



Sveriges lantbruksuniversitet  
Swedish University of Agricultural Sciences

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## **Increased public participation as a potential human – large carnivore conflict mitigation measure**

Ökat deltagande av allmänheten – ett sätt att minska konflikterna mellan rovdjur och människa

*Ruben Bloemsma*

**Examensarbete i ämnet biologi**

Department of Wildlife, Fish, and Environmental studies

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*Ruben Bloemsma*

**Supervisor:** Göran Ericsson, Dept. of Wildlife, Fish, and Environmental Studies

**Examiner:** Fredrik Widemo, Dept. of Wildlife, Fish, and Environmental Studies

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## Abstract

Large carnivores are species that have a great impact on their environment. They influence their prey population directly by killing animals, and indirectly by affecting their behavior (e.g., feeding, vigilance and distribution). They are also known to affect people through induction of fear and controversy resulting often in conflicts between stakeholders. The life of people that live close to large carnivores is affected by their presence every day. Recently, wildlife managers and scientists are recognizing more and more the importance of stakeholder participation and responsibilities in the management of large carnivores to reduce conflict potential. Stakeholder engagement in wildlife management can be implemented by two general approaches. The top-down approach, where stakeholder involvement in management decision making is low, and the bottom-up approach where this is high.

Several studies have addressed the theory that public participatory processes increase conflict resolution potential of large carnivore management. However, to date, there has been limited empirical evidence to confirm the claim that conservation conflicts can be resolved through effective or more public participation. Therefore, I have attempted to evaluate how effective an increase of public participation and responsibility in the management of the four large carnivores of Europe is in mitigating conflicts. As an indicator of whether conflict potential is high or low for a given country, I have used general attitudes toward the four large carnivore species. A meta – analytic approach was chosen for this study.

I have found an indication that the mean positive attitudes toward the brown bear seem to be higher than toward the wolf. In addition, for the brown bear I have found indications that the mean positive attitudes toward the species increases as stakeholder involvement increases. Whereas for the wolf I did find this indication for the general public, but not for the public within large carnivore area. On top of that I have found indications of a general trend regarding the changes in natural resource management for the chronological time course (from 1950 – 2016) for the brown bear, wolf, and lynx. The expert authority + passive receptive approach seems to have dominated until the 1990's. Starting from 2000, the transactional approach has emerged, indicating a general increase of stakeholder involvement of large carnivore management in Europe as time passes. The protection of the four large carnivores in Europe seems to have shifted from unprotected to protected over the years. For hunting regulation, a shift is visible from free to hunt and bounty hunts to no hunting at all. During the time periods of these changes, the Habitats Directive was implemented in Europe.

My results give an indication that attitudes are higher toward brown bears than toward wolves. This finding has been reported before. Suggested reasons behind this difference in attitudes are that wolves are more often perceived as a threat to livestock and competitor for big game, self-reported fear and concern for oneself and others, knowledge about the species, and the allowance of hunting bears, but not wolves. In addition, I have found an indication that attitudes toward wolves among the public within large carnivore area do not increase when public involvement in the wolf governance increases, in contradiction to my finding for the brown bear. I suggest three possible explanations for these findings. Firstly, it could be that the current way of stakeholder engagement and involvement for wolf management fails to succeed in mitigating conflicts. Secondly, it could be that European laws, like the Habitats Directive, could limit the implementation of certain inputs from stakeholders in wolf governance. Finally, I suggest that as long as rural cultural values and stakeholder identities are not taken into account by the governance system, attitudes toward large carnivores could remain the same regardless of the level of stakeholder engagement in large carnivore governance.

However, one should interpret my results and conclusions with extreme caution. My study suffers from a great attitude data deficit. This is the main limitation that makes interpretations of my results unreliable due to a high potential of biased results and a lack of statistical testing. Nevertheless, my study sheds a light on subjects that can be useful to investigate in future studies.

## 1. Introduction

Large carnivores are species that have a great impact on their environment. They influence their prey population directly by killing animals, and indirectly by affecting their behavior (e.g., feeding, vigilance and distribution). They are also known to affect people through induction of fear and controversy resulting often in conflicts between stakeholders (Linnell et al. 2000; Skogen et al. 2008; Linnell et al. 2010; Pellikka & Sandström 2011).

A good example of controversy between social groups in Europe due to large carnivores is the recovery of the wolf in southeastern Norway and the French Alps. The main stakeholders in this complex field are rural inhabitants, environmentalists, and urban elites or authorities. Their views collide when it comes to wolf recovery. Sheep farmers and hunters generally value economic and practical consequences. On the other hand, environmentalists and urban elites or authorities value the symbolic power of the wolf (as a symbol of unspoiled wilderness). However, the symbolic power of the wolf is perceived as a great threat imposed upon rural communities, it contradicts their own cultural values, and it is seen as an object of hegemonic and patronizing academic knowledge (Skogen et al. 2008).

