STUDY
for the PETI committee

European Parliament

Large Carnivore Management Plans of Protection : Best Practices in EU Member States

Committee on Petitions

Policy Department for Citizens' Rights and Constitutional Affairs
Directorate General for Internal Policies of the Union
PE 596.844 February 2018

EN

DIRECTORATE GENERAL FOR INTERNAL POLICIES

POLICY DEPARTMENT FOR CITIZENS' RIGHTS AND CONSTITUTIONAL AFFAIRS

PETITIONS

Large Carnivore Management Plans of Protection: Best Practices in EU Member States

STUDY

Abstract

This study was commissioned by the European Parliament's Policy Department for Citizens' Rights and Constitutional Affairs at the request of the PETI Committee. This paper analyses the legal framework on large carnivores – brown bear *(Ursus arctos*), Eurasian lynx (*Lynx lynx*), wolf (*Canis lupus*), wolverine (*Gulo gulo)* - and their current management within the EU are presented. Additionally, the best coexistence methods obtained from research and EU-funded projects are compiled. A thorough analysis of the conditions for derogations under the Habitats Directive is followed by the implications of the current management. A general review and recommendations are made.

PE 596.844 EN

ABOUT THE PUBLICATION

This research paper was requested by the European Parliament's Committee on Petitions and commissioned, overseen and published by the Policy Department for Citizen's Rights and Constitutional Affairs.

Policy Departments provide independent expertise, both in-house and externally, to support European Parliament committees and other parliamentary bodies in shaping legislation and exercising democratic scrutiny over EU external and internal policies.

To contact the Policy Department for Citizens' Rights and Constitutional Affairs or to subscribe to its newsletter please write to: poldep-citizens@europarl.europa.eu

RESPONSIBLE RESEARCH ADMINISTRATOR

Giorgio MUSSA
Policy Department for Citizens' Rights and Constitutional Affairs
European Parliament
B-1047 Brussels
E-mail: poldep-citizens@europarl.europa.eu

AUTHORS

Alberto FERNÁNDEZ-GIL - senior researcher, EBD-CSIC (Doñana Biological Station)
Duarte CADETE DA ROCHA PEREIRA - researcher, Zoo Logical
Sara Maria DIAS FERREIRA PINTO - researcher, Zoo Logical
Ilaria DI SILVESTRE - study supervisor, Eurogroup for Animals

LANGUAGE VERSION

Original: EN

Manuscript completed in February 2018

This document is available on the internet at:
http://www.europarl.europa.eu/supporting-analyses

DISCLAIMER

CONTENTS

LIST OF ABBREVIATIONS

AT Austria

BA Bosnia and Herzegovina

BG Bulgaria

CH Switzerland

CZ Czech Republic

DE Germany

EC European Commission

EE Estonia

EL Greece

ES Spain

EU European Union

FCS Favourable Conservation Status

FR France

HR Croatia

IT Italy

LV Latvia

LT Lithuania

HU Hungary

ME Montenegro

MK The former Yogoslav Republic of Macedonia

NO Norway

PL Poland

PT	Portugal
RO	Romania
RS	Serbia
SL	Slovenia
SK	Slovakia
FI	Finland
SE	Sweden
XK	Kosovo

LIST OF TABLES

LIST OF MAPS

LIST OF FIGUES

EXECUTIVE SUMMARY

Background

Unlike the USA, Canada or Russia, EU Member States are highly populated and lack large areas that facilitate the conservation of large carnivores, such as the brown bear (*Ursus arctos*), the lynx (*Lynx lynx*), the wolf (*Canis lupus*) and the wolverine (*Gulo gulo*). These species, due to their specific ecological and behavioural traits, require large territories to fulfil their needs and quite often their range overlaps with some kind of human activity. For example, species of large carnivores are found in the mountains where Mediterranean sheep graze and in the Nordic tundra, where reindeer are herded.

It comes as no surprise that the main source of conflict between human activities and large carnivore conservation are livestock depredations. Traditionally Europeans coexisted with large predators and applied effective measures to protect their domestic animals. More recently, during the last century, fundamental changes took place. These included the spread of the use of firearms and poison leading to the extirpation of large carnivore populations in several European countries while in others they were decimated to historical minimums.

In 1979 a pioneer legal instrument was enacted - the Council of Europe's Convention on the Conservation of European Wildlife and Natural Habitats (also known as The Berne Convention) – in an attempt to revert this situation from a biological and ethical perspective. Other initiatives followed at national level, and in 1992 an important EU legal framework on nature conservation was established, the Habitats Directive (Council Directive 92/43/EEC). Under the scope of this instrument and The Berne Convention, large carnivores are currently protected or strictly protected, meaning that justification is needed to harvest these species and for derogations to be allowed under specific circumstances. This has allowed for a slow recovery of the populations of large carnivores in several Member States.

However, in the last century traditional coexistence methods have been forgotten and a fundamental change in farming and husbandry systems has been observed. These changes have influenced people's perception of the threat posed by the presence of large carnivores. Even though the range of large carnivores is still much smaller than it was historically (thus disabling the functionality of the ecosystem), affected stakeholders often request culling or hunting quotas for protected or strictly protected species, despite scientific recommendations for the use of preventive methods as better alternatives. The efficiency of these preventive methods has been proven by various EU-funded projects in different Member States.

Aim

- To present the EU legal framework for the management of large carnivore populations in the EU;
- To fulfil the request of several petitions to the European Parliament, expressing concern about the management methods for conflicts between people and large carnivores;
- To discuss technical considerations, implications and recommendations on the interpretation of the conditions for derogations for strictly protected species under the Habitats Directive and European Conventions;
- To identify and discuss best practices for the management of conflicts between people and large carnivores in the EU, drawing particular attention to the outcomes of recent

research from pilot projects - developed, inter alia, under the EU LIFE funding programme - and to provide practical examples;

- To present suggestions for stakeholder engagement activities to prevent and reduce conflicts with large carnivores;
- To present conclusions and recommendations for policy makers and stakeholders to prevent and reduce conflicts with large carnivores as well as recommendations for future research.

1. STUDY'S RATIONALE AND METHODS

KEY FINDINGS

- This study aims to compile information on the status, distribution, legal framework and conflict mitigation of the four species of large carnivores in Europe.
- The study also aims to provide a response to the many petitions received by the European Parliament Committee on Petitions expressing concern over the management methods for conflicts between people and large carnivores.
- Finally, the study aims to analyze the best coexistence practices with large carnivores in the light of science, ethics and European Union core values regarding animals and nature conservation.
- The methodology used was based on standard literature research.

A considerable amount of scientific research on large carnivores has been developed in the EU, including by numerous EU-funded conservation projects (e.g. under the LIFE programme), all of which should provide a knowledge base to allow the harmonious coexistence between human communities and large carnivore populations.

Nonetheless, species management quite often does not take advantage of the knowledge provided by science. In many cases, lethal actions are chosen instead of more efficient coexistence tools. This is often in breach of national and international legal frameworks and jeopardizes the medium/long-term conservation of large carnivores. This study, therefore, firstly aims to compile information on the status, distribution, legal framework, coexistence issues, conflict mitigation and management actions of the four species of large carnivores – brown bear (*Ursus arctos),* Eurasian lynx (*Lynx lynx*), wolf (*Canis lupus*) and wolverine (*Gulo gulo*) - within the EU. Secondly, and most importantly, this study aims to discuss which are the best practices for humans to coexist with large carnivores, in the light of science and European Union core values and legislation regarding wildlife and nature conservation.

In order to compile, identify and analyze pertinent information that could suit the study's aims for the aforementioned four large carnivore species, standard literature research has been deployed, using:

- EU official sources, websites and publications;
- Peer-reviewed journals and books;
- EU-funded projects' technical reports.

In addition, this study aims to fulfil the request of several petitions to the European Parliament, expressing concern over management methods for conflicts between people and large carnivores. Particularly, during the preparation of the present study, the following petitions[1] were considered (see the Annex for more details):

[1] The petitions' full text is available in the report's Annex and here: https://petiport.secure.europarl.europa.eu/petitions/en/show-petitions

1771-13 (ES)

560/2016 (ES)

984/2016 (ES)

152/2017 (IT)

0057/2017 (FI)

2348/2014 (DE)

459/2015 (RO).

Some of these petitions were looking for the European Parliament's support to ensure the strict protection of large carnivores, as requested by the Council Directive 92/43/EEC. On the contrary, others were asking the European Parliament to revise the status of some large carnivore species and to legalize their hunting. By indicating the best coexistence practices with large carnivores, the present study intends to provide an answer to the concerns expressed in the above-mentioned petitions.

2. BROWN BEAR (URSUS ARCTUS)

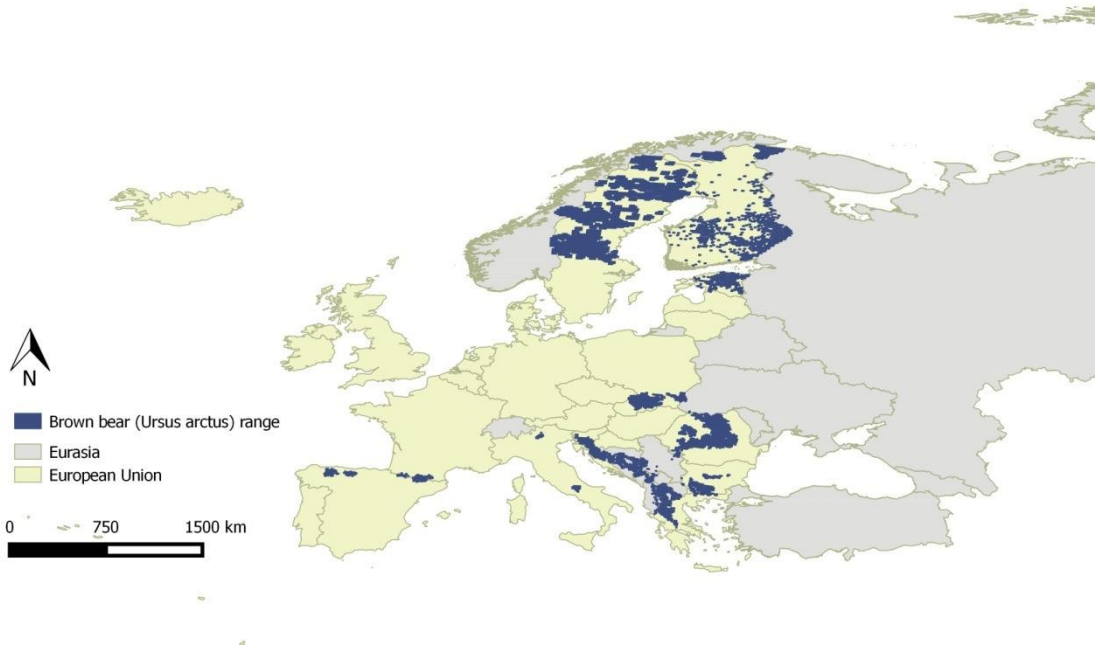
KEY FINDINGS

- For the majority of EU countries, the brown bear's Conservation Status is considered bad or inadequate, meaning that the species did not reach a Favourable Conservation Status as mandated by the Habitats Directive.
- The brown bear is a strictly protected species under the Habitats Directive.
- Human-bear conflicts are very diverse and are mainly connected with the bear's opportunistic foraging and consumption of food.
- Lethal management has no effect, little effect and even counter-expected effects in minimizing the livestock of brown bears or the depredation of beehives.
- Managing livestock and beehives is the best method to reduce conflict between human activities and bears.

2.1. Status and Distribution within the EU

After a period of intensive persecution, great habitat loss and fragmentation, the brown bear became locally extinct in many European areas. Its range is currently very restricted (Map 1).

Map 1 Brown bear range in Europe



Source: Data from Chapron et al. 2014.

Today the brown bear is present in 22 European countries - out of which 15[2] are EU Member States - distributed in 10 populations: Alpine, Baltic, Carpathians, Cantabrian, Central Apennine, Dinaric-Pindos, Eastern Balkans, Karelian, Pyrenean and Scandinavian (Table 1). Some of these populations (n=4) are very small and isolated, which grants them the "Critically Endangered" status. For these reasons, and also due to the species' dispersal patterns, it is not likely that these populations will be connected in the medium-term.

Only 6 Member States have achieved the brown bear's Favourable Conservation Status (FCS, as defined by the Directive 92/43 EEC), while for the majority of the countries (n=9) the conservation status is bad or inadequate. For the remaining countries, this information is not available. According to the Habitats Directive, the 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.

[2] Austria, Bulgaria, Croatia, Estonia, Finland, France, Greece, Italy, Latvia, Poland, Romenia, Slovakia, Slovenia, Spain, Sweden.

Table 1 Brown bear populations across Europe, Red List Assessment and Favourable Conservation Status Assessment for individual country/area.

Population	Red List assessment[3]	Non-EU countries	EU Countries	Conservation Status[4]
Alpine	CR	CH	AT	U2
			IT	U2+
			SL	FV
Baltic	LC	-	EE	FV
			LV	U2+
Carpathians	VU	SR	RO	N/A
			SK	FV
			PL	U1
Cantabrian	CR		ES	U1
Central Apennine	CR	-	IT	U2+
Dinaric-Pindos	VU	AL, BA, MK, ME, RS	HR	N/A
			SL	FV
			EL	U1+
Eastern Balkans	VU	RS	BG	N/A
			EL	U1+
Karelian	LC	NO	FI	FV
Pyrenean	CR	-	FR	U1
			ES	FV
Scandinavian	LC	NO	SE	N/A

[3] CR: Critically Endangered; EN: Endangered; VU: Vulnerable; NT: Near Threatened; LC: Least Concern

[4] FV: Favorable; N/A: Non-available; U1: Inadequate; U1+: Inadequate but improving; U2: Bad; U2+: Bad but improving

Source: Kaczensky et al., 2012; The IUCN Red List of Threatened Species; EIONET - European Topic Centre on Biological Diversity

2.2. Legal framework within the EU

Within the European Union, the brown bear's legal protection is granted through the following legal binding instruments:

- The Convention on the Conservation of European Wildlife and Natural Habitats 19.IX.1979, also known as The Bern Convention;
- Habitats Directive 92/43/EEC;
- National laws of EU Member States.

The Bern Convention includes the brown bear in Appendix II, which lists all strictly protected fauna species. According to the Convention Chapter III, Article 6, it is prohibited to deliberately capture, kill or disturb these species or their refuge areas/habitat. Nonetheless, some of the signatory countries (n=5) have made reservations and do not consider the brown bear as a strictly protected species under this convention (Table 2).

The EU Habitats Directive Annex II includes all the species which require the designation of special areas for their conservation. All the Member States include the brown bear in this Annex, except Estonia (for which the species is included only in Annex IV), Finland (Annex IV) and Sweden (Annex IV).

According to the Habitats Directive Article 12, which regulates fauna protection, it is prohibited to deliberately capture, kill or disturb species listed in Annex IV, as well as their refuge areas/habitat. The brown bear is included in the aforementioned Annex, with no exceptions.

Table 2 Brown bear legal framework within Europe and European Union

Population	Non-EU countries	Brown bear strict protection Bern Convention	EU Countries	Habitats Directive	Brown bear strict Protection Bern Convention
Alpine	CH	YES	AT	II, IV	YES
			IT	II, IV	YES
			SL	II, IV	NO
Baltic	-	-	EE	IV	YES
			LV	II, IV	YES
Carpathians	RS	YES	RO	II, IV	YES
			SK	II, IV	NO

			PL	II, IV	YES
Cantabrian	-	-	ES	II, IV	YES
Central Apennine	-	-	IT	II, IV	YES
Dinaric-Pindos	AL	YES	HR	II, IV	NO
	BA	YES			
	ME	YES			
	MK	YES	SL	II, IV	YES
	RS	YES	EL	II, IV	YES
Eastern Balkans	RS	YES	BG	II, IV	NO
		YES	EL	II, IV	YES
Karelian	NO	YES	FI	IV	NO
Pyrenean	-	-	FR	II, IV	YES
			ES	II, IV	YES
Scandinavian	NO	YES	SE	IV	YES

Source: Habitats Directive and Bern Convention.

2. 3. Analysis of Brown Bear's Management within the EU

2.3.1. Conflicts related to human activities

Throughout history, people have regularly come into conflict with bears, and most often the first choice to resolve them was to remove the bears (Schwartz et al. 2005; Treves et al. 2006). A good understanding of the causes of human-bear conflicts is the first step for their effective resolution. Human-bear conflicts are very diverse and are mainly connected with the bear's opportunistic foraging. Several factors affect the risk of human-bear conflict and probably the most important one is the access to anthropogenic food (garbage, slaughter remains etc; Skrbinsek & Krofel, 2015).

Conflicts with people are widespread and often severe, and a feature of most European populations of brown bears and wolves (Kaczenzensky, 1999, Montag 2003), which can hinder the functional recovery of their populations (Linnel et al. 2005 *in* Fernández-Gil 2013). Several factors have been reported to affect the probability of conflicts between humans and bears: the season, natural food availability, cover for bears, bears' age, sex and reproductive status, familiarity with human presence, availability of anthropogenic food sources, livestock husbandry and hunting. In addition, several factors affect the probability of an attack on humans (wounded bear, presence of cubs, presence of carcass used by a bear, proximity to

a den and the presence of dogs). Data suggests that a significant number of conflicts are caused by a relatively small number of bears. A common characteristic of these "problem" bears is that during their lives they have changed their behaviour because of, for example, an increased awareness of the presence of humans and anthropogenic food (Herrero 2002; Smith et al. 2005).

