recommend that:

- Everything possible should be done to minimise the risk of hybridisation between wolves and dogs. This requires that the keeping of wolves and wolf-dog hybrids as pets be prohibited, discouraged, or at least carefully regulated, and that strong actions be taken to minimise the numbers of feral and stray dogs.

- Everything practically possible should be done to remove obvious hybrids from the wild should such an event occur and be detected. In reality this will be most effectively achieved through lethal control, as the chances of selectively live capturing all the specific members of a hybrid pack are minimal. Furthermore, the welfare issues associated with keeping wild-born hybrids in captivity must be considered - as it is almost inevitable that they will be captured after the period when they can potentially be socialised towards humans.

- It is important that management authorities clarify their legislation concerning the legal status of wild-born wolf-dog hybrids. Their management status should be such that they receive the same legal status as wolves from hunters and the public in order to close a potential loophole for the irregular killing of wolves – but such that they can be effectively removed under special license by carefully trained government appointed wardens when necessary. From the point of view of EU regulations there should be an automatic derogation from Habitats Directive protection, and that all effective methods, even those banned for normal hunting, should be allowed provided that they are selective and respectful of animal welfare principles.

- When removing potential hybrids from the wild it is crucial that all staff are familiar with the physical characteristics of wolves and hybrids, and that great care be taken to not kill pure wolves by mistake. A clear set of criteria should be decided in advance. From experience F1 hybrids can generally be recognised based on morphological criteria – but later generations may be difficult to detect – even with genetic methods. In cases where identity is unclear, it is possible to collect scats and have them DNA tested before making a management decision.

# LCIE Policy Support Statement

## The release of captive-bred individuals as a tool in large carnivore conservation

The reintroduction and population augmentation of threatened carnivores are potentially powerful tools in the conservation toolkit. These methods have been widely applied to a wide range of taxa on all continents. There are two potential sources of individuals – from larger wild populations and from captive breeding. Both sources have been used for carnivore conservation projects and there are successful and unsuccessful examples of both. Reintroduction and population augmentation projects should never be undertaken without careful consideration because they are very expensive, highly technical, very controversial with the public, and while there are many successful examples - overall there is a relatively low rate of success. As a result the LCIE cannot support any reintroduction or population augmentation projects that do not carefully follow the recommendations of the IUCN's Captive Breeding Specialist Group. Any such activity should only be conducted after exhaustive research into the cause of population extinction or decline, careful analysis to determine that adding new animals to an area / population will significantly assist conservation, and detailed evaluation of both the release site and methodology. Furthermore, any such release should be carefully monitored.

Additional concerns exist when the animals to be released are of captive origins.

- **Concern over genetics**. Animals in captivity are often of uncertain origins as stud books have not always been kept. Where it is possible maintaining local genetic characteristics is regarded as being important in conservation, and should only be deliberately interfered with if there is evidence for inbreeding depression or virtually no chance of natural dispersal.

- **Welfare.** Experience indicates that translocated wild born individuals have a higher survival than released captive born individuals. This implies that there may be some welfare concerns for captive born individuals if they are not able to adapt to the wild, and if there is no follow-up or support for released animals.

- **Public safety**. Some large carnivores, such as wolves and bears, are potentially dangerous to humans. There is reason to believe that individuals that become habituated to, or loose their fear of, humans because of their experiences in captivity, may be more dangerous or may be more likely to develop problem behaviour if released. It is also possible that a lack of shyness could bring them into close contact with people and into more conflict situations that could negatively affect public opinion.

Therefore, the LCIE does not ever recommend the release of captive-bred wolves or bears under any circumstances in the human-dominated environments that characterise Europe. For other large carnivore species living in Europe we advise against the use of captive-bred individuals in any situation where wild living individuals from a population that can support their removal and with a similar genetic background to the animals living in the release area are available. The release of captive bred individuals should only be contemplated in situations where (1) there exists a clear need for reintroduction or population augmentation in a context that can make a substantial contribution to their conservation , and (2) no other alternative sources of animals exists. It is difficult to imagine any such situations for Eurasian lynx or wolverine. However, one potential example that fulfils these criteria is the Iberian lynx for which there are no source populations and where their survival depends on the re-establishment and augmentation of populations in the wild.

# LCIE Policy Support Statement

## The use of compensation and economic incentive systems to alleviate economic losses caused by large carnivores

Large carnivores often cause a range of conflicts with human interests. These conflicts include depredation on livestock, killing of domestic dogs, destruction of beehives, damage to crops and fruit trees, and in exceptional cases the risk of injury to humans. These conflicts are mainly economic (although there may be a range of non-material social conflicts too) and usually fall disproportionably on the rural communities within large carnivore range. In contrast, the benefits associated with large carnivores are often more aesthetic or ethical than material, and are experienced at national or international levels.