Nevertheless, direct physical human injuries are not the most common cause of human-bear conflict across Europe (Penteriani et al. 2016). Bears are large, opportunistic carnivores with a wide range of biological needs during their life cycle, which may bring them into conflict with humans. Some of these needs are in direct conflict with human interests (e.g. property loss due to livestock depredation or attacks on humans), some others threaten bears (e.g. habitat fragmentation and den disturbance), and some are mutually problematic (e.g. traffic accidents).

Most countries pay damage compensation to affected individuals, either from the state budget or from funds contributed by interest groups, mostly by hunters. The rough economic cost in Europe per year (based on reported compensation only and excluding mitigation measures) is in the magnitude of €2.5 M to €3.0 M (Kaczensky et al. 2013).

Livestock losses are the most important damage type, but the variety of damage is much wider than for wolves, wolverines and lynx, and includes damages to beehives, orchards, crops, trees and even vehicles and buildings. More than half of the amount paid for compensation in Europe occurs in Norway (€1.5 M), followed by €321,000 in the Cantabrian Mountains, and €252,000 in Slovenia (Kaczensky et al. 2013). As the Dinalp Bear Action Project results show, bear-caused damages are recorded mainly in agriculture, livestock and beehives activities. The frequency of such damage is different in each European country and highly depends on the current ecological conditions and human presence.

The different categories of human-bear conflicts have been identified as follow:

Human-Bear Conflicts
(Adapted from the Dinalp BearAction LIFE Project, Action A.1: Analysis of damages and interventions by bears, preparation of guidelines for intervention group protocols, 2015):

- Damage in hunting and forestry;
- Attacks on humans;
- Damage to silage, grass;
- Traffic collisions on roads and highways;
- Calls to intervention groups as a result of damage by bears and other types of behaviour that can in some people trigger fear or other negative feelings;
- Occurrence of bears in the proximity of people; occurrence of bears near settlements and human infrastructure (roads, fences for livestock farming facilities, and garbage dumps);
- Damage to beehives;
- Damage to orchards, vineyards, fruit shrubs, fruit trees and fruit in orchards, grapevine and grapes in vineyards, plantations of blackberries and blueberries;
- Damage to corn crops, vegetables, grain, rapeseed oil, garden plants, field crops, harvested crops, including processed and stored crops;

- Attacks on large domestic animals such as horses, cattle, domestic pigs, donkeys, dogs (hunting, guard and other dogs), game animals kept and bred in captivity (e.g. captive fallow deer and red deer);
- Attacks on small domestic animals such as sheep, goats, rabbits, chickens, common quails, turkeys, ostriches and fish;
- Damage to buildings and other human property such as barns, including doors, windows etc., storerooms, hen houses, rabbit houses, feeding boxes for fish, fishponds, house doors and windows, vehicles, dry meat in smokehouses, wooden, electric and other types of fences (e.g. for the protection of orchards, fields, livestock…), other buildings/objects/items.

2.3.2. Review on scientific research, management and conflict mitigation

Within the main types of conflicts related to the conservation and/or management of wildlife in general, and of large carnivores in particular, damage to human property (i.e. livestock, beehives), and the risks perceived by humans because of the presence of bears have received a lot of attention in scientific literature.

A revision by Can et al. (2014) presents a general framework on the topic. The authors make suggestions for solving conflicts with bears, but also recognize that there is little evidence of evaluation and adaptation in plans for human-bear conflict management.

Livestock depredation by brown bears is by far (likewise for other large carnivore species) the more frequent type of conflict scenario in Europe. It has received attention from a social and economic perspective (namely compensation for damages) in general analyses involving other large carnivore species (Fourli 1999, Kaczensky 1999, Swenson & Andren 2005, Kaczensky et al. 2013, Chapron et al. 2014) and in analyses looking specifically at brown bears in certain European countries (Karamanlidis et al. 2011, Bautista et al. 2015, Fernández-Gil et al. 2016).

The pattern and correlation of damage by brown bears with human factors (e.g. land use, social and/or economic factors) and natural variables (e.g. bear abundance, forest cover) have been investigated in Europe at a regional level (Fernández-Gil et al. 2016) and on a continental scale (Bautista et al. 2017), although different variables were used in these works. Most of the damage by bears claimed in Europe were on livestock (59%), apiaries (21%) and agriculture (17%), as shown in the results by Bautista et al. (2017). The relationship between stock farming and depredations has also received attention (Mabille et al. 2015). These studies found that bear density was strongly associated with claimed losses for sheep, but the dataset "was not well suited to evaluate the efficiency of mitigation strategies".

Supplementary feeding, either directed to bears or other wildlife, is another reason of concern (Krofel et al. 2017) because of the consequences on the bear's behaviour and ecology, and because it may condition bears to expect non-natural food sources, therefore potentially increasing the risk of human-bear encounters.

Some research has been developed on attempts to mitigate depredations. Findings showed that the most effective methods were the use of fences and dogs to guard livestock (Rigg et al. 2011, Kavcic et al. 2013, Eklund et al. 2017).

Another important reason for conflict between bears and humans in Europe is the risk perceived by humans of bear attacks. Indeed, brown bears are the only large carnivore species in Europe for which attacks on humans have been recorded, although this happens rarely (Penteriani et al. 2016).

Another controversial issue analyzed by the scientific literature is the recreational use of bears by humans, either consumptive (hunting) or not (tourism bear watching). This often generates discussions concerning the consequences of such actions on the conservation and/or management of bears, human behaviour and land use. In fact, such activities are increasing in natural areas, putting humans closer to bears, thereby bringing risks for both (Ordiz et al. 2011, Elfström et al. 2014, Penteriani et al. 2017) and causing bears to get used to the presence of humans (see above).

2.3.3. Recommendations

In summary, the findings of the scientific research regarding the conflict scenarios related to depredations of large carnivores, including bears, can be classified in three main groups: a) carnivore management, lethal or non-lethal (via translocation or keeping in captivity); b) livestock management, e.g. prevention measures; and c) measures related to the social dimensions of the problem, e.g. compensations, environmental education.

The scientific research implemented so far indicates that lethal management of the carnivores, including bears, has no effect or little effect, and even counter-expected effects to minimize depredations, and thus mitigate conflicts (see revision by Treves et al. 2016, and references therein).

Scientific literature has shown that managing livestock (including beehives in the specific case of bear depredations) is the most rationale, effective, and least controversial measure to decrease and prevent depredations, and thus mitigate conflicts (see revisions by Can et al. 2014, Eklund et al. 2017, and references therein).

Regarding damage compensation as a way to increase social acceptance and tolerance towards large carnivores (including bears) involved in conflict scenarios, a recent revision of the topic by Ravenelle & Nyhus (2017) has shown that compensation should be linked to a clear commitment by livestock herders (and beekeepers) to adequately manage their animals. Without this, the system becomes unfair, socially unsustainable and can lead to a perverse vortex of misleading management and conservation (e.g. Fernández-Gil et al. 2016).

On the other hand, ongoing rampant habitat encroachment in natural areas, mainly due to road construction and urbanization, is putting bears (and large carnivores in general) increasingly closer to humans and increasing the risk of encounter, attacks and conflicts (Nelleman et al. 2007, Ordiz et al. 2011, Elfström et al. 2014, Penteriani et al. 2016). In such scenarios, the full protection, conservation and promotion of natural areas (less humanized, less encroached) is urgently needed for conservation reasons (Gilroy et al. 2015) and to make them less prone to conflict scenarios (Milanesi et al. 2017).

The brown bear is the large carnivore species in Europe that causes the largest spectrum of conflicts with human activities, mostly related to its trophic behaviour. Bears can cause damage in different aspects of human-dominated landscapes. Hence, it is vital that conflict mitigation actions are species-specific and take into consideration landscape heterogeneity and particular ecological and anthropogenic conditions (population level approach). Therefore, it is recommended that future actions to mitigate human-bear conflict are based on research and innovative methods - including extensive communication with local stakeholders - while individual removal or translocation must be well justified and monitored.

2.4. Best Practices for Brown Bear Management and Coexistence

2.4.1. EU funded and pilot projects

In recent decades, due to the broad range of bear-human conflicts across Europe, several EU-funded and pilot projects have been deployed to assess the best management practices and improve coexistence. In such projects, efforts were made to apply innovative prevention methods in terms of conservation and research and to assess the efficiency of techniques already tested in other countries (e.g. USA). We highlight below some of the most relevant and recent EU-funded projects addressing this issue. The goal of the majority of these projects was to improve coexistence and provide conflict mitigation in areas with similar ecological and social features. Others focused specifically on bear attacks on humans:

- Life Dinalp Bear http://dinalpbear.eu/brown-bear/

  The main objective of this project, implemented in Croatia, Slovenia, Austria and Italy, is to overcome the current local-scale practices of brown bear management and to pave the way for the transition to population-level conservation, management and monitoring. Using a variety of actions the project explores the drivers of conflict "hot-spots" and uses non-lethal solutions to provide best practice examples. Solutions show how bears can be prevented from reaching anthropogenic food and explore how carrion from game road kills can be used as an alternative natural source of protein. In addition, bears are promoted as an eco-tourist attraction, as a way of exploring public attitudes towards bears and curating targeted educational and promotional activities to enhance understanding of this species and to promote co-existence.

- Life Amybear http://lifeamybear.eu/en

  The project deals with the recorded increase in the incidents of human and bear interaction in the areas of Amyntaio and Florina municipalities, Greece. It aims to improve the global conservation status of bears by achieving a sustainable way of managing human-bear co-existence by minimizing negative interference between bears and humans. The expected results include both the elimination or limitation to tolerable levels of negative interactions (through the installation and use of electric fences and livestock guard dogs) and the enhancement and diffusion of the socio-economic benefits and know-how associated with the presence and coexistence of bears with humans in the area.

- Life for Bear http://www.forbear.icaswildlife.ro/en/

  This project, implemented in Romania, aimed at enhancing knowledge of the brown bear population through research on different topics (e.g. a socio-economic analysis of stakeholders' attitudes towards the brown bear population in Romania; an analysis of human-bear conflicts at national level and in the Brasov-Prahova Valley; research on the quality of the brown bear habitat in Romania). In addition, a team of 'bear conflict' specialists has been established and problematic bears have been relocated in the project area. Finally, a set of forest management measures as well as sheepfold, field, bee and farm protection techniques that are favourable for brown bears have been established and measures to improve awareness among local stakeholders and the general public have been implemented.

- Life for Arctos/Kastoria http://www.callisto.gr/en

  The ARCTOS/KASTORIA project applied innovative conservation technologies to mitigate brown bear mortality in the Dinara-Pindos population in Greece. Monitoring

confirmed that the outcomes were in line with the project's expected results. The measures were implemented through successful collaborations with stakeholders and the outcomes were included in relevant national policies.

A publicity campaign communicated the project's goals and achievements to local communities and the national public, helping to change perceptions about bears and their interaction with human activities.

The project team established and operated a special Bear Emergency Team (BET) of four trained experts to intervene in road accidents, provide advice to local authorities (e.g. on the management of garbage dumps or small orchards close to villages), and to undertake recommended methods for aversive conditioning or bear relocation. The BET intervened in 89 cases during the project.

In addition, the project team radio-tagged 10 brown bears to identify 6 crossing areas where bears were most at risk from road accidents. It also erected bear-proof fencing around 35 km of roads, installed 22 warning signs to influence the behaviour of drivers and placed 5,400 reflectors as optical deterrents. These structures and mitigation measures decreased bear fatalities through traffic accidents by almost 100%.

By creating a registry of all livestock-raisers who owned guard dogs in the area, the project helped to share information and experience (including a list of 29 suitable livestock guard dog breeds).

The project's environmental education programme and awareness-raising campaign helped to mobilise volunteers and actively involve stakeholders. The project had a positive effect on the conservation status of the local brown bear population by implementing coordinated measures to mitigate the impact of conflict between bears and road-users, farmers and rural residents. By helping to implement a range of mitigation measures, such as bear-proof refuse containers and electric fencing around vulnerable areas (e.g. orchards), the project contributed to the preservation of rural activities and provided significant socio-economic benefits.

- Life Arctos http://www.life-arctos.it/english/home.html
  This project foresaw a series of coordinated actions that contributed to the protection of the two populations of brown bear (Ursus arctos) in Italy: in the Alps and the Apennines. The actions included the adoption of land management activities compatible with the bear presence, allowing the reduction of conflicts with human activities, together with information and awareness programmes.

3. EURASIAN LYNX (LYNX LYNX)

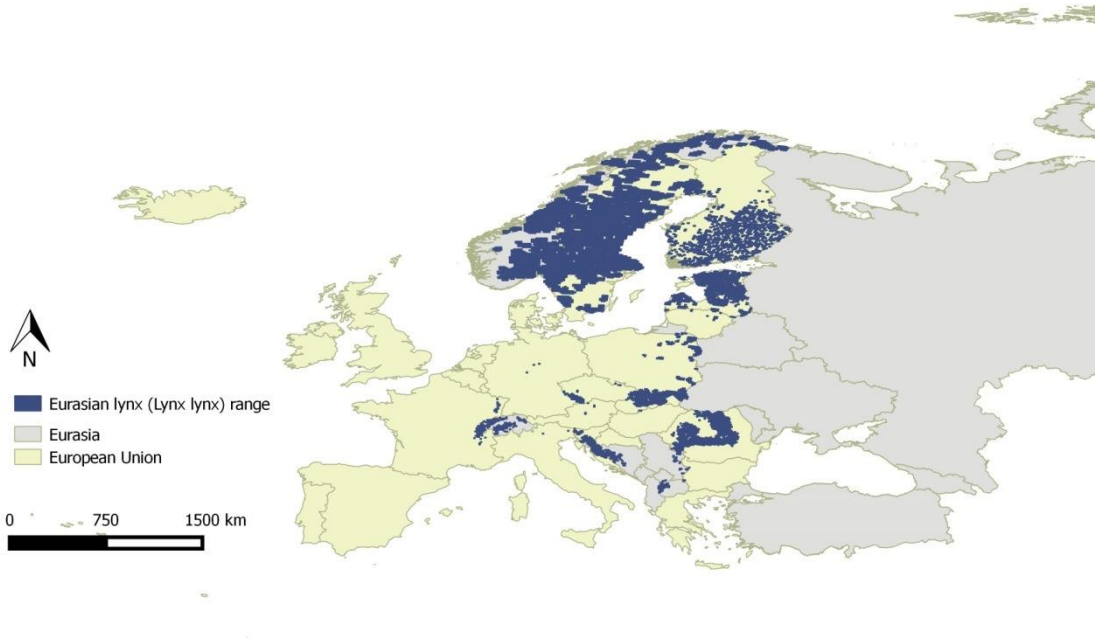
KEY FINDINGS

- For the majority of Member States the lynx Conservation Status is considered bad or inadequate.
- The lynx is a strictly protected species under the Habitats Directive except in Estonia (where it is included in Annex V), Latvia (Annex IV) and Finland (Annex IV).
- Human-lynx conflicts have small relevance compared to other large carnivore species and these are almost exclusively related to reindeer and sheep herding.
- Lethal management has no or little effect to prevent lynx depredation on sheep. Management strategies for the lynx should take into account its coexistence with other species such as the wolverine.
- The use of traditional husbandry methods is recommended to reduce conflict between human activities and the lynx.

3.1. Status and Distribution within the EU

Similar to the other large carnivore species, the Eurasian lynx has a very restricted range throughout Europe, being currently absent from large parts of the continent (Map 2).

Map 2 Eurasian lynx range in Europe



Source: Data from Chapron et al. 2014.

The range of the Eurasian lynx covers parts of 27 European countries (17 are EU Member States[5]) and occurs in 10 different populations: Alpine, Balkan, Baltic, Bohemian-Bavarian, Carpathian, Dinaric, Jura, Karelian, Scandinavian and Vosges-Palatinian (Table 3).

Six of these populations are small and fragmented and are currently Endangered or Critically Endangered, while the others (n=4) are of Least Concern (Kaczensky et al. 2012). Nonetheless, only 4-5 EU countries (including Slovenia, with two populations) have achieved a Favourable Conservation Status (FCS), although some of them share the population with other countries with Indeterminate or Unfavourable status (Table 3). For the remaining EU countries, the Conservation Status is considered bad or inadequate.

[5] Austria, Bulgaria, Czech Republic, Croatia, Estonia, Finland, France, Germany, Hungry, Italy, Latvia, Lithuania, Poland, Romenia, Slovakia, Slovenia, Sweden

Table 3 Eurasian lynx populations across Europe, Red List Assessment and individual country/area Favourable Conservation Status Assessment.

Population	Red List assessment[6]	Non-EU countries	EU Countries	Conservation Status[7]
Alpine	EN	CH	AT	U2
			FR	U1
			IT	U2
			SL	FV
Balkan	CR	AL, MK, ME, RS, XK	-	
Baltic	LC	UA	EE	FV
			LV	FV
			LT	U1+
			PL	U2
Bohemian-Bavarian	CR	-	DE	U2
			PL	U1
Carpathian	LC	ME, RS, UA	BG	N/A
			CZ	N/A
			HU	U2
			PL	U1
			RO	N/A
			SK	U1
Dinaric	EN	BA	HR	N/A
			SL	U2

[6] CR: Critically Endangered; EN: Endangered; VU: Vulnerable; NT: Near Threatened; LC: Least Concern

[7] FV: Favorable; N/A: Non-available; U1: Inadequate; U1+: Inadequate but improving; U2: Bad; U2+: Bad but improving

Jura	EN	CH	FR	U1
Karelian	LC	-	FI	FV
Scandinavian	LC	NO	SE	N/A
Vosges-Palatinian	CR	-	DE	U2
			FR	FV

Source: Kaczensky et al., 2012; The IUCN Red List of Threatened Species ; EIONET - European Topic Centre on Biological Diversity

3.2. Legal framework within the EU

Within the European Union, the Eurasian Lynx legal framework is granted through the following binding legal instruments:

- The Convention on the Conservation of European Wildlife and Natural Habitats 19.IX.1979, also known as The Bern Convention;
- Habitats Directive 92/43/EEC;
- National laws of EU Member States.

The Bern Convention includes the Eurasian Lynx in Appendix III, which grants protection to the listed species. According to the Convention Chapter III, Article 7, any form of exploitation shall be regulated in order to keep the populations out of danger, using measures such as closed hunting seasons and bans on local or temporary exploitation. As a result of the inclusion of this species in this Appendix, the Bern Convention does not grant strict protection to the species in any EU country (Table 4).

EU Habitats Directive Annex II includes all the species which require the designation of special areas for their conservation. All the Member States include the Eurasian Lynx in this Annex, except Estonia, Latvia and Finland.

According to the Habitats Directive Article 12, it is prohibited to deliberately capture, kill or disturb species listed in Annex IV or their refuge areas/habitat. Given the precarious situation of this species within the EU, the lynx is strictly protected in all Member States, except Estonia, Latvia and Finland. For these countries, the Eurasian Lynx is included in Annex V, which lists species whose taking in the wild and exploitation may be subject to management measures.

Table 4 Eurasian lynx legal framework within Europe and European Union.

Population	Non-EU countries	Lynx strict protection Bern Convention	EU Countries	Habitats Directive	Lynx strict protection Bern Convention
Alpine	CH	NO	AT	II, IV	NO
			FR	II, IV	NO

			IT	II, IV	NO
			SL	II, IV	NO
Balkan	AL	NO	-	-	-
	XK	NO			
	ME	NO			
	MK	NO			
	RS	NO			
Baltic	UA	NO	EE	V	NO
			LV	IV	NO
			LT	II, IV	NO
			PL	II, IV	
Bohemian-Bavarian	-	-	DE	II, IV	NO
			PL	II, IV	NO
Carpathian	ME, RS, UA	NO	BG	II, IV	NO
			CZ	II, IV	NO
			HU	II, IV	NO
			PL	II, IV	NO
			RO	II, IV	NO
			SK	II, IV	NO
Dinaric	BA	NO	HR	II, IV	NO
			SL	II, IV	NO
Jura	CH	NO	FR	II, IV	NO
Karelian	-	-	FI	IV	NO
Scandinavian	NO	NO	SE	II, IV	NO

Vosges-Palatinian	-	-	DE	II, IV	NO
			FR	II, IV	NO

Source: Habitats Directive and Bern Convention.

3.3 Analysis of Eurasian lynx management within the EU

3.3.1. Conflicts related with human activity

In most areas where several large carnivore species coexist with humans, the lynx is seen as a minor problem compared to other large carnivores. Negative human attitude towards the lynx are basically rooted in two types of conflicts: hunters claiming that the species reduces game abundance and availability, and livestock owners due to losses by depredations (Breitenmoser et al. 2000).

Livestock depredation is low for most of the Eurasian Lynx populations, usually below 0.5% of available stock (Kaczensky 1999). Other data on lynx depredations and costs in Europe are shown by "Key Actions For Large Carnivore Conservation in Europe" (Boitani et al. 2015): damage to about 7,000-10,000 sheep and 7,000-8,000 semi-domestic reindeer are attributed to lynx and compensated in Norway every year, totalling up to ~€5 M per year. In 2009 Sweden paid approximately €17,500 for depredation on sheep and an additional €3.5 M as an economic incentive to reindeer herders for accepting the presence of the lynx. In 2011 Finland paid €15,600 for 25 attacked domestic animals and approximately €827,000 for 554 reindeers (Boitani et al. 2015).

The main perceived conflict associated with the presence of the Eurasian lynx is related to the recreational hunting of ungulates, mainly roe deer (*Capreolus capreolus*) and chamois (*Rupicapra rupicapra*; Boitani et al. 2015). While a range of practical prevention measures exists to decrease livestock depredation, effective methods for the management of conflicts with hunters are still not available. Conflicts with hunters are more severe in areas where the lynx has been reintroduced (Breitenmoser et al. 2000). Hunters oppose lynx reintroduction programmes because they perceive the predator as a competitor and because reintroductions are usually promoted by nature conservation institutions, which frequently limit recreational hunting (Breitenmoser et al. 2000).

3.3.2. Review on scientific research, management and conflict mitigation

A study carried by Mattisson et al. (2011) unequivocally showed the need to adopt an adaptive management and a multi-species approach when addressing the management and conflict mitigation of large carnivores. Researchers studied the interactions between lynx and wolverine reindeer depredation in Sweden and extrapolated some results to improve management practices. The study indicated that a reduction of the lynx population (lethal control) would not necessarily affect the viability of the lynx population as the lynx is also abundant outside the reindeer husbandry area. However, lowering the lynx density in the reindeer husbandry area, or separating lynx and wolverine populations (i.e., by zoning), would likely have negative consequences for the wolverine population through a decreased number of available carrions.

Furthermore, as shown by Andrén et al. (2011), the total predation pressure on reindeer could be reduced in areas with both lynx and wolverines if enhanced scavenging opportunities led to a significant decrease in wolverine predation without increasing lynx predation. This study highlighted the importance of understanding coexistence dynamics to improve conservation and management in multi-predator systems.

Linnell et al. (2001) studied the behavioural ecology of lynx in Sweden and Norway and concluded that very few protected areas hosted sufficient forested areas to provide space for more than a few individuals. Consequently, the majority of the population needed to be conserved in the multi-use semi-natural forest habitats that cover large areas in Scandinavia. This leads to conflicts with some human land uses (mainly sheep and semi-domestic reindeer herding, and roe deer hunters), but not with all of them (forestry and moose harvest).

Liukkonen et al. (2009) analyzed public attitudes towards the presence of the species in Finland and concluded that hunters who harvest roe deer, white-tailed deer (*Odocoileus virginianus*) or hare (*Lepus* spp.) were especially negative. The researchers stressed that to solve the conflict between different stakeholders on lynx management, it was necessary to find a compromise and ensure cooperation between stakeholders holding conflicting views.
Research in countries where the species is subject to lethal control (hunting and/or culling) in order to reduce conflicts, has considered population and species recovery as ecological functionality goals, showing that there is no evidence to support the effectiveness of such actions. As an example, Herfindall et al. (2005) analyzed whether the recreational hunting of lynx reduced sheep losses by depredation in Norway. The results showed that the magnitude of the decrease in depredation rates from each lethal control action was so small that it was of little practical management benefit. Lynx hunting only reduces depredation when it significantly reduces the size of the lynx population. However, this is not acceptable from a conservation and legislative point of view (due to the requirements of the Habitats Directive).

Other research (Odden et al. 2013) focused on assessing the role of wild prey availability in reducing lynx depredation on free-ranging domestic sheep in Norway. The research showed a negative correlation between the depredation of sheep and wild prey availability. In addition, the authors highlighted the importance of using ecology tools models to predict where loss rates would be higher and to identify areas where mitigation measures were most likely to be required.

Comparative studies from France and Sweden have shown that confining sheep in fenced fields or on alpine pastures (out of the forest) dramatically reduces depredation losses by lynxes (Stahl et al. 2001, Stahl et al. 2002, Karlsson & Johansson, 2010).

Post *facto* compensation systems can lead to social tensions. In fact, livestock owners usually claim that only a small fraction of the compensated sheep losses are documented through a formal examination of the carcass (Mattisson et al. 2014). Combined with accurate lynx population monitoring, the findings by Odden et al. (2013) on how depredation rates vary with different factors can be used to evaluate current compensation levels based on empirical data, instead of an educated guess of estimated losses by regional managers, as is currently the case. The authors stressed how the findings could be useful to create a compensation system based on more objective and accurate data. This could also promote a transition to a risk-based incentive system that could encourage prevention measures against depredations rather than damage documentation and ex post payments (Ferraro & Kiss, 2002).

Mattisson et al. (2014) highlighted how access to semi-domestic reindeer modulates lynx depredation on domestic sheep. This study confirms the importance of different prey species in management and conflict mitigation strategies. In addition, the authors demonstrated how the lynx will inevitably kill sheep at some point, as long as unguarded sheep are found at

high densities throughout the predator's natural habitats. Data shows that husbandry changes to reduce lynx access to sheep had a very small impact on the predation of reindeer. The authors recommended the inclusion of a spatially explicit risk model of sheep depredation in order to get a more accurate estimate of loss rates. This is an approach that initially requires a large amount of ecological data, but can eventually open the way to an improved fairness coexistence model that tolerates the presence of predators.3.3.3 Recommendations The conflict between humans and the Eurasian Lynx is related not only to the natural recovery and local reintroduction of the species, but mainly to a lack of public awareness and the abandonment of traditional husbandry measures that can prevent or mitigate depredations. This is confirmed by the available scientific literature, the species' status and its recent history of distribution and abundance in EU countries.

Therefore, in terms of the current and potential future of the European lynx's distribution, suitable ecological conditions (e.g. adequate wild prey availability) and preventive measures (traditional and innovative) should be fully provided and implemented. Additionally, hunters are stakeholders who need to be specifically targeted by awareness raising activities focusing on their perceived competition with the lynx.

Finally, researchers suggest an alternative preventative measure model that incorporates *a priori* payments to livestock owners within a lynx's range. We consider that a pilot study should be implemented in order to evaluate the efficiency of such an innovative measure. We, like many of the cited authors, strongly recommend that ecological findings and scientific results should be extensively applied in species conservation and management. Lastly, due to the lack of proven efficiency of lethal management as a method to decrease lynx depredations, we do not recommend the use of this tool for the species' management.

3.4. Best Practices for Eurasian Lynx Management and Coexistence

3.4.1. EU funded and pilot projects

Several EU-funded and pilot projects have been implemented in recent decades to improve the conservation of the lynx, some only focusing on this species and others in combination with other species of large carnivores.

LIFE Projects:

- Piatra Craiului project (LIFE99 NAT/ RO/006435

  http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=398);

  Action plans for wolves, bears and lynxes were agreed by local stakeholders in Piatra Craiului National Park, Romania. Measures such as the use of electric fences and changes in grazing management (reducing grazing pressure) were used to prevent damage to grazing livestock and orchards. These measures were found to be effective. Although there was a steady decrease in the number of attacks on livestock (down from 40 animals lost in 2001 to 10 in 2003), this may not have just been a result of the project's activities (for example increased tourist activity may have pushed the carnivores to more remote areas). Shepherds were taught how to correctly use electric fences and move livestock to night resting places.

- Vrancea Project (LIFE02 NAT/RO/008576
  http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=1984);

The project's main objective aimed to conserve, manage and restore viable populations of bear, wolf and lynx in Vrancea County, Romania. The project was considered to have been successful in assisting the conservation of viable populations of large carnivores. The management plan was produced and this now provides an informed framework of actions that are required to sustain the target species. Demonstration areas highlighted methods to harmonise the habitat requirements of carnivores with the socio-economic needs of local land managers. These included building feeding points to steer carnivores away from livestock areas and electric fences were installed to further deter carnivores from preying on livestock. Awareness raising work with the local community proved useful for helping to achieve the project's main objectives.

Alpine Projects:

- LIFE97NAT/IT/004097 (http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=517)
- LIFE98NAT/IT/005112 (http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=290)
- LIFE04NAT/IT/000190 (http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=2637)

These projects were part of an international strategy for the conservation of large carnivores throughout Europe. As a general objective, they sought to encourage the spontaneous return of large carnivores to the Alps and to maintain populations in good shape. A significant part of LIFE97NAT/IT/004097 consisted of extensive awareness campaigns, mainly directed at the inhabitants of areas potentially suitable for carnivores. Prevention, compensation and awareness raising among stakeholders were the main actions of the project, which involved relevant local groups and obtained good results. One side result was that local authorities learnt how to better manage compensation measures. LIFE04NAT/IT/000190 was one of the biggest projects implemented in Italy: the work was carried out over 30 Natura 2000 sites distributed across 9 regions. The coordination aspects were particularly successful and almost all the expected results were achieved. Several aquatic habitats, terrestrial habitats and fauna species of EU importance for conservation – e.g. bears, lynx and the beetle, (*Rosalia alpina*) – were the targeted objectives of non-recurring and recurring management.

- Carnivores Vrancea II' (LIFE05 NAT/RO/000170

  http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=2956).);

The project put in place a visible team of experts to work with farmers on protecting crops and flocks from large carnivores, including the lynx, in Vrancea county, east-central Romania. This has radically reduced incidences of poaching and helped avoid conflicts between large carnivores and the local population. The project also led to initiatives that have developed the possibilities of ecotourism. For example, the beneficiary created nature trails in the park

and a bear observation hide. Around 80% of the land in the park is publicly owned and the creation of ecotourism opportunities was developed in exchange for restricting areas that are favourable for making dens, such as oak forests.

Large Carnivores project (LIFE00 NAT/H/007162

http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=1742).

One of the main project objectives, namely building a foundation for the long-term conservation of the wolf and lynx in Hungary was achieved. Together with the involvement and agreement of all relevant stakeholders, the project drew up a series of national species conservation action plans (SCAP) for the wolf and lynx that were subsequently approved by the Minister of the Environment. In addition, the legal protection status of the wolf has been updated to "strictly protected," with the penalties for killing a wolf or a lynx increasing considerably. Furthermore, the project developed a system for assessing and compensating damages caused by wolves and lynxes, which resulted in a government decree on compensation.

The LIFE projects conducted so far have not been able to improve the conservation status of the reproductive populations of the Eurasian lynx in Europe. However, they have made some important progress in improving the monitoring of the species, protecting important areas for the species and increasing public awareness about how easy successful coexistence can be (Silva et al. 2013).
Some relevant multi-species or lynx-only related platforms are not linked with EU programmes but develop important work on species monitoring and conservation, namely through volunteer programmes:

- KORA platform (throughout Europe)

  http://www.kora.ch/index.php?id=3&L=1

- SCANDLYNX platform (Scandinavia)

  http://scandlynx.nina.no/scandlynxeng

4. WOLF (CANIS LUPUS)

KEY FINDINGS

- The wolf Conservation Status is considered bad or inadequate in 9 out of 17 EU countries where data is available.
- The wolf is a strictly protected species for all Member States, except for Estonia (where the species is included in Annex V of the Habitats Directive), Latvia (Annex V), Finland (Annex IV and V), Poland (Annex V), Slovakia (Annex II and V), Bulgaria (Annex II and V), the Greek population north of 19º parallel (Annex II, IV and V), the Finnish populations within reindeer areas (Annex IV and V) and north of the river Douro in Spain (Annex II, IV and V).
- Human-wolf conflicts at European level rely mainly on livestock depredation and hunting (game) competition.
- Lethal management has no or little effect and even counter-expected effects in minimizing wolf's livestock depredation.
- The adoption of preventive measures and a willingness to change counterproductive husbandry habits seems to be crucial if local populations are to tolerate and coexist with wolves when other management measures are taking place, such as compensation schemes.