There are several potential mechanisms for redistributing economic inequalities. The most commonly used is *ex post* compensation – where a cash payment is made to cover (in part or in total) the losses caused by large carnivores after the damage has occurred. Insurance systems also exist where farmers, for example, take out a policy to cover the eventual loss of animals. A few economic incentives (paying for risk) exist where funds are distributed to people potentially affected by large carnivores that the recipient can either use for mitigation or to cover losses. Finally, there are a number of assistance schemes where funds are provided to help mitigate damage by subsidising the introduction of effective damage prevention measures.

Although large carnivores must be recognised as natural parts of the landscape and therefore as natural risk factors, the LCIE recognises that in some situations the conflicts caused by large carnivores can be severe and that the costs and benefits are not equally distributed. Furthermore, large carnivore conservation in Europe occurs within a human dominated environment where their acceptance by local people is crucial. Therefore, the LCIE feels, from both pragmatic and ethical standpoints, that it is important to consider issues of social justice along with conservation goals. This implies that it may often be desirable to more equably distribute both the costs and benefits associated with large carnivores.

In principle the LCIE believes that a successful scheme should confer a sense of responsibility to the recipients and that conflict prevention is better than reaction. The LCIE also believes that economic schemes should primarily be considered for damage to private property (eg, livestock, dogs, beehives, crops and orchards) rather than for any economic loss felt by hunters who have reduced hunting bags of wild game due to competition with carnivores. Any financial incentive should be carefully monitored to guard against fraud.

Of the potential mechanisms available the LCIE strongly supports the use of assistance schemes. The provision of grants or subsidised loans for technical support and materials (eg, electric fencing, livestock guarding dogs, secure pens for dogs, better night-time enclosures, and temporary accommodation for shepherds on pastures) can help cover most of the initial costs associated with adapting to carnivore-compatible husbandry systems. We do however recommend that recipients be required to make a significant own contribution in terms of labour or funds in order to provide a sense of ownership and increase the sense of responsibility towards maintenance.

Financial incentives for the risks associated with large carnivore presence are a little explored option that the LCIE believe deserves further testing. The principle is that it is up to the recipient to determine how the funds should be used. There should be clear conditions attached to this form of scheme regarding the development of the large carnivore population, such that it is understood that if, for example, poaching continues at unacceptable levels then the scheme will be stopped. It must also be understood that *ex post* compensation will not be paid for any damage that occurs. Financial incentives could potentially be in cash, or in kind – such as reducing any fees associated with grazing access on public land.

The use of insurance schemes is also recommended as it confers a sense of responsibility to the policy holder. It may be acceptable for the State to operate such a scheme, or partially subsidise the system if it is operated by private companies.

The LCIE believes that the payment of *ex post* compensation for damage should be considered the least desirable of all financial mechanisms. If *ex post* compensation is paid, then there should be clear requirements for a minimum level of effective mitigation measures within the husbandry system. The only situations where *ex post* compensation may be desirable are: (1) for rare and unpredictable events where mitigation is difficult or impossible (eg, loss of domestic dogs under hunting situations), (2) in situations where wild prey are scarce or absent such that large carnivore survival depends on their access to domestic animals, and (3) in areas where individual carnivores appear and cause damage far outside their normal range such that it was not realistic to expect effective mitigation measures to be in place.

A final point concerns who should pay. The LCIE believes that those feeling the benefit of large carnivores should help pay the costs. In most cases this will imply the national, or super-national, level. However, in cases where large carnivore hunting opportunities are sold for trophy hunters or where large carnivores are used to promote eco-tourism, it would be reasonable for these operators to also make contributions.

# LCIE Policy Support Statement

## Monitoring of large carnivores

Monitoring of large carnivore populations is a crucial activity. It is needed to guarantee their survival, to adapt management practices to changing situations, and for EU countries to fulfil obligations to the Habitats Directive. It is also a very demanding exercise because of the large scales over which it must be conducted, often stretching across international borders, and because of the low densities and elusive behaviour of large carnivores. These species occur under a diversity of situations across Europe and their monitoring hence represents a variety of challenges – this statement therefore only outlines some of the general principles, although it mentions some of the species specific methods that have proven successful under different circumstances.

**Parameters and basic principles**

It is very important to realise that many different aspects of a population's status can be monitored, and that different methods are needed for each. The most normal parameters are:

*Distribution*: The area occupied by the species – the distribution area – is the most common parameter that is monitored. The repeated detection of sites occupied by a species is relevant to aspects such as habitat requirements, inter-specific relationships, range and metapopulation dynamics. For large carnivores, it is crucial to separate between areas of constant and occasional presence, and within the permanently occupied range, between areas of reproduction and areas without. A variety of types of observations such as dead animals, camera trap pictures, tracks, excrements, prey animals killed, and sightings can be used to describe the distribution, but we recommend that all observations should be classified into (1) hard evidence (e.g. dead animals, pictures, genetic records), (2) confirmed observations of tracks and kills (approved by a trained person) and (3) unconfirmed records. To gain a more differentiated picture of distribution and habitat use, but still tolerating imperfect detection of these elusive species, we recommend using the recently developed occupancy analysis models. These methods allow fine-scale adjustment and can be used to estimate abundance, especially in combination with additional data sets.