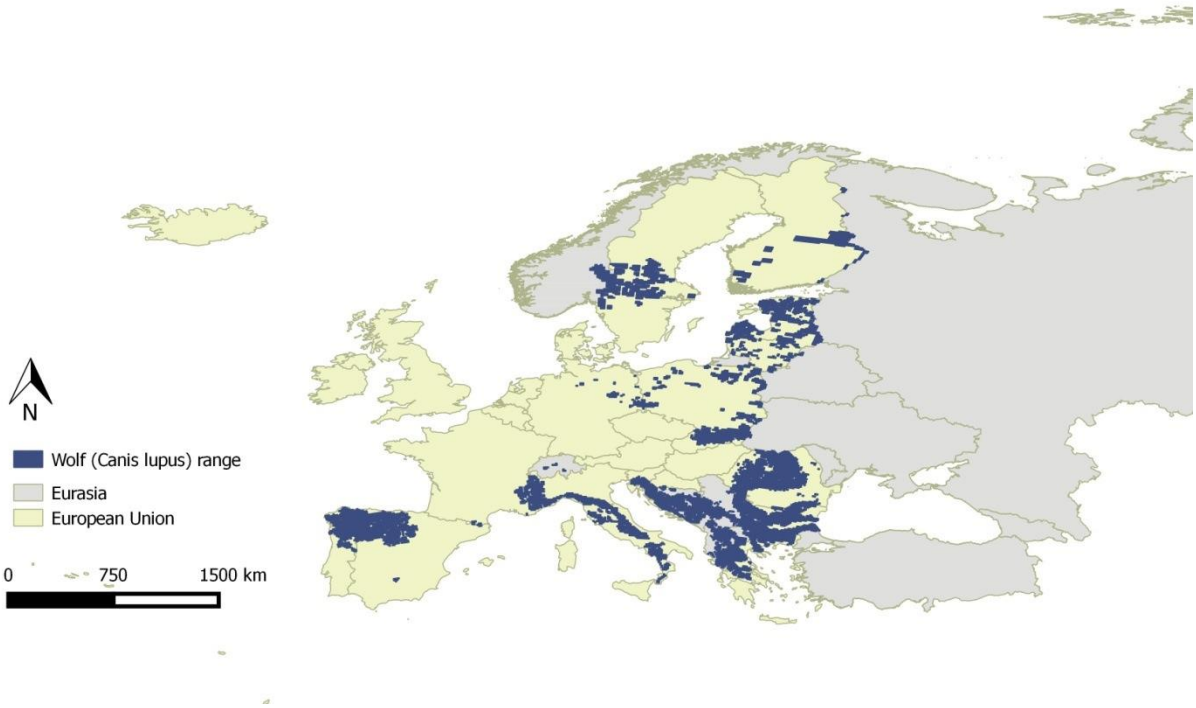
4.1. Status and distribution within the EU

The wolf, once the most widespread large carnivore species of the Northern hemisphere, has a long history of intense trapping and hunting on the European continent. As such, the

species' historical distribution suffered a considerable contraction, especially during the 20th century, when firearms and poison became widely available.

Currently, the wolf is absent from a large part of the European Union and mainly present in southern and Eastern Europe (Map 3).

Map 3 Wolf range in Europe



Source: Data from Chapron et al. 2014.Wolves can be found in 26 European countries (20 from the EU[8]). This includes 10 populations shared with several non-EU countries: Alpine, Baltic, Carpathians, Central European Lowlands, Dinaric-Balkan, Italian Peninsula, Karelian, NW Iberia, Scandinavian and Sierra Morena (Table 5). The status of the wolf varies greatly across countries and populations: the Conservation Status is considered Favourable in 8 countries and Bad or Inadequate in 9 countries. For the remaining countries, information is not available.

[8] Austria, Bulgaria, Czech Republic, Croatia, Estonia, Finland, France, Germany, Greece, Hungry, Italy, Latvia, Lithuania, Poland, Portugal, Romenia, Slovakia, Slovenia, Spain, Sweden.

Table 5 Wolf populations across Europe, Red List Assessment and individual country/area Favourable Conservation Status Assessment.

Population	Red List assessment[9]	Non-EU countries	EU Countries	Conservation Status[10]
Alpine	EN	CH	AT	N/A
			FR	FV
			IT	U1+
Baltic	LC	-	EE	FV
			LT	FV
			LV	FV
			PL	U1
Carpathians	LC	-	CZ	U2
			RO	N/A
			SK	FV
			PL	FV
			HU	U1
Central European Lowlands	EN	-	DE	U2
			PL	U1
Dinaric-Balkan	LC	BA, MK, AL, RS	BG	N/A
			HR	N/A
			EL	U1+
			SL	FV
Italian Peninsula	VU	-	IT	U1+
Karelian	EN	-	FI	FV

[9] CR: Critically Endangered; EN: Endangered; VU: Vulnerable; NT: Near Threatened; LC: Least Concern

[10] FV: Favorable; N/A: Non-available; U1: Inadequate; U1+: Inadequate but improving; U2: Bad; U2+: Bad but improving

NW Iberia	NT	-	PT	U1
			ES	XX
Scandinavian	EN	NO	SE	N/A
Sierra Morena	CR	-	ES	XX

Source: Kaczensky et al., 2012; The IUCN Red List of Threatened Species; EIONET - European Topic Centre on Biological Diversity

4.2. Legal framework within the EU

Within the European Union, wolf legal protection is granted through the following binding legal instruments:

- The Convention on the Conservation of European Wildlife and Natural Habitats 19.IX.1979, also known as The Bern Convention;
- Habitats Directive 92/43/EEC;
- National laws of EU Member States.

The Bern Convention includes the wolf in Appendix II, which grants strict protection to the listed species. According to the Convention's Chapter III, Article 6, it is prohibited to deliberately capture, kill or disturb this species or its refuge areas/habitat. Nonetheless, several signatory countries (n=13) have made reservations and do not consider the wolf as a strict protected species within this convention (Table 6).

The EU Habitats Directive Annex II includes all the species which require the designation of special areas for their conservation. All Member States include the wolf in this Annex, except Estonia, Latvia, Lithuania and Finland.

According to Habitats Directive Article 12, which regulates fauna protection, it is prohibited to deliberately capture, kill or disturb any of the species listed in Annex IV, as well as their refuge areas/habitat. Within the EU, the wolf is a strictly protected species for all Member States, except for Estonia, Latvia, Finland, Poland Slovakia, Bulgaria, the Greek population north of 19º parallel, the Finnish populations within reindeer areas and north of the river Douro in Spain. For these countries, the wolf is included in Annex V, which lists species whose capture in the wild and exploitation may be subject to management measures.

Table 6 Wolf legal framework within Europe and European Union.

Population	Non-EU countries	Wolf Protection Bern Convention	EU Countries	Habitats Directive Annex	Wolf Protection Bern Convention
Alpine	CH	YES	AT	II, IV	YES
			FR	II, IV	YES
			IT	II, IV	YES

Baltic	-	-	EE	V	NO
			LT	V	NO
			LV	V	NO
			PL	II, V	NO
Carpathians	-	-	CZ	II, IV	NO
			RO	II, IV	YES
			SK	II, V	NO
			PL	II, V	NO
			HU	II, IV	YES
Central European Lowlands	-		DE	II, IV	YES
			PL	II, V	NO
Dinaric-Balkan	AL	YES	BG	II, V	NO
	BA	YES	EL	II, IV, V	YES
	RS	YES	HR	II, IV	YES
			SL	II, IV	NO
Italian Peninsula	-		IT	II, IV	YES
Karelian	-	-	FI	IV, V	NO
NW Iberia	-	-	PT	II, IV	YES
			ES	II, IV, V	NO
Scandinavian	NO	YES	SE	II, IV	YES
Sierra Morena	-		ES	IV	NO

Source: Habitats Directive and Bern Convention.

4.3. Analysis of wolf management within the EU

4.3.1. Conflicts related with human activities

Folk stories, old legends and ancient hunting stone traps (e.g. in the Iberian Peninsula) are a few examples that testify to the ancient origins of the conflict between Europeans and the wolf. Its extirpation in a large part of the continent shows the degree of conflict and the efforts of local communities to make areas wolf-free.

As a highly populated and crowded continent, wolf distribution in Europe overlaps or is always fairly near to human activities, posing challenges to managers, human activities and wolves (Linnel et al. 2001).

Livestock depredation

The types of conflict and human attitudes towards wolves vary greatly across the continent (Kaczensky 1999). However, in all European countries the main cause of conflict with the wolf is related to free-ranging livestock. In some European countries wolf-caused livestock losses may be as low as 0.6% of the available stock (Álvares et al. 2015, Fernández-Gil et al. 2016). In fact, the overall low wolf predatory impact on livestock for several European countries has been acknowledged in extensive literature (Kaczensky 1999). Nonetheless, at a local level, single farmers can suffer a high impact due to particularly unfavourable landscape features or deficient husbandry practices (Fourli 1999).

A thorough analysis is presented below in order to identify issues and vulnerabilities, taking into account the targeted livestock species.

Even though artificial selection in domestic animals has favoured tameness to the detriment of natural anti-predatory traits, several authors have stressed that some cattle breeds are well adapted to their ecological areas, including the presence of natural predators such as wolves. Thus, this factor along with others such as cattle ecology and behaviour, group size, herd composition and specific anti-predator behaviour may influence vulnerability to wolf depredation (Álvares et al. 2014). Nevertheless, the rearing of such breeds has been dropping in favour of more productive breeds, which were frequently selected in the absence of large carnivores (Steinfeld et al. 2006) and hence are more susceptible to depredation.

In several Mediterranean countries another change is happening as sheep and goat herding is replaced by cattle for meat consumption. Usually, along with cultural loss, this replacement carries modern and non-traditional herding habits. This can be particularly severe in areas where wolves were absent or are naturally re-colonising, because often there is a complete lack of preventive measures (Linnell et al. 2001, Marucco et al. 2010).

Portugal is one of the countries with the highest documented rates of wolf cattle depredations in the world (Álvares et al. 2015). An analysis of individual farmer management habits and husbandry systems has revealed that only <2% of cattle farms suffered wolf attacks, of which just a small part (<4%) had chronic depredations throughout any year (Pimenta et al. 2017). The same research has shown that wolf attacks were concentrated in the free-ranging (extensive) husbandry systems, particularly in those farms where calves remained unprotected and unconfined during winter nights (Pimenta et al., 2017). A pilot action carried out in 2 mountainous areas of the Iberian Peninsula with a relatively high rate of cattle depredations by wolves has shown that generally cattle breeders are not informed about the best carnivore prevention measures and that they are not willing to change husbandry habits unless they have technical and/or financial aids (Álvares et al., 2014).

Free-ranging sheep/goat farming is a deeply rooted traditional farming activity from which Europeans have inherited a rich cultural background, as well as landscapes, modulated by

grazing and related activities. For centuries, this activity was indeed compatible with the presence of large predators because preventive measures were applied. Nonetheless, small ruminants, especially sheep, are often cited as the most depredated domestic animals in several European countries (Álvares et al. 2015, Kaczensky 1999), even when preventive measures were deployed. The explanation could be associated with sheep availability (while cattle are the most common livestock species in Europe, their rearing is often confined, while sheep are mostly free ranging, particularly during warmer seasons) and also their husbandry system conditions.

In large parts of the EU, sheep grazing areas and the presence of wolves overlap in mountainous regions, where rugged terrain and climactic conditions pose challenges to the efficiency of livestock guard dogs and human surveillance. However, for cattle and small ruminants alike only a small percentage of animals are affected (Álvares et al. 2015, Kaczensky,1999). In a 6 year study, it was found that only 1% of sheep farms were affected by wolves in Finland (Kaartinen et al. 2009); in Portugal 0.4% of sheep and 1.2% of goats were depredated within wolf distribution areas (Álvares et al. 2015). In Sweden, sheep are the most commonly attacked species and only approximately 500 are killed or injured each year (Widman et al. 2018).

Semi-domesticated reindeer herding, which occurs in a large part of Scandinavia, has suffered deep changes during the last century. Research has shown that a shift occurred from intensive herding to free-range herding, when, among other factors, large predators such as wolves were eradicated. After natural wolf recolonization took place, intensive herding was not re-adopted (Helle et al. 2008). In a small-scale study, Nieminen (2010) has shown that the wolf predatory impact can be high in reindeer herding areas, being responsible for as much as 38% of calves' mortality. The hostility of reindeer herders towards wolves (Wabbaken et al. 2001) is therefore understandable. Nonetheless, the underlying causes of a strong predatory impact seem to be linked with the aforementioned changes and shifts in reindeer management. In addition, the indiscriminate killing of the Finnish wolves in the reindeer herding area is heavily affecting the survival of the whole Scandinavian wolf population (Raikkonnen et al, 2013). This is mainly threatened by inbreeding, due to the overhunting of wolves in the Finnish reindeer herding area which prevents the introduction of new genetic stock from the Russian to the Scandinavian populations.

Equids are herded in free-ranging systems in the Northern Iberian Peninsula, with no human surveillance and protection year round. Research has shown that wolves in this region show a high selectivity for the species, but they mainly attack colts. Even though equids are depredated in other European countries, depredation events are negligible compared with North Western Spain (Álvares, 2011).

Leisure activities

Wolf conservation may be compromised when certain leisure activities (wildlife watching, sports, etc) take place near sensitive places, such as rendez-vous sites (places where cubs are raised until they are several months old), as wolves may become more stressed in the presence of humans. In addition, certain ecotourism activities may compromise the safety of rendez-vous sites and therefore make the wolves more prone to poaching and other illegal actions. The type of activities and their location should be taken into account by managers, who should balance human (e.g. economic) interests with wolf conservation (Higginbottom 2004, and references therein).

Infrastructure development

Infrastructure development in remote areas inhabited by wolves can hinder the conservation of the species, especially in countries where habitats have been destroyed and/or fragmented. Examples of such infrastructure are dams, paved roads and windmill farms.

Hunting

In areas where large carnivores have been extirpated, populations of wild ungulates have been controlled by hunting. The natural re-colonization by wolves in Scandinavian countries and the restoration of ecosystems have led to conflicts with hunters. Wolves are regarded as competitors for wild prey, namely the moose (Wikenros et al. 2015). This situation is worse in areas with low densities of moose (Apollonio et al. 2010). Nonetheless, research has shown that the predilection of wolves for the weakest creatures is likely to enhance the overall health and fitness of the prey population (Sand et al. 2012). A more generalized conflict between wolves and hunting in Europe seems to be the wolf depredation of dogs used by hunters.

Fear of wolves

In countries where wolves were absent and have now returned, the collective memory of coexistence between the species has disappeared, giving rise to fears. Even though there aren't any well documented cases of wolf attacks on people in Europe, in certain countries like Finland, social alarm is so high that a special taxi transports children from their front doors to school (Barkham 2017). Research has shown, however, that when humans have intentionally approached radio-collared wolves in Sweden (n=125), there have been no occasions of aggressive behaviour and on 123 occasions the wolves ran away (Wam 2002).

4.3.2. Review on scientific research, management and conflict mitigation

Wolf management in the EU has been based on the application of the following measures (Table 7):

- Lethal actions, which include wolf culling by national entities and/or hunting quotas;
- Compensation schemes for livestock damages;
- Preventive measures.

Culling and/or hunting is performed in 7 out of 10 European wolf populations, therefore wolf management in Europe commonly relies on both these methods (Boitani and Ciucci 2009). The belief that lethal management mitigates social tension (Salvatori and Boitani 2015), decreases livestock depredation rates and poaching seems to be spread among wolf managers. Lethal population control, i.e. the indiscriminate killing of individuals to limit the population, is therefore presented as a tool to improve human tolerance and to reduce the impact on the livestock.

However, growing evidence shows that lethal population control is not compatible with the ecological integrity of wolf populations and is not necessarily effective to reduce the predation on livestock (Fernández-Gil et al. 2016) or to improve human tolerance (Chapron and Treves 2016). Livestock predation could be reduced via certain levels of culling both at pack (Bradley et al. 2015) and population levels (Wielgus and Peebles 2014), but lethal management can also increase attacks on livestock by deteriorating the wolves' social structure (Wallach et al., 2009 and 2015). In addition, the level of extraction that would be needed to limit damage to livestock would compromise the viability and ecological role of wolf populations (Wallach et al. 2015). Consequently, effective culling and hunting seem not to be compatible with the conservation mandates of the EU Habitats Directive and the Bern Convention which require

Member States to maintain their wolf populations in a favourable conservation status (Epstein et al. 2015).

Compensation for livestock damages has been the subject of an intense discussion on whether it is useful for carnivores and farmers (Marucco et al. 2012). Recent research has shown that compensation alone would not be good for conservation nor socially fair (Bulte and Rondeau 2005, Ravenelle and Nyhus 2017). In the EU, compensation schemes vary from private to public funding and in certain countries a mix of both is applied. Twelve Member States apply this approach and remarkably only half of these (n=6) deploy compensation and lethal management simultaneously. In the 7 Member States where compensation is not applied, 5 include lethal action as a species management tool. In the remaining countries (n=2) wolf density is extremely low, which might explain the low predatory impact on livestock, and therefore have no need for compensation schemes. Thus, it seems that in those countries that lack compensation schemes, lethal actions are the main management tool.

LIFE is the EU's financial instrument supporting environmental, nature conservation and climate action projects. Numerous wolf conservation projects were possible only thanks to LIFE support, allowing Member States to test, deploy and disclose efficient preventive measures to reduce conflicts and encourage coexistence with this large carnivore. Eleven Member States have benefited from LIFE projects on wolf coexistence and conservation and applied preventive measures (see below, under session 4.4). Only 6 of the countries who have participated in these projects also deploy lethal actions as a management tool. In the 12 countries where lethal management occurs, half did not participate in LIFE wolf coexistence projects.

Table 7 Wolf management and conflict mitigation measures in EU member-states.

Population	EU Countries	Strict Protection	Lethal Management	Compensation for livestock damages	Participation on LIFE wolf coexistence projects
Alpine	AT	YES	NO	N/A	NO
	FR	YES	YES	YES	YES
	IT	YES	NO	YES	YES
Baltic	EE	NO	YES	NO	NO
	LT	NO	YES	NO	NO
	LV	NO	YES	NO	NO
	PL	NO	NO	YES	NO
Carpathians	CZ	YES	NO	NO	NO
	RO	YES	YES	NO	YES

	SK	NO	YES	YES	NO
	PL	NO	NO	YES	NO
	HU	YES	NO	NO	YES
Central European Lowlands	DE	YES	NO	YES	NO
	PL	NO	NO	YES	NO
Dina	BG	NO	YES	NO	YES
	HR	YES	YES	YES	YES
	EL	NO	NO	YES	YES
	SL	YES	YES	YES	YES
Italian Peninsula	IT	YES	NO	YES	YES
Karelian	FI	NO	YES	YES	NO
NW Iberia	PT	YES	NO	YES	YES
	ES	NO	YES	YES	YES
Scandinavian	SE	YES	YES	YES	NO
Sierra Morena	ES	YES	NO	YES	NO

Source: Kaczensky et al.,2012; Musiani et al. 2009; http://ec.europa.eu/environment/life/funding/lifeplus.htm

4.3.3. Recommendations

Lethal management, by means of culling and/or hunting, has not shown any efficiency in mitigating losses by wolves, unless the population is reduced to levels that are not compatible with the mandate of the Habitats Directive (Wielgus and Peebles 2014, Bradley et al. 2015, Fernández-Gil et al. 2016, Treves et al. 2016, Epstein 2017).

The adoption of preventive measures and the willingness to change counterproductive husbandry habits, seems to be crucial to achieve wolf social tolerance and coexistence even when other management measures are taking place, such as compensation schemes (Pimenta et al. 2017). Moreover, compensation schemes should be integrated with preventive measures to be efficient (Marucco et al. 2012, Ravenelle and Nyhus 2017). It is also clear that farmers must be assisted to apply these measures correctly (Álvares et al.

2014), especially in areas where wolves have been absent for a certain period of time (Marucco et al. 2010).

The dissemination of best preventive practices and the exchange of experiences among farmers should be encouraged by national authorities, institutions and NGOs. Social tolerance towards wolves has been argued as a key aspect for the conservation of this species (Treves et al. 2013). Nonetheless, little research has been deployed in Europe to thoroughly investigate human attitudes towards wolves compared to studies on the ecology and behaviour of the species. Therefore, specific research should be deployed at a pan-European level to investigate public attitudes towards wolves regarding the use of preventive measures, lethal management and compensation schemes.

Several studies have stressed the importance of wild prey availability to reduce livestock attacks (Meriggi et al. 1996). In fact, large wild prey scarcity has often been highlighted as a major factor that may increase wolf livestock depredations (Fritts et al. 1981). Thus, it is recommended that a significant and diverse amount of large wild prey is available where wolves are present. In those countries where wild prey occurs in low densities, a well-planned reintroduction programme is advisable (Meriggi et al. 1996).

4.4 Best practices for Wolf Management and Coexistence

4.4.1. EU funded and pilot projects

The experience of previous projects has shown that a mixed approach between traditional preventive measures and modern technology should be adopted in order to optimize livestock protection. The following best practices have been identified.

Livestock Guard Dogs (LGD)

LGD are by far the best cost-effective tool to protect livestock (Marucco et al. 2012; Salvatori and Mertens, 2012). Extensive research has shown that their presence dramatically decreases the number of depredation events and also the number of animals depredated (Riggs et al. 2011). They can be used regardless of local ecological conditions because there is a wide variety of European breeds well adapted to different kinds of landscape and climate. Traditionally LGD were mainly used to herd small ruminants, but several experiences have shown that they can be just as efficient with cattle and other domestic animal species.

Even though the use of LGD increases the costs of livestock production and human work, the rearing of these dogs and their subsequent sale potentially offers farmers another source of income.

Confinement

Confinement is essential to decrease livestock losses, especially during sensitive periods such as the calving and lambing season. Confinement can be done through different ways:

- Anti-predator fences: they can be mobile or fixed and should be at least 2 m high; they should be knotted and have at least 5 wires spaced at 20-30cm apart, with the lowest no more than 20 cm from the ground and the highest at least 90-110 cm above the ground; the base of the fence should be buried 20 cm below the ground;
- Electric fences: using the aforementioned dimensions with electrical *stimuli* to further dissuade predators;
- Turbo-fladry fences: a mix of electric fence with visual deterrents (often small flags or pieces of cloth);

- Night confinement in stables.

Deterrents

Even though deterrents have been shown to be less effective and to be easily lost over the medium-term, they can be used in critical situations or be applied in combination with other measures:

- Fladry: a visual deterrent which consists of the application of small flags or pieces of cloth along a line;
- Auditory deterrents: electric devices activated by animal motion which produce sounds or ultrasounds intended to keep away predators and other wildlife;
- Light deterrents: electric devices activated by animal motion which produces light intended to keep away predators and other wildlife.

Autochthonous breeds

The rearing of autochthonous breeds, well adapted to the presence of predators should be encouraged.

Information campaigns and stakeholder participation

Objective knowledge about wolves and their behaviour is essential to ensure coexistence with human activities and this large carnivore. Environmental education based on the presentation of the aforementioned preventive measures and a dialogue between stakeholders is therefore crucial to make human interests and wolf conservation compatible.

The following EU funded projects have produced a great amount of valuable knowledge on wolf-human coexistence and the application of preventive measures in different ecosystems. Their findings should be consulted for conflict mitigation scenarios:

- WOLF LIFE https://www.wolflife.eu/en/

The aim of the project was to implement the best practices for the conservation of the wolf (Canis lupus) in the wild and to maintain a viable population of wolves in the Carpathian Mountains by strengthening the management the species and promoting human–wolf coexistence. A highlight of the project was the sterilising and vaccinating of a large numbers of feral dogs, reducing the risk of wolves' spreading diseases in the project area.

- SloWolf http://www.volkovi.si/?lang=en

The project clarified the status and dynamics of Slovenia's wolf population via a range of methods, including innovative genetic methods. The findings indicated that the population is stable and contains between 35 and 40 wolves, despite annual culling quotas and occasional poaching. The project showcased many innovative technologies based on using DNA to identify individual wolves.

Project monitoring of the wolf population provided a basic prerequisite for controlling the species' long-term conservation status. The project developed tools for other important issues such as prey species management, institutional cooperation, trans-boundary cooperation and the illegal killings of wolves. The project results also produced comprehensive data sets and other information outputs such as a wolf portal, bulletins, posters, brochures, recommendations, instructions, film and an action plan. The latter Wolf

Action Plan (adopted by the government) was based on scientific knowledge about the population and its habitat. It provided a firm foundation for wolf conservation and management. The Wolf Conservation Action Plan adopted by the Slovenian government, was developed within the project through a participative process with interested stakeholders. The economic aspects of different farming practices with or without wolf/bear damages were analyzed. These helped to demonstrate the benefits of wolf-friendly farming within the wolf range. Electric fences and shepherd dogs were proved by the project to be useful tools for preventing wolf damage to farms. During the project's first two years, measures to protect against damage to agriculture were reduced. The financial compensation for wolf attacks paid to the farmers in 2013 was €200, 000 less than in the previous years, when fences were not used.

Annual national culling quotas declined during the project, down to zero in 2014. The public response was outstanding in terms of media coverage (144 written articles, 32 TV emissions, 361 internet articles). This helped to improve the perception of wolves by Slovenia's media and the general public.

- LIFE WOLFALPS http://www.lifewolfalps.eu/en/

This project is still ongoing. The ultimate goal of the project is to implement and coordinate wolf conservation actions throughout the Alps to further support the natural wolf recolonization process. The lack of any form of coordinated management in the Italian Alps is one of the most crucial challenges. The project, is based on a shared and coordinated conservation programme implemented by the various administrative divisions in Italy and Slovenia and shared with other alpine countries. Among other actions, the project has established Wolf Alpine Conservation and Communication Groups in each core area, increasing coordination in conservation measures and amplification of positive results. In addition new ad hoc preventive measure strategies in the Alps context have been developed, tested, and implemented to decrease wolf attacks on livestock.

- MED-WO http://www.medwolf.eu/index.php/home-25.html

The project's goal was to decrease the conflict between the wolf's presence and human activities in rural areas where the cultural tradition of coexistence with predators has been lost. The project facilitated the adoption of best livestock management techniques by livestock owners in Italy and Portugal and the adoption of common methodologies and criteria to enable efficient transboundary wolf monitoring. An international Damage Prevention Working Group was also created and the electronic bulletin "Carnivore Damage Prevention News" reactivated.

- WOLFNET http://www.lifewolf.net/it/component/content/index.html

The project's main finding was the improvement of the conservation status of the species inside the project areas. The project developed and disseminated a system to assess wolf damage based on objective findings and on a standardized procedure, using software that facilitates and speeds up compensation procedures. The system is now applied and well-established in various areas and has also been the subject of numerous training sessions and technical meetings. The project required experimental evaluation and application by

other public bodies involved in the project but not directly involved in its actions, such as co-financiers of public administrations.

- CROWOLFCON http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=2202&docType=pdf

The project's goal was the conservation and management of wolves in Croatia. The highlights of the project were the deployment of a damage assessment expert team and preventive measures such as Livestock Guard Dogs and Electric Fences.

- Progetto Pasturs https://pasturs.org/

This pilot project brings volunteers to support shepherds with flock herding and implementing the best preventive measures against damage by large carnivores in Italy. It is a voluntary-based "citizen-conservation" project that brings together the conservation and farming sectors to work towards a common goal.

5. WOLVERINE (Gulo gulo)

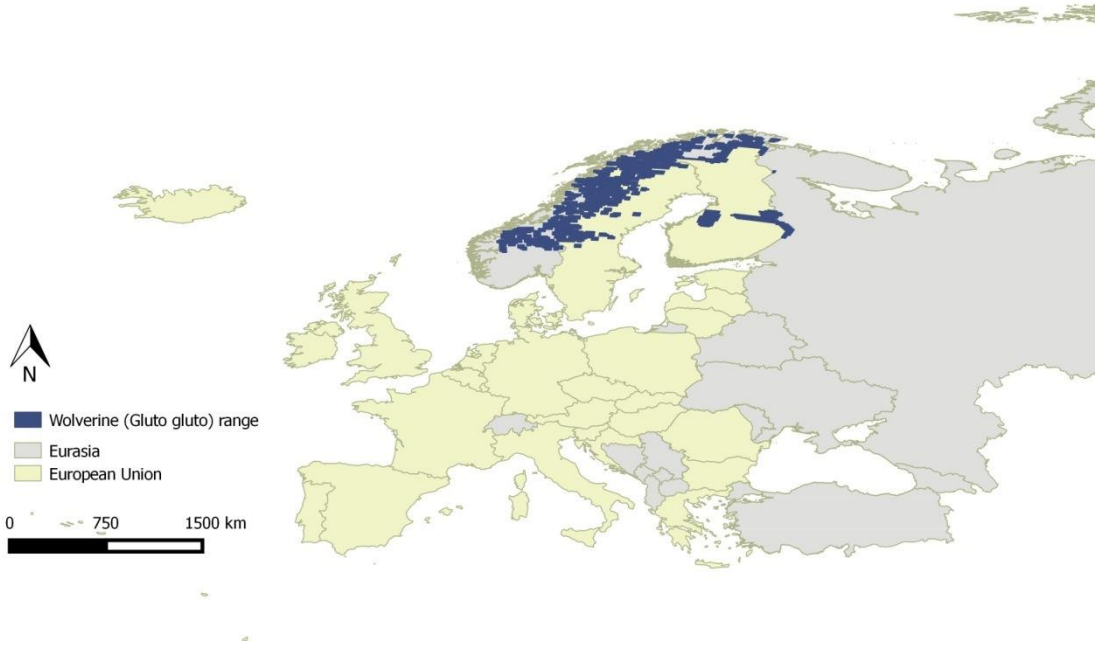
KEY FINDINGS

- Wolverine distribution is restricted to the northern European range.
- In the Finnish alpine bio-region, the species has reached a favourable conservation status, while for the remaining range it is inadequate or non-available.
- Wolverine-human conflicts have a small impact at a pan-European level and are related to reindeer and sheep herding.
- The establishment and implementation of a compensation programme at a national level is recommended.
- The lethal management of wolverines is inefficient for the conservation of the species and for conflict mitigation.

5.1. Status and distribution within the EU

With an already naturally restricted range due to the species' ecological requirements, the wolverine's distribution in Europe has recently been reduced (Map 4). Historically, this species could be found in Baltic countries, such as Estonia, Lithuania and Poland.

Map 4 Wolverine range in Europe



Source: Data from Chapron et al. 2014.

Currently, wolverines are only found in 3 European countries (2 of which are Member States[11]) and in 2 populations: Karelian and Scandinavian. In the Finnish alpine bio-region, the species has reached a favourable conservation status, while for the remaining regions the conservation status is inadequate or non-available (Table 8).

Table 8- Wolverine populations across Europe, Red List Assessment and individual country/area Favourable Conservation Status Assessment.

Population	Red List assessment[12]	Non-EU countries	EU Countries	Conservation Status[13]
Karelian	EN	-	FI	FV/U1+
Scandinavian	VU	NO	SE	N/A

Source: Kaczensky et al., 2012; The IUCN Red List of Threatened Species ; EIONET - European Topic Centre on Biological Diversity

[11] Finland and Sweden

[12] CR: Critically Endangered; EN: Endangered; VU: Vulnerable; NT: Near Threatened; LC: Least Concern

[13] FV: Favorable; N/A: Non-available; U1: Inadequate; U1+: Inadequate but improving; U2: Bad; U2+: Bad but improving

5.2. Legal framework within the EU

Within the European Union, the legal protection of wolverines is granted through the following binding legal instruments:

- The Convention on the Conservation of European Wildlife and Natural Habitats 19.IX.1979, also known as The Bern Convention;
- Habitats Directive 92/43/EEC;
- National laws of EU Member States.

The Bern Convention includes the wolverine in Appendix II, which grants strict protection to the listed species. According to the Convention Chapter III, Article 6, it is prohibited to deliberately capture, kill or disturb this species or its refuge areas /habitat (Table 9).

The EU Habitats Directive Annex II includes all the species which require the designation of special areas for their conservation. The wolverine is listed under this Annex for both Finland and Sweden, which are the only two EU Member States where the species is present.

Table 9 Wolverine legal framework within Europe and European Union.

Population	Non-EU countries	Wolverine strict protection Bern Convention	EU Countries	Habitats Directive	Wolverine strict protection Bern Convention
Karelian	-	-	FI	II	YES
Scandinavian	NO	YES	SE	II	YES

Source: Habitats Directive and Bern Convention.

5.3. Analysis of wolverine management within the EU

5.3.1. Conflict related with human activities

The wolverine shares its main prey, the semi-domestic reindeer (*Rangifer tarandus tarandus*) with Europe's other large carnivores (lynx, wolf and brown bear; L., 1758; Mattisson et al 2011). The wolverine is an opportunistic predator, which to a large extent relies on scavenging, but it also preys effectively on calves and adult reindeer (Samelius et al. 2002, Persson 2005).

The main conservation problem for the wolverine is due to its year round predation on domesticated reindeer in the northern parts of Fennoscandia and on unattended sheep during the summer grazing period over most of their distribution in Norway (Landa et al. 2000). Therefore, conflicts with humans usually involve sheep farmers and domestic reindeer herders. In areas with high levels of conflict between wolverines and domestic sheep and reindeer, there is poor tolerance for the presence of the wolverine, especially outside protected areas.

Wolverine predation on semi-domestic reindeer (throughout the year) and on unattended sheep (during the summer) is also well documented in Norway. In Sweden and Finland,

almost no unattended sheep grazing occurs in wolverine areas. However, the wolverine predation on semi-domestic reindeer is well documented in all the Nordic countries. Extensive sheep husbandry, as occurs in Norway, seems to be incompatible with either the presence of wolverine populations or their expansion into former parts of their range.

The wolverine's recovery has occurred without a change in the causes behind its original decline (sheep depredation, misinformation, etc.), and the conflict potential due to livestock predation has even increased because of increased stock numbers and the loss of traditional herding and livestock guarding methods (Landa et al. 2000).

5.3.2. Review on scientific research, management and conflict mitigation

Scientific knowledge about wolverines is relatively poor compared to other large carnivore species like the wolf, lynx and brown bear. Luckily, the last two decades have seen a dramatic increase in research into wolverine biology, with projects in Norway, Sweden and North America (Landa et al.2000).

Wolverine research in Europe has mainly looked at the species' ecology (e.g Mattisson et al.2016, Lopez-Bao et al.2016), often focusing on its interaction with other sympatric species (e.g Mattisson et al 2016, Inman et al. 2012, Mattisson et al. 2011, Persson et al 2011). Only a few peer-reviewed publications focus on species management, best practices for coexistence and conflict mitigation analysis. Some researchers have already addressed the topic by analysing the impact of lethal management programmes on the population's viability and the importance of protected areas for the conservation of the species (Aronsson et al. 2017, Rauset et al 2016, Persson, 2015).

Researchers have highlighted that updated population level monitoring techniques are of key importance to achieve an efficient and unbiased population level based on adaptive management and conflict mitigation (Aronsson & Pettersson, 2016). Underestimating the size of the population may limit the effectiveness of conflict mitigation measures, have detrimental effects on stakeholders' trust in management measures (Young et al., 2016) and therefore decrease acceptance of wolverines and their conservation in reindeer farming areas (Aronsson & Pettersson, 2016).