*Population trend*: Indices reflecting increases or decreases in population size are important to show the trend of the population. They can base on a variety of parameters (e.g. dead animals, wild and domestic kills, direct sightings per year, track counts per kilometre, etc.) and need not directly measure or estimate population size. It is imperative that these parameters must be collected in a consistent manner (same method, same area, same effort) over multiple years. Because of random fluctuations of parameters or sampling, population development can generally be seen only over several years, and are more reliable if several independent parameters indicate the same trends.

*Population size*: To come up with a reliable measure of the number of individuals in a population is very demanding. Simple count methods provide some idea of a minimum number of individuals that are present without any statistical estimate of uncertainty. Trustworthy estimation methods calculate a mean and an error, giving some idea of the statistical precision in the measure. Such estimations are generally based on "capture-recapture" statistics and require a method allowing individuals to be distinguished. For large carnivores, these can be genetic identification of hairs or excrements, or camera trapping for species such as the Eurasian lynx with their individual pelt pattern.

*Health and population structure*: Monitoring the disease situation, genetic health and demographic structure is especially important for small populations and populations that have passed through a historic bottleneck. Pathological and clinical examination requires handling of a (narcotised) animal or a carcass; we strongly recommend the establishment of programmes for the collection and examination of all animals killed or found dead. Tissue samples should always be stored for future study. Dead animals should be sexed and aged as information on trends in age and sex structure can provide some indications of population development and status. For genetic analyses, samples from live or dead animals are good, but some examinations can also be done using material taken from hairs or excrements.

All parameters are important, and it is likely that a monitoring programme will include several different approaches and combinations of methods. It is very unlikely that many monitoring programmes will seek to repeatedly count or estimate the total number of animals in a population. Most programmes will involve some degree of extrapolation. This can be either from a more easily documented demographic segment of the population (such as reproductive units) to the whole population or from small representative sample areas to the wider area of distribution.

Monitoring methods should be coordinated and standardised across the entire area of a population, or preferably the meta-population, to allow holistic assessment of the conservation status of the unit. This often requires coordination of monitoring efforts across international borders. If several independent institutions are involved in a monitoring programme, it is important to agree not only on the methods used and the analyses of data, but also on interpretation and reporting. Data from large carnivore monitoring are often used to take controversial management decisions, and it is therefore important to produce consistent and incontestable results. This includes professional training of all staff involved, from the person collecting data in the field to the statistician responsible for the analyses.

The most important aspect of monitoring is that the activities are repeated over time in the same way. This implies that it is important to carefully plan the programme from the start, because making changes underway can make comparisons difficult.

**Data collection and storage**

It is crucial that field data is validated by trained and critical observers. This concerns all data whatever its nature. Raw observational data should also be stored in a manner such that irrespective of the manner in which it is analysed the underlying data can be easily accessed for reassessment. It is crucial to store raw, validated, data free from interpretation in addition to the processed results. It is a good idea to also record and store unvalidated data as it may help focus future sampling efforts. It is highly desirable that such databases should be as centralised as possible – at least on a national basis. Modern computer systems easily allow multiple users at dispersed locations to enter data into a central database. Regarding clinical and genetic research, it is not only important to store pathological or genetic information in databases, but to retain collections of original samples for future analyses.

**Examples of good practice**

The following list is not exhaustive, but refers to some monitoring programmes that may serve as good models. The increasing use of genetic methods should be noted. There are constant improvements in methods here, and they are increasingly being applied on very large spatial scales.

**Wolverines:**

- Annual monitoring of known natal denning localities (Norway and Sweden).
- Collection of faeces for DNA-based capture-mark-recapture (Norway).

**Bears:**
- Collection of faeces and hairs for DNA-based capture-mark-recapture (Sweden, Spain, Norway, Croatia, Slovenia).
- Observations of females with cubs of the year (Spain, Norway, Sweden, Estonia).

**Eurasian lynx:**
- Camera trapping for small (500-1000 $km^2$) reference areas (Switzerland).
- Collection of faeces and hairs for DNA-based capture-mark-recapture (Poland, France)
- Intensive snow-tracking (Norway, Sweden, Finland, Estonia, Latvia, Poland).

**Iberian lynx:**
- Camera trapping (Spain).

**Wolf:**
- Intensive snow-tracking (Norway, Sweden, Finland, Poland, Estonia, Latvia, Lithuania, Italian Alps, Croatia).
- Collection of faeces for DNA-based capture-mark-recapture (Italian Alps, France, Switzerland).
- Howling surveys to detect family groups (Spain, Italian Apennines)

**All species:**
- Collection of any validated observations of presence = photographs, tracks, dead animals, kills of wild and domestic prey (Scandinavia, the Alps).
- Intensive radio-tracking studies (Mainly useful as a research and calibration method rather than a monitoring method).
- Collection of all animals shot or found dead for age determination, sexing, monitoring of reproductive status and tissue storage (Norway, Sweden, Latvia, Estonia, Switzerland, Italy etc.)