Lopez-Bao et al. (2016), after studying reindeer depredations, concluded that population management measures aimed at the lynx may affect wolverine populations and human-wolverine conflict mitigation due to species coexistence and trophic niche overlap.

An analysis by Gervasi et al (2015) found a compensatory emigration between individuals from Norway and Sweden and discussed how different management programmes can generate undesired demographic and spatial dynamics and jeopardize conservation goals on both sides of the border. The authors stressed the need to adopt a coordinated population approach to the conservation of large carnivores to avoid hindering effective conflict mitigation.

Rauset et al (2015) showed that the creation of protected areas alone was not enough to decrease illegal killings of wolverine. In fact, poaching rates were higher inside those areas. Performance payments were made on a strict quid pro quo basis depending on the conservation outcome - all attention was focused on the end result with no attention paid to the actions that led to the conservation outcome. This conditionality concept allowed the agency to pay solely for its conservation goal.

Lethal control is currently the main management tool used to decrease predation by wolverines because few preventive measures are applicable to modern, extensive reindeer herding (Persson et al., 2009). Some research has, however, been performed regarding the efficiency of non-lethal coexistence methods, namely the CPP (Conservation Performance

Payments). Persson et al (2015) conducted a study on wolverine CPP and analysed the existence of a direct link between monetary payments and the achievement of desired species conservation goals in Sweden. Results showed that the compensatory method decreased illegal hunting by reindeer farmers, therefore allowing a remarkable recovery of the population.

5.3.3. Recommendations

In summary, the findings in the scientific research regarding the conflict scenarios related to wolverine underline the need to address the species at a population level and highlight several weak points regarding human-wolverine coexistence via non-lethal methods.

Following the Swedish example, we recommend that a well-coordinated, population level damage compensation programme is established. In addition, we recommend that future scientific research should rely on efficient public awareness and educational methods and, more importantly, on finding, testing and applying innovative and practical preventive measures that suit different conflict scenarios (reindeers and sheep).

Institutional and financial support should be deployed to develop research for conflict mitigation via *a priori* (stock protection) and *a posteriori* (damage compensation) methods. Efforts should be made to promote and achieve legal obligations regarding the species' conservation via non-lethal methods.

5.4. Best practices for Wolverine Management and Coexistence

5.4.1. EU funded and pilot projects

Compared to the other 3 large carnivore species, little attention has been paid to the wolverine in Europe. Nonetheless, in recent years some actions and initiatives regarding this species were implemented, such as the Swedish Wolverine Project.

The CPP Swedish Programme is a conservation programme aimed at decreasing wolverine-human conflict via a damage compensatory scheme.

In Finland an educational and monitoring programme involving volunteers is ongoing.

In 2000, an important document was published: the Action Plan for the conservation of wolverine (*Gulo gulo*) in Europe, funded by WWF Sweden, WWF Norway, the Council of Europe and the Norwegian Institute for Nature Research (NINA; Landa et al, 2000).

This action plan has identified five main objectives with suggestions for required actions:

- Conserve viable wolverine populations in Fennoscandia and hereby secure the viability of small populations.

- Coordinate cross-borders carnivore conservation policies and between agricultural and environmental ministries.

- Co-ordinate wolverine conservation plans with those for other large carnivores.

- Establish wolverine recovery zones where habitat quality is high. Wolverine populations should be allowed to naturally increase and re-establish within these zones.

- Reduce the conflict between wolverines and humans (mainly livestock depredation) in and around recovery zones by changing husbandry practices.

This action plan is not a management plan *per se*, but provides guidelines for national plans, and because most populations are shared across national borders, conservation and management should be carried out co-operatively among involved countries.

6. CONDITIONS FOR DEROGATIONS UNDER HABITATS DIRECTIVE

KEY FINDINGS

- Killing individual members of a large carnivore population commonly takes the form of culling and hunting. These are used as widespread tools in Europe to reduce the population of carnivores and to try to decrease the rate and/or number of depredations on livestock.
- Scientific research has shown that the culling and hunting of large carnivores is usually ineffective or even counterproductive in reducing depredations on livestock unless the level of extraction is so high as to compromise the viability and functionality of the carnivore's population. Culling and hunting are also ineffective in improving the social acceptance of the presence of large carnivores.
- Apex-species traits and other traits, such as the ecological importance of large carnivores, can be overridden by severe perturbations, like hunting and culling.
- Derogations on the taking, capture and removal of species listed in Annexes IV and V of the Habitats Directive should be very critically evaluated.

6.1. Legal context

Article 16 of the Habitats Directive (Council Directive 92/43/EEC) lays down the conditions under which derogations can be applied to the taking, capture, killing and exploitation of species listed in the Annexes IV and V of the Directive.

The Habitats Directive would allow the removal of individuals of a given species if the following pre-requisites are fulfilled.

For the species listed in Annex V, pre-requisites are specified in Art. 14:

If, in the light of the surveillance provided for in Article 11, Member States deem it necessary, they shall take measures to ensure that the taking in the wild of specimens of species of wild fauna and flora listed in Annex V as well as their exploitation is compatible with their being maintained at a favourable conservation status. Where such measures are deemed necessary, they shall include continuation of the surveillance provided for in Article 11.

For the species listed in Annex IV, pre-requisites are specified in Art. 16:

Provided that there is no satisfactory alternative and the derogation is not detrimental to the maintenance of the populations of the species concerned at a favourable conservation status in their natural range, Member States may derogate from the provisions of Articles 12, 13, 14 and 15 (a) and (b).

The aforementioned pre-requisites imply that derogations should be delivered only if the population maintains its Favourable Conservation Status (FCS) after the removal of individuals. Hence, the maintenance of FCS is a post-requisite in the Habitats Directive's mandate. Art. 1 defines the conservation status 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 habitats, 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.

More guidance on the definition of the FCS according to the Habitats Directive has been published by the EC in 2007 (http://ec.europa.eu/environment/nature/conservation/species/guidance/index_en.htm).

Importantly, this document states that: "the assessment of conservation status not only includes an element of 'diagnosis' based on current conditions, but also an important element of 'prognosis' (foreseeable future) based on influences. Such foreseeable future influences could be specific or general threats, positive or negative, medium-to long-term impacts, etc".

According to Art. 14, the exploitation of species in Annex V is a possible reason for a derogation, if deemed necessary. Strictly speaking, "exploitation" refers to the use of a species for food, fur or some other form of economic profit. In Europe large carnivore species are not exploited for food or fur, but sometimes hunting is considered exploitation by some Member States.

However, the exploitation of large carnivore populations is not compatible with the post-requisite of the Habitats Directive, given their key and apex traits (Estes et al. 2011, Ripple et al. 2014, Wallach et al. 2015), which are in the words and spirit of the Habitats Directive: the protection and conservation of wild species (Art. 1: 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 habitats). A teleological interpretation of the Habitats Directive (in Epstein et al. 2015), states: " that a species must remain a component of its habitat implies ecological functionality in addition to demographic viability". The functionality of a large carnivore population cannot be reached if the species is exploited, because it unavoidably causes severe perturbations overriding or neutralizing key and apex traits (Wallach et al. 2009, Ordiz et al. 2013). Apex carnivores can express their ecological importance (i.e. key traits) even in humanized landscapes (Palomares et al. 1999) despite some claims that apex carnivores do not show their key traits (ecological importance) in humanized landscapes.

The Directive then establishes that the taking in the wild of specimens (*sensu lato*) could be justified if: a) deemed necessary – for species in Annex V (as for Art.14); or b) there is no satisfactory alternative – for species in Annex IV (as for Art.16).

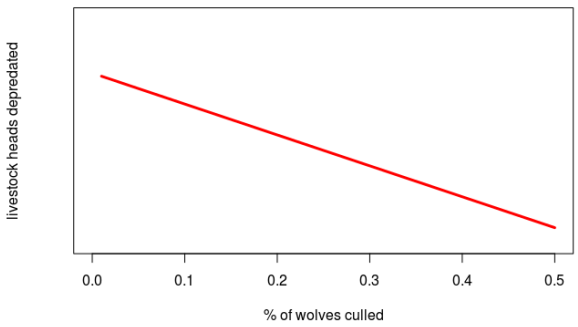
Next we evaluate the potential needs for taking individuals (considering lethal methods as ways to remove, or take, individuals from the wild) for an intended goal deemed necessary (Annex V), or because no satisfactory alternative has been found (annex IV). By far, the more common intended reasons for lethal control are to minimize losses on domestic animals and to reduce social conflicts (e.g. as mentioned in the Wolf Management Plans in the Asturias and Castilla y León, Spain).

6.2. Lethal control to minimize depredations on livestock

In Europe, the taking in the wild of specimens of a large carnivore population commonly takes the form of culling and hunting to reduce the population of the carnivore and thus decrease the rate and/or number of depredations on livestock. Culling (and hunting, a form of recreational culling) is by definition the killing of individuals to reduce the carnivore population.

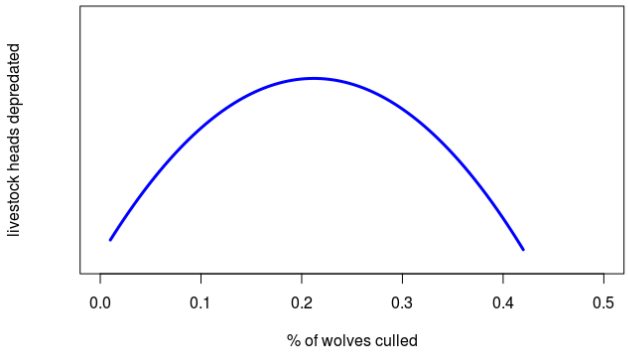
The assumed rationale of culling to minimize depredations may be represented as a linear, negative, relationship between the number of individual members of the carnivore population removed and the number of depredated livestock (Figure 1).

Figure 1 Assumed, negative linear relationship between the number of culled carnivore individuals and number of depredated livestock individuals.



Nevertheless, such a relationship has never been shown in scientific literature. Indeed, more complex relationships have been observed (Wielgus & Peebles 2014, about culling wolves and depredations in North America; see below Figure 2). The results described by Fernández-Gil et al. (2016), which analyze data on wolves in Spain, provide further evidence to support the complex pattern identified by Wielgus & Peebles (2014).

Figure 2 Empirical, complex pattern of relationships between rate of culling and number of subsequent depredations (modified from Wielgus & Peebles 2014).



Other studies have analyzed the impact of the lethal management of large carnivores on the rate of livestock depredations: Bradley et al. (2015) on wolves in North America; Krofel et al. (2011) on wolves in Europe; Peebles et al. (2013) on pumas; Herfindal et al. (2005) on Eurasian lynx in Europe (this study includes the poaching mortality of lynxes); Treves et al. (2010), and Obbard et al. (2014) on black bears in North America; Sagør et al. (1997) on brown bears in Europe; Conner et al. (1998) on coyotes. Some of those studies were discussed in a meta-analysis by Treves et al. (2016). The authors concluded that: "Culling and hunting appear risky for livestock owners because effects were slight or uncertain, and five of seven tests produced no effect or a counterproductive effect. This conclusion stands even without the inclusion of four studies that found counterproductive effects of killing wolves, bears, or cougars (Treves et al. 2010; Peebles et al. 2013; Wielgus and Peebles 2014; Fernández- Gil et al. 2016). The non-lethal methods that have been tested (LGD, fladry, night enclosures) were not associated with similar negative results".

A more recent meta-analysis of scientific literature discussed the effect of lethal methods to reduce depredations (Eklund et al. 2017). This paper included only experimental studies

(those that would allow replication, and control vs treatment design) and excluded most of the studies in the meta-analysis by Treves et al. (2016), except the study by Bradley et al. (2015).

The study performed by Wielgus & Peebles (2014) received a lot of attention and some criticism from the scientific community (Poudyal et al. 2016) due to the inclusion of a "time index" (a variable that showed a correlation between some of the original explanatory variables). This explained much of the variance in the models and the authors concluded that the results were misperceived due to the omission of a time series and that the increase in depredations were a short-term phenomenon. Nevertheless, a variable such as a "time index" has no biological meaning and would explain most of the variance in any model that include temporal data: for instance in this particular case, both critical variables in the original study (wolves culled and heads depredated) increased during the study period.

Nevertheless, the study by Fernández-Gil et al. (2016) did not show a temporal correlation between critical variables: the number of packs and wolves culled revealed no trends during the study period, while heads depredated showed a significant positive trend.

The reasons behind the positive relationship between culling and depredations found in the aforementioned studies probably lay in the complex social behaviour of wolves being affected by severe perturbations, such as culling (Wallach et al 2009). Predation rates have no linear relationship with the abundance of predators, but are related to more subtle factors such as their complex social system and social behaviour, population dynamics, age classes and sex ratios, number of potential prey species, prey abundance and vulnerability, predator guild, and habitat and human variables.

In conclusion, depredations to livestock can be reduced by culling carnivores like wolves, either at population or pack level (Wielgus & Peebles 2014, Bradley et al. 2015). However, the level of perturbation needed to achieve it is so high (i.e. complete pack removal, high proportion of the population removed) that it would be classed as an infringement of the Habitats Directive, which requests the maintenance of a favourable conservation status (Art. 1). In addition, while aiming to reduce depredations, culling can cause counter-expected results by actually increasing depredation rates (Wielgus & Peebles 2014, Fernández-Gil et al. 2016, Treves et al. 2016).

6.3. Lethal management to increase tolerance

The second more common reason to apply derogations allowing the lethal management of a carnivore population is to try to increase social acceptance in conflict scenarios, such as the presence of large carnivores, depredations to livestock, or other real or perceived threats to people's life or properties.

Culling is performed as a way to alleviate social tension in some European countries (e.g. Wolf Management Plan in Asturias, Spain, Decree 23/2015).

Scientific literature on conflicts related to humans and wildlife conservation and/or their management provide some insights on the topic. A recent study (Chapron & Treves, 2016) showed that hunting does not decrease the negative effects of low tolerance to the carnivores' presence (i.e., poaching). Instead, the opposite was observed. Other studies supported these results (Browne-Nunez et al. 2015, Hogberg et al. 2015).

Nevertheless, it can be argued that this subject falls into the field of social science: social perception and the trust of humans in the law and the actions performed by public managers as a consequence of a pretended legitimate action, i.e. lethal management for a desired outcome, tolerance increasing. Although natural sciences (e.g., biology, ecology) can answer questions, quantitatively, about how the mortality rates of a wild carnivore affect the rates

of predation on its prey (see above), biology alone cannot respond to the questions that fall in the field of social perceptions and values (Darimont 2017).

6.4. Lethal management to control the carnivore population

At first glance, "controlling" a population of key apex predators (all the concerned carnivore species in this report fall in this category, plus the Iberian Lynx among other species in Europe) under protected status (Bern Convention, Habitats Directive, and several Member States normative) because of their ecological importance (see chapters above, Estes et al. 2011, Ripple et al. 2014, and references therein) would seem paradoxical. However, perceived overpopulation was used to justify the use of lethal management by several public agencies in Europe (e.g. in Picos de Europa National Park, Spain).

Apex predators have unique traits, such as intrinsic ways of population auto-regulation, because of their behaviour and ecology (Wallach et al. 2015). Such important traits (and those related to their key condition (i.e. ecological importance) can be overridden by severe perturbations, like hunting and culling (Wallach et al. 2009, Ordiz et al. 2013).

6.5 Recommendations

The most recent research discussed above demonstrates that the removal of large carnivore specimens is ineffective or even counterproductive, both in reducing depredations to livestock and in improving the social acceptance of the presence of large carnivores. As discussed above, the rate of removal necessary to observe a significant decrease in the depredation rate is so high that it would compromise the conservation principle of the Habitats Directive.

Consequently, efforts should focus on preventing attacks on livestock and the use of derogations related to the taking, capture and removal of species listed in Annex IV of the Habitats Directive should be very critically evaluated and only exceptionally accepted.

CONCLUSIONS AND RECOMMENDATIONS

KEY FINDINGS

- Preventive measures are presented as the more rationale, effective, fair and least controversial ways to decrease and prevent depredations and other damage, and thus mitigate conflict.
- Ethical principles must be taken into account along with biological and social sciences to adequately and fairly inform management and stakeholder's decisions about large carnivore individuals and populations.
- We recommend an alternative model of management that is based on scientific principles and that creates a strategy of support, awareness and information for different stakeholders.

Large carnivores are species that imply great challenges in terms of their conservation. Because they are easily recognizable by the general public (apart from the wolverine) as iconic species, they are very commonly used as flag-ships for conservation purposes. Nevertheless, their predator traits cause real or perceived conflicts with humans that require management strategies based on accurate scientific inputs and guidelines, backed by a solid awareness, educational and support programmes.

In recent decades, the overall analysis of the large carnivores range at a pan-European level shows what seems to be a shy but positive recovery of their populations. However, some authors have already wondered if such recovery is real or just perceived, relying on the analysed dataset and time frame (see Fernández-Gil et al. 2017 for the Iberian wolf case). Hence, what can be perceived as a remarkable recovery might only be a partial recovery of a species ancient status and range. What is currently perceived as a recovery of the populations of large carnivores is an opportunistic response to renewed available ecological conditions and has only occurred after a drastic decrease of their distribution during the last two centuries which was directly related to human activities (e.g direct persecution, habitat loss). The current distribution of the four species is still very limited, compared to its original state. Conservation biologists and wildlife managers should therefore consider that much effort is still necessary for populations of large carnivores to recover their full functionality in a large part of their ancient distribution areas where ecological conditions are still available or can be improved

Two major legal instruments have been adopted in the EU to protect and conserve wildlife: the Convention on the Conservation of European Wildlife and Natural Habitats 19.IX.1979, also known as The Bern Convention, and the Habitats Directive 92/43/EEC. In both instruments, some species are strictly protected whereas others are simply protected and their harvest needs to be justified. Culling and hunting are the tools most frequently applied by European Member States to manage conflicts with all species of large carnivores. In addition, the European Commission is increasingly requested to allow more national flexibility in the management of populations of large carnivores and to accept more derogation requests from Member States. However, scientific literature has demonstrated that lethal management has no or little effect or even counter-expected effects on the desired outcome (e.g. mitigate depredations) unless the carnivore population is reduced to such levels that are incompatible with the mandate of the Habitats Directive.

The second more common goal to justify the lethal management of a carnivore population is to increase human tolerance of the presence of carnivores and of depredations to livestock. Scientific literature has shown that hunting does not decrease the negative effects of low tolerance of carnivores (e.g. poaching). In fact the opposite happens.

The third more common goal to justify culling is to control a perceived carnivore over-population. The idea of "controlling" the population of a key-apex predator that is legally protected (Bern, Habitats Directive, and several state members normative) is out of place because of the population's ecological relevance and because such action is incoherent with scientific knowledge. Apex predators have unique traits that allow population auto-regulation, due to their behaviour and ecology. These important traits can be severely affected by perturbations like hunting and culling.

Scientific literature has shown that managing livestock is commonly presented as the most rationale, effective, fair and least controversial measure to decrease and prevent depredations, and thus mitigate conflicts. In addition, not only has scientific research been developed, but preventive measures and their efficiency have been proved and tested through EU funded programmes in different countries. Life Projects have been developed in order to conserve biodiversity and to disclose model methodologies that can be used in other areas that share common problems and issues. These projects are usually short-term (4-5 years) and geographically restricted. The dissemination of their results to other areas outside of the project's scope and the continuity of actions is crucial for conflict mitigation in the medium- and the long-term, when direct funding is no longer available. Furthermore, information about the outcomes of Life projects should be delivered by public conservation institutions in the EU countries where large carnivores are found.

Regarding damage compensation as a way to increase tolerance and the social acceptance of large carnivores in real or perceived conflict scenarios, scientific research has shown that compensation should be linked to clear compromises by the livestock herders to adequately manage the livestock. If this is noir the case, the system becomes unfair, socially unsustainable,and can lead to a vicious cycle of misleading management and conservation.

Another important step towards conflict mitigation is the engagement of stakeholders. Stakeholders (especially farmers, as this group is the one mainly affected by the presence of large carnivores) should have easy access to information and technical support to apply the best coexistence tools available. This support should be led by public institutions and by technicians with experience of large carnivore coexistence methods and husbandry practices.

At stakeholder meetings, every voice should be heard, but not every opinion can be taken into consideration by managers because perspectives on large carnivores are often incompatible. Thus, a fair method, based on objective arguments, biological and social sciences, ethical principles and on stakeholders' immediate interests, should be applied by decision makers. When management decisions are made, they must be transparent and clearly communicated to stakeholders and to citizens. We recommend a stakeholder management strategy and engagement that incorporates different interest groups, and their concerns and needs, but that ultimately relies on updated scientific recommendations and on legal obligations related to EU species conservation. Therefore, the management of large carnivores should in the future shift to an innovative model that integrates a science-based conservation and coexistence strategy, sustained by a science-backed scheme of public awareness, education and support to all stakeholders.

Other tools (social sciences, management of human behaviours and human activities, i.e. stock management, compensations, awareness) are useful and feasible alternatives to

mitigate and prevent livestock losses, raise public concern about conservation crisis and conflict mitigation, and reach a fair use of public resources and trust from citizens.

A helpful summary of the principles that should guide wildlife management decisions has been developed by a panel of 20 experts worldwide in control wildlife, including conflict mitigation (Dubois et al., 2017):

"*Efforts to control wildlife should begin wherever possible by altering the human practices that cause human–wildlife conflict and by developing a culture of coexistence; be justified by evidence that significant harms are being caused to people, property, livelihoods, ecosystems, and/or other animals; have measurable outcome-based objectives that are clear, achievable, monitored, and adaptive; predictably minimize animal welfare harms to the fewest number of animals; be informed by community values as well as scientific, technical, and practical information; be integrated into plans for systematic long-term management; and be based on the specifics of the situation rather than negative labels (pest, overabundant) applied to the target species. We recommend that these principles guide development of international, national, and local standards and control decisions and implementation*".

Finally, we recommend that the Member States and the European Commission increase the financial support to the scientific research on damage prevention. This would allow for a more efficient application of damage prevention methods in conservation projects (e.g Life Program), highly improving the sustainability and success of conservation actions regarding the four species of large carnivores.

REFERENCES

Álvares F (2011). Ecologia e conservação do lobo (Canis lupus, L.) no Noroeste de Portugal. PhD Thesis. Universidade de Lisboa, Portugal.

Álvares F, Barroso I, Espírito-Santo C, Ferrão da Costa G, Fonseca C, Godinho R, Nakamura M, Petrucci-Fonseca F, Pimenta V, Ribeiro S, Rio-Maior H, Santos N. (2015). Situação de referência para o Plano de Ação para a Conservação do Lobo-ibérico em Portugal. ICNF/CIBIO-INBIO/CE3C/UA. Lisboa. 67 pp.

Álvares F, Blanco JC, Salvatori V, Barroso I, Ribeiro S., (2014). Exploring traditional husbandry methods to reduce wolf predation on free-ranging cattle in Portugal and Spain. Large Carnivore Initiative for Europe. Final Report to the European Comission. 42 pp.

Apollonio M, Andersen R, Putman R. (2010).European Ungulates and their Management in the 21st Century. Cambridge University Press. Cambridge, UK.

Aronsson M, Persson J. (2016). Mismatch between goals and the scale of actions constraints adaptive carnivore management: the case of wolverine in Sweden. Animal Conservation 20(3):261-269. doi: 10.1111/acv.12310

Barkham P. (2017). "It's very scary in the forest": should Finland's wolves be culled?, The Guardian.https://www.theguardian.com/world/2017/feb/25/europe-wolf-population-finland-culling-protection

Bautista C, Nabes J, Revilla E, Fernández N, Albrecht J, Scharf AK, Rigg R, Karamanlidis A, Jerina K, Huber D. (2017). Patterns and correlates of claims for brown bear damage on a continental scale. *Journal of Applied Ecology* 54:282-292. http://dx.doi.org/10.1111/1365-2664.12708

Bautista C, Olszanska A, Berezowska-Cnota T, Fedyn H, Jastrzebski T, Agnieszka M, Nuria S.(2015). Compensations for brown bear damages in the Podkarpackie Voivodeship in 1999– 2014. Chronmy Przyrodez Ojczystaz, 71: 442–453 .

Blanco JC, Reig S, de la Cuesta L. (1992).Distribution, status and conservation problems of the wolf Canis lupus in Spain. Biol Conserv 60:73–80. doi: 10.1016/0006-3207(92)91157-N..

Boitani L, Ciucci P. (2009).Wolf Management across Europe: Species Conservation without Boundaries. In A New Era for Wolves and People: Wolf Recovery, Human Attitudes, and Policy: 15-39. Musiani, M., Boitani, L., and Paquet, P.(Eds.): University of Calgary Press.

Boitani L, Salvatori V. (2015). Piano di conservazione e gestione del lupo in Italia. Unione Zoologica Italiana, Roma.

Boitani, L, F. Alvarez, O, Anders, H, Andren, E, Avanzinelli, V, Balys, J. C, Blanco, U, Breitenmoser, G, Chapron, P, Ciucci, A, Dutsov, C, Groff, D, Huber, O, Ionescu, F, Knauer, I, Kojola, J, Kubala, M, Kutal, J, Linnell, A, Majic, P, Mannil, R, Manz, F, Marucco, Dm Melovski, A, Molinari, H, Norberg, S, Nowak, J, Ozolins, S, Palazon, H, Potocnik, P.-Y, Quenette, I, Reinhardt, R, Rigg, N, Selva, A, Sergiel, M, Shkvyria, J, Swenson, A, Trajce, M, Von Arx, M, Wolfl, U, Wotschikowsky, D, Zlatanova.. (2015). Key actions for Large Carnivore populations in Europe. Institute of Applied Ecology (Rome, Italy). Report to DG Environment, European Commission, Bruxelles. Contract no. 07.0307/2013/654446/SER/B3

Bradley et al. (2015). Effects of Wolf Removal on Livestock Depredation Recurrence and Wolf Recovery in Montana, Idaho, and Wyoming. The Journal of Wildlife Management; DOI: 10.1002/jwmg.948

Breitenmoser U, Breitenmoser-Wursten C, Okarma H, Kaphegyi T, Kaphegyi-Wallmann U, Muller UM. (2000). Action plan for the conservation of the Eurasian lynx in Europe (Lynx lynx). Council of Europe Nat. Environ. 112: 1– 69.

Bulte EH, Rondeau D. (2005). Why compensating wildlife damages may be bad for conservation. Journal of Wildlife Management, 69 (1): 14-19.

Cadete D, Pinto S. (2015). Towards a Wolf Conservation and Management Plan for Italy. Technical Review of the Italian Draft Plan on Wolf Conservation and Management compiled by Luigi Boitani and Valeria Salvatori (October 2015, Unione Zoologica Italiana) and Recommendations for future Actions. Commissioned by the Italian not for profit organisation LAV. 28 pp. + appendix.

Can OE, D'Cruze N, Garshelis D.L, Beecham J, Macdonald DW. (2014). Resolving human-bear conflict: a global survey of countries, experts, and key factors. Conservation Letters 7: 501–513.

Černe R, Majić Skrbinšek A, Bartol M, Jonozovič M, Angeli F., Bartol M., Blažič M, Bragalanti ., Groff C, Huber Đ, Jerina K, Krma P, Knauer F, Marinčič ., Molinari P, MolinariJobin A, Musil ., Pedrotti L, Rauer G, Reljić S., Sila A, Slijepčević V, Stoffella A, Vilfan M., Vivoda B, Wilson S. (2015). Guidelines for bear intervention groups. Guidelines prepared within A.1 action of the LIFE DINALP BEAR project (LIFE13 NAT/SI/000550): 23 pp.

Chapron G, Kaczensky P, et al. (2014). Recovery of large carnivores in Europe's modern human-dominated landscapes. Science 346, 1517–1519. http://dx.doi.org/10.1126/science.1257553.

Chapron G, Treves A. (2016). Blood does not buy goodwill: allowing culling increases poaching of a large carnivore.Proc. R. Soc. B 283: 20152939. http://dx.doi.org/10.1098/rspb.2015.2939

Darimont C. (2017). Science on its own can't dictate policy. Nature 551: 565.

Dubois, S., Fenwick, N., Ryan, E. A., Baker, L., Baker, S. E., Beausoleil, N. J., Carter, S., Cartwright, B., Costa, F., Draper, C., Griffin, J., Grogan, A., Howald, G., Jones, B., Littin, K. E., Lombard, A. T., Mellor, D. J., Ramp, D., Schuppli, C. A. and Fraser, D. (2017), International consensus principles for ethical wildlife control. Conservation Biology, 31: 753–760. doi:10.1111/cobi.12896

Eklund A, López-Bao JV, Tourani M, Chapron G, Frank J. (2017). Limited evidence on the effectiveness of interventions to reduce livestock predation by large carnivores. Scientific Reports, DOI:10.1038/s41598-017-02323-w.

Elfström M, Zedrosser A, Jerina K., Støen O-G, Kindberg J, Budic L, Swenson, JE. (2014). Does despotic behaviour or food search explain the occurrence of problem brown bears in Europe? The Journal of Wildlife Management 78(5):881–893. http://doi.org/10.1002/jwmg.727

Epstein Y. (2017). Killing Wolves to Save Them? Legal Responses to 'Tolerance Hunting' in the European Union and United States. Review of European Community and International and Environmental Law 26: 19-29. doi: 10.1111/reel.12188.

Epstein Y, López-Bao JV, and Chapron G. (2015). A Legal-Ecological Understanding of Favorable Conservation Status for Species in Europe. Conservation Letters 9: 81-88; doi: 10.1111/conl.12200

Estes JA, Terborgh J, Brashares JS, et al. (2011). Trophic Downgrading of Planet Earth. Science 333:301-306. doi: 10.1126/science.1205106.

Fernández-Gil A, Naves J, Ordiz A, Quevedo M, Revilla E & Delibes M. (2016). Conflict Misleads Large Carnivore Management and Conservation: Brown Bears and Wolves in Spain. Plos One. DOI:10.1371/journal.pone.0151541.

Fernández-Gil A, Naves J, Ordiz A, Quevedo M & Revilla E. (2017). Se recuperan los lobos (Canis lupus) en España?. Oral communication. XIII Congresso Sociedad Española para la Conservación y Estudio de los Mamíferos. 6-9 December 2017. Guadalajara. Spain.

Ferraro PJ, Kiss A. (2002). Direct payments to conserve biodiversity. Science 298: 1718–1719.

Fourli M. (1999). Compensation for Damage Caused by Bears and Wolves in the European Union: Experiences from LIFE-Nature Projects. Office for Official Publications of the European Communities, Luxembourg.

Fritts S, Mech L. (1981). Dynamics, movements, and feeding ecology of a newly protected wolf population in northwestern Minnesota. Wildlife Monographs 80: 1- 79.

Gervasi V, Brøseth H, Nilsen EB, Linnell JDC. (2015). Compensatory immigration counteracts contrasting conservation strategies of wolverines (*Gulo gulo*) within Scandinavia. Biol Conserv 191:632–639.

Gilroy JJ, Ordiz A, Bischof R. (2015). Carnivore Coexistence: Value the Wilderness. Science, 347; issue 6220: 382.

Helle T, Jaakkola L. (2008). Transitions in Herd Management of Semi-Domesticated Reindeer in Northern Finland. Annales Zoologici Fennici 45(2):81-101. https://doi.org/10.5735/086.045.0201

Herfindal I, Linnell JDC, Moa PF, Odden J, Austmo LB,Andersen R.(2005).Does recreational hunting of lynx reduce depredation losses of domestic sheep? Journal of Wildlife Management, 69, 1034–1042

Higginbottom K. (ed.). (2004). Wildlife Tourism. Impacts, Management and Planning. http://SustainableTourism.Publisher-Site.com. UniversityPress.com.

Räikkönen J, Vucetich J A, Vucetich L M, Peterson R O, Nelson M P. (2013). What the Inbred Scandinavian Wolf Population Tells Us about the Nature of Conservation. PLoS One. 2013; 8(6): e67218.

Jerina K, Krofel M, Mohorović M, Stergar M, Jonozovič M, Anthony S. (2015). Analysis of occurrence of Human-Bear conflicts in Slovenia and neighbouring countries. Action A.1: Analysis of the damage cases and bear intervention group interventions, preparation of guidelines for Intervention group protocols. Life DinalpBear.

Kaartinen S, Luoto M, Kojola I. (2009). Carnivore-livestock conflicts: determinants of wolf (Canis lupus) depredation on sheep farms in Finland. Biodivers Conserv 18: 3503. https://doi.org/10.1007/s10531-009-9657-8

Kaczensky P. (1999). Large carnivore depredation on livestock in Europe. Ursus 11: 59-72.

Kaczensky P, Chapron G, von Arx M, Huber D, Andrén H, Linnell J. (2012). Status, management and distribution of large carnivores – bear, lynx, wolf & wolverine – in Europe.

A Large Carnivore Initiative for Europe report prepared for the European Commission (contract 070307/2012/629085/SER/B3).

Karamanlidis AA, Sanopoulos A, Georgiadis L, Zedrosser A. (2011). Structural and economic aspects of human–bear conflicts in Greece. Ursus, 22: 141–151.

Karlsson J, Johansson O. (2010). Predictability of repeated carnivore attacks on livestock favours reactive use of mitigation measures. J. Appl. Ecol. 47: 166–171.

Kavcic I, Adamic M, Kaczensky P, Krofel M, Jerina K. (2013). Supplemental feeding with carrion is not reducing brown bear depredations on sheep in Slovenia. Ursus, 24: 111–119.

Krofel, M, Špacapan, M, Jerina, K. (2017). Winter sleep with a room service: denning behaviour of brown bears with access to anthropogenic food. J. Zool. http://dx.doi.org/10.1111/jzo.12421/full

Landa A, Lindén M, Kojola I. (2000). Action Plan for the Conservation of Wolverines (*Gulo gulo*) in Europe. Convention for the Conservation of European Wildlife and Natural Habitats, Strasbourg.

Linnell JDC, Swenson SE, Anderson R. (2001). Predators and people: conservation of large carnivores is possible at high human densities if management policy is favourable. Anim Conserv 4:345–349. doi: 10.1017/S1367943001001408.

Liukkonen T, Mykrä S, Bisi J, Kurki S. (2009). Conflicts and Compromises in Lynx Lynx lynx Conservation and Management in Finland. Wildlife Biology 15: 165–174.

Lopez-Bao JV, Mattisson J, Persson J, Aronsson M, Andren H. (2016). Tracking neighbours promotes the coexistence of large carnivores. Scientific Reports 6:23198.

Mabille G, Stien A, Tveraa T, Mysterud A, Broseth H, Linnell JDC. (2015) Sheep farming and large carnivores: what are the factors influencing claimed losses? Ecosphere 6: 1–17.

Marucco F, Boitani L.(2012). Wolf population monitoring and livestock depredation preventive measures in Europe. Hystrix 23(1): 1-4. doi:10.4404/hystrix-23.1-6364

Marucco F, McIntire EJB. (2010). Predicting spatio-temporal recolonization of large carnivore populations and livestock depredation risk: wolves in the Italian Alps. Journal of Applied Ecology, 47: 789–798. doi:10.1111/j.1365-2664.2010.01831.x

Mattisson J, Rauset GR, Odden J, Andren H, Linnell JDC, Persson J. (2016). Predation or scavenging? Prey body condition influences decision-making in a facultative predator, the wolverine. Ecosphere 7(8):e01407.

Meriggi A, Lovari S. (1996). A review of wolf predation in southern Europe: does the wolf prefer wild prey to livestock? Journal of Applied Ecology 33(6): 1561-1571. doi: 10.2307/2404794.

Milanesi P, Breiner F, Puopolo F, Holderegger R. (2017). European human-dominated landscapes provide ample space for the recolonization of large carnivore populations under future land change scenarios. Ecography 40: 1359–1368, doi: 10.1111/ecog.02223.

Ministerio de Agricultura, Alimentación y Medio Ambiente, MAGRAMA. (2016).Censo 2012-2014 de Lobo Ibérico en España. http://www.magrama.gob.es/es/biodiversidad/temas/inventarios-nacionales/censo_lobo_espana_2012_14_tcm7-414048.pdf

Nellemann C, Støen O-G, Kindberg J, Swenson JE, Vistnes I, Ericsson G, Katajisto J, Kaltenborne BP, Martin J, Ordiz A. (2007). Terrain use by an expanding brown bear

population in relation to age, recreational resorts and human settlements. Biol Conserv 138:157–165. doi: 10.1016/j.biocon.2007.04.011.

Nieminen M. (2010).The impact of large carnivores on the mortality of semi-domesticated reindeer (Rangifer tarandus tarandus L.) calves in Kainuu, southeastern reindeerherding region of Finland. Rangifer 30 (1): 79 – 88. doi: 10.7557/2.30.1.1218

Odden J, Linnell JDC, Fossland MP, Herfindal I, Kvam T, Andersen R. (2002). Lynx depredation on domestic sheep in Norway.Journal of Wildlife Management 66: 98–105

Ordiz A, Bischof R, Swenson JE. (2013). Saving large carnivores, but losing the apex predator? Biological Conservation, 168:128-133. doi: 10.1016/j.biocon.2013.09.024

Ordiz A, Støen OG, Delibes M, Swenson JE. (2011). Predators or prey? Spatio-temporal discrimination of human-derived risk by brown bears. Oecologia, 166: 59–67 .

Peebles KA, Wielgus RB ,Maletzke BT, Swanson ME. (2013). Effects of Remedial Sport Hunting on Cougar Complaints and Livestock Depredations. PLoSONE, 8:e79713.doi:10.1371/journal.pone. 0079713PMID:24260291 42..

Penteriani, V, del Mar Delgado, M, Pinchera F, Naves J, Fernández-Gil A, Kojola I, Härkönen S, Norberg H, Frank J, Fedriani JM. (2016). Human behaviour can trigger large carnivore attacks in developed countries. Scientific Reports 6:20552. doi: 10.1038/srep20552.

Penteriani V, LópezBao JV, Bettega C, Dalerum F, Delgado MDM, Jerina K,Ordiz A. (2017). Consequences of brown bear viewing tourism: A review. Biological Conservation 206:169–180. doi:10.1016/j.biocon.2016.12.035

Persson J, Rauset GR, Chapron G. (2015). Paying for an endangered predator leads to population recovery.*Conserv. Lett.* **8***:* 345–350. doi:10.1111/conl.12171.

Pimenta V, Barroso I, Boitani L, Beja P. (2017). Wolf predation on cattle in Portugal: assessing the effects of husbandry. Biological Conservation 207: 17-26. doi: https://doi.org/10.1016/j.biocon.2017.01.008

Ravenelle J, Nyhus PJ. (2017). Global patterns and trends in human–wildlife conflict compensation. Conservation Biology, 31(6): 1247–1256, doi: 10.1111/cobi.12948.

Rauset GR, Andren H, Swenson J, Samelius G, Segerstrom P, Zedrosser A, Persson J.(2015). National parks in northern Sweden as refuges for illegal killing of large carnivores. Conserv. Lett., doi: 10.1111/conl.12226

Rigg R, Find'o S, Wechselberger M, Gorman M, Sillero-Zubiri C, MacDonald D. (2011).Mitigating carnivore-livestock conflict in Europe: lessons from Slovakia 2011. Oryx, 45(2): 272–280. doi: 10.1017/S0030605310000074.

Ripple WJ, Estes JA, Beschta RL, et al. (2014). Status and Ecological Effects of the World's Largest Carnivores. Science 343:1241484. doi: 10.1126/science.1241484.

Salvatori, V, Mertens, A. (2012). Damage prevention methods in Europe: experiences from LIFE nature projects. Hystrix 23(1): 73-79.

Sand H, Wikenros C, Ahlqvist P, Strømseth T, Wabakken P. (2012). Comparing body condition of moose (Alces alces) selected by wolves (Canis lupus) and human hunters: consequences for the extent of compensatory mortality. Canadian Journal of Zoology 90: 403-412 http://doi.org/10.1139/z2012

Silva JP et al. (2013). *Life and human coexistence with large carnivores.* Publication Office of the European Union. Luxembourg. doi:10.2779./11477/

Soulé ME, Estes JA, Miller B, Honnold DL. (2015). Strongly Interacting Species: Conservation Policy, Management, and Ethics. Bioscience, 55(2): 168-176.

Stahl P, Vandel JM, Herrenschmidt V, Migot P. (2001). Predation on livestock by an expanding reintroduced lynx population: long term trend and spatial variability. J. Appl. Ecol. 38: 674–687.

Stahl P, Vandel JM, Ruette S, Coat L, Coat Y, et al. (2002). Factors affecting lynx predation on sheep in the French Jura. J. Appl. Ecol. 39: 204–216.

Steinfeld H, Gerber P, Wassenaar T, Castel V, Rosales M, De Haan C. (2006). Livestock's Long Shadow. FAO. Rome.

Swenson JE, Andren H. (2005). A tale of two countries: large carnivore depredation and compensation schemes in Sweden andNorway. People and Wildlife: Conflict or Coexistence? (eds: R Woodroffe, S Thirgood & A Rabinowitz), pp: 324–339. Cambridge University Press, New York.

Treves A, Kapp KJ, MacFarland DM. (2010). American black bear nuisance complaints and hunter take. Ursus, 21:30–42. 41.

Treves A, Krofel M, McManus J. (2016). Predator control should not be a shot in the dark. Front Ecol Environ 2016; 14(7): 380-388, doi:10.1002/fee.1312-

Treves A, Naughton-Treves L, Shelley V. (2013). Longitudinal Analysis of Attitudes Towards Wolves. Conservation Biology, 27(2): 315-323.

Vucetich JA, Bruskotter JT, Nelson MP, Peterson RO, Bump, JK. (2017). Evaluating the principles of wildlife conservation: a case study of wolf (Canis lupus) hunting in Michigan, United States. Journal of Mammalogy, 98(1):53–64. doi:10.1093/jmammal/gyw151.

Wabakken P, Sand H, Liberg O, Bjärvall A. (2001). The recovery, distribution, and population dynamics of wolves on the Scandinavian peninsula, 1978–1998. Can. J. Zool. 79: 710–725. doi: 10.1139/cjz-79-4-710.

Wallach AD, Ritchie EG, Read J, O'Neill, AJ. (2009). More than mere numbers: the impact of lethal control on the social stability of a top-order predator. PLoS ONE 4, e6861.

Wallach AD, Bekoff M, Nelson MP, Ramp D. (2015). Promoting predators and compassionate conservation. Conservation Biology. doi: 10.1111/cobi.12525

Wallach AD, Izhaki I, Toms JD, et al. (2015). What is an apex predator? Oikos 124: 1453–1461. doi: 10.1111/oik.01977.

Wam H. (2002). Wolf behaviour towards people - the outcome of 125 monitored encounters. Cand. scient thesis. Norwegian Agriculture University, Norway.

Widman M, Elofsson K. (2018). Costs of Livestock Depredation by Large Carnivores in Sweden 2001 to 2013. Ecological Economics 143: 188-198. https://doi.org/10.1016/j.ecolecon.2017.07.008

Wielgus RB, Peebles KA. (2014). Effects of Wolf Mortality on Livestock Depredations. PLoS ONE 9:e113505. doi: 10.1371/journal.pone.0113505.

Wikenros C, Sand H, Bergström R, Liberg O, Chapron G. (2015). Response of Moose Hunters to Predation following Wolf Return in Sweden. PLoS ONE 10(4): e0119957. https://doi.org/10.1371/journal.pone.0119957

ANNEX

European Parliament Petitions relevant to the report.

Petition 1771/2013 by Luis Miguel Dominguez Mencia (Spanish), on behalf of Lobo Marley, on Habitats directive.

Summary title: Petition 1771/2013 by Luis Miguel Dominguez Mencia (Spanish), on behalf of Lobo Marley, on Habitats directive

Petition Summary

The petitioner is looking for EP's support in declaring the Iberian wolf with its status as 'protected' among the species (also) north of the Duero River in Annex II and Annex IV of the Habitats Directive 92/43/EEC. While the wolf population seems to be protected in the region south of the Duero River it should equally be protected on its north side. He gives this 'regional departmentalisation' as an ill bureaucratic example which does not fit the reality of wolf population. While following administrative boundaries of the Spanish state the wolf becomes unprotected in some parts - those which are not part in Annexes of the Habitats Directive. The petitioner thus asks for: a) independent census of wolf population in the entire country (Spain), b) mapping it as a protected species throughout the Spanish territory, c) a national plan for wolf population, etc.

Petition No 0057/2017 by Sari Kantinkoski (Finnish) on behalf of the Tapiola Nature Conservation Union, on speeding up the complaint addressed to the Commission regarding the protection of the wolf (Canis Lupus) in Finland.

Summary title: Petition No 0057/2017 by Sari Kantinkoski (Finnish) on behalf of the Tapiola Nature Conservation Union, on speeding up the complaint addressed to the Commission regarding the protection of the wolf (Canis Lupus) in Finland

Petition Summary

The petitioner explains that the wolf is a native species in Finland and has been threatened in the 2000s. The species is listed in Annex IV of the Habitats Directive for outside of the reindeer preserve areas and in Annex V within the reindeer preserve areas. The wolf population grew in a relatively steady pace until 2007, when a control of population by hunting was introduced. Since then no growth in the population was achieved, the numbers stagnate around 200 individuals. The petitioner believes that the government's actions do not aim at long term protection as recommended in the Convention on the Conservation of European Wildlife and Natural Habitats Standing Committee (2012) opinion or in line with the Favourable Conservation Status defined in the Guidance document on the strict protection of animal species of Community interest under the Habitats Directive 92/43/EEC. In the recent 2 years altogether 106 wolves were killed based on different permits and quotas. Out of these animals 25 were confirmed (or potentially) reproductive alfa animals. The petitioner informs that the Nature Conservation Union of Tapiola addressed a complaint to the European Commission on 28 April 2016 concerning the failure of measures to protect wolves, after having used all legally available channels of redress at the national level. The petitioner adds that during the present hunting year so far there were already 36 wolves killed and permits are continuously issued. The petitioner also points out that the wolf population in Finland is so inbred that the widespread hunting activity reduces the diversity of the genetic pool and provides the threat of the wolf disappearing from Finland's nature. The petitioner concludes that government action is not sufficient for the protection of the wolf as the government has also not ratified international protection agreements (here the petitioner mentions the Bern

Convention on the Conservation of European Wildlife and Natural Habitats). The petitioner asks for the European Parliament's help to intervene with the European Commission for swift intervention for the cause of the protection of the wolf (Canis Lupus) in Finland.

Petition 0560/2016 by A.G.S (Spanish) on the management of wolf hunting south of the River Duero

Summary title: Petition 0560/2016 by A.G.S (Spanish) on the management of wolf hunting south of the River Duero

Petition summary

The petitioner discusses management planning for wildlife species such as the wolf in the Convention on the Conservation of European Wildlife and Natural Habitats and Directive 92/43/EEC. The directive differentiates the levels of protection afforded to this species within the Iberian Peninsular, around the River Duero: to the south of the river strict protection is required and to the north the species may be subjected to management measures. The petitioner asks that the term 'species management' does not become synonymous with hunting management.

Petition No 0984/2016 by Samuel Martin Sosa (Spanish) on wolves south of the River Duero

Summary title: Petition No 0984/2016 by Samuel Martin Sosa (Spanish) on wolves south of the River Duero

Petition Summary

The petitioner explains that the Parliament of Castile and Leon has approved a Non-Legislative Proposal (PNL) for the revision of the status of wolves south of the River Duero, which would legalise the hunting of the species where it is now strictly protected. The proposal to divest wolves of their protected status by classifying them as a 'manageable species' is in flagrant breach of the Habitats Directive, which provides for the strict protection of wolves south of the Duero and requires the achievement of favourable conservation status for the species. A change in legal status will not solve current conflicts with farmers, who will lose their right to financial assistance from the Castile and Leon regional government, for which they fought for many years. This funding acts as direct compensation for the damage caused to farmers' property by wolves south of the Duero. Should the wolves lose their status as a protected species, the farmers themselves would have to bear the cost of the losses. The petitioner calls on the European Parliament to continue to protect species south of the Duero and to repeal the laws whose provisions are at odds with EU legislation.

Petition No 0152/2017 by Marco Giovannelli (Italian) on behalf of Save our Wolves International, bearing 170.000 signatures, on the protection of the Italian wolf

Summary title: Petition No 0152/2017 by Marco Giovannelli (Italian) on behalf of Save our Wolves International, bearing 170.000 signatures, on the protection of the Italian wolf

Petition Summary

The petitioner denounces the "plan of conservation and management of the Italian wolf", recently proposed by the Italian Minister of environmental affairs. Such plan would eradicate the hybrids from the wild and the ecosystem. The petitioner exposes the irregularity of such plan and in particular the decision to manage a vulnerable species despite the lack of sound scientific data. He believes that such practices would contradict EU rules on the protection and conservation of vulnerable species. In the petitioner's view, the culling of a big carnivore

as the wolf, pure or hybrid, would affect the whole ecosystem. The petitioner calls upon the European Commission to investigate the issue and to take the necessary measures with the Italian authorities.

Petition No 2348/2014 by Adolf With (Germany) with two signatures regarding restrictions on the wolf population in Saxony (Germany)

Summary title: Petition No 2348/2014 by Adolf With (Germany) with two signatures regarding restrictions on the wolf population in Saxony (Germany)Petition Summary

The petitioners, being representatives of the hunting community, state that in recent years there has been an excessive increase in the population of wolves in Saxony, which may be harmful, in particular for livestock farmers. In this regard, they demand a reduction in the population of wolves by changing legislation regarding their protection. In particular, they request an amendment to the so-called 'Habitats Directive'. They demand introducing uniform standards for monitoring the population of wolves in the entire EU.

Petition No 0459/2015 by B.M. (Romanian) on ending bear hunting in Romania

Summary title: Petition No 0459/2015 by B.M. (Romanian) on ending bear hunting in Romania

Petition Summary

The petitioner, a Romanian national living in the United Kingdom, has appealed to a Scottish company which organises hunting and sports trips to various parts of Europe to stop bear hunting in Romania. According to the petitioner, the company's reply was highly offensive.

This study was commissioned by the European Parliament's Policy Department for Citizens' Rights and Constitutional Affairs at the request of the PETI Committee. This paper analyses the legal framework on large carnivores – brown bear (Ursus arctos), Eurasian lynx (Lynx lynx), wolf (Canis lupus), wolverine (Gulo gulo) - and their current management within the EU are presented. Additionally, the best coexistence methods obtained from research and EU-funded projects are compiled. A thorough analysis of the conditions for derogations under the Habitats Directive is followed by the implications of the current management. A general review and recommendations are made.

Print ISBN 978-92-846-2623-6| doi: 10.2861/17813| QA-02-18-135-EN-C
PDF ISBN 978-92-846-2624-3|doi : 10.2861/282578| QA-02-18-135-EN-N