In turn controversy can result from conflicts as well. As an example: lethal control or hunting is often used in an attempt to mitigate conflicts by empowering local people, to maintain traditional livestock herding activities or by keeping carnivore populations within desired limits. However, these mitigation methods arise controversy by themselves, because often conservationists feel that too many are being killed, animal right advocates believe that it is wrong to kill carnivores at all, whereas many rural social groups (like hunters and sheep farmers) feel that not enough carnivores are being killed (Linnell et al. 2010).

The life of people that live close to large carnivores is affected by their presence every day. Many different attempts have been made to classify the diversity of conflict types that have been associated with conservation in general and large carnivores in particular. I will give a brief description of five different conflict dimensions originating from Niemela et al. (2005) and Young et al. (2010), adapted and presented by Linnell (2013).

### 1.1.1. Substance:

Conflicts within this dimension concern with 'how things are', including the economic or material components of the conflict. European conflicts with large carnivores within this dimension has five general aspects:

The impact of predation on domestic livestock by large carnivores is experienced all across Europe. Depending on Livestock species and husbandry form, the extent of predation varies greatly (Kaczensky 1999). Predation on horses and cattle is less common, whereas sheep and goats are most exposed. Impacts experienced from predation include not only killed animals, but many are injured and there is a widespread claim that behavior of livestock is also influenced by the presence of predators (Linnell 2013). In the past livestock owners depended solely on their livestock for living. Therefore, efficient techniques for guarding livestock were necessary during former times. However, during the last decades where large carnivores have been absent, these traditions have been altered. Nowadays livestock owners are not as dependent on their livestock as before, and have not been guarding their livestock as efficient as before (Kaczensky 1999). Therefore, in these places husbandry methods need to be adapted and changed which may require additional and new tasks for the livestock breeders. However, generally support or acknowledgement is only there for the technical means (e.g. livestock guarding dogs, electric fences), but not for the additional workload. Economical loss is not the only impact, the loss of livestock is also perceived as indirect evidence from lacking respect from the society towards the farmer's job (often in favor of large carnivores) (Linnell 2013).

Predation on semi-domestic reindeer is of major importance in the Nordic countries, causing a real issue for Sami reindeer herders, for whom reindeer herding represents a major livelihood and cultural symbol. In arctic areas reindeer constitute the only potential prey for large carnivores (Nieminen & Leppäluoto 1988; Hobbs et al. 2012), creating a very complicated situation due to the fact that the persistence of wolverine and lynx at least requires that they predate reindeer. Within the context of the modern husbandry form, there are almost no effective measures to prevent predation on reindeer (Linnell 2013).

Competition for shared quarry by hunters and large carnivores is one of the conflict components between large carnivores and hunters. Carnivores can lead to reduced hunting bags, but the extent to which this competition is perceived or real varies widely with context (Melis et al. 2009; Gervasi et al. 2012). In addition, hunters often claim that the behavior of wild ungulates is influenced by the presence of predators, making hunting more time consuming. Furthermore, large carnivores may be attracted by the feed often used for supplementary feeding of wild ungulates, this is particularly the case for bears, which scare away the ungulates and consume the food (Linnell 2013).

The killing of dogs by wolves is highly variable across Europe. The environmental and behavioral factors that explain why it is not a problem in some areas, but is in others are not clear. The targets can be both dogs and hunting dogs kept close to houses and in villages (Kojola & Kuittinen 2002; Sidorovich et al. 2003; Karlsson & Jaxgård 2004). It can be a major conflict regardless of where it occurs (Skogen et al. 2006). The losses of dogs and hunting dogs are difficult to compensate due to the often strong emotional bond between a dog and his owner, and the many years of training invested into a good hunting dog (Linnell 2013).

Documentations on wolves and bear attacks, and kills, on people under special circumstances exist, however the actual danger of injury and death is so low that it is hardly worth quantifying (Swenson et al. 1999). The perception of this risk and fear is still widespread in many areas, especially where bears and wolves recolonize after long periods of absence, despite the fact that the objective risk is low. Fear increases for wolves due to the added dimension of being highly aggressive when infected with rabies (Linnell et al. 2002), and the perceived ability of wolves to spread parasites, like *Echinococcus* sp. (Romig et al. 2006).

#### 1.1.2. Knowledge and information:

Conflicts within this dimension concern 'how things are perceived' by the different stakeholders. The overarching core driving these conflicts is the fact that Europe is a diverse place, therefore there is not always a good mutual understanding of how different things are in different areas. Some parts of this conflict dimension are a result of a lack of knowledge and information about a certain topic. Scientific research has made rapid progress and it takes a long time before new scientific knowledge becomes general knowledge, also known as information deficit. For communicating the local experience of living with large carnivores to other stakeholders at larger spatial scales there are also challenges. As different people build their knowledge in different ways, knowledge is a complex topic. While lay people often build their knowledge through a compilation of personal and local experience or the experience of personal acquaintances, scientists construct their knowledge through field studies or by reading the works of many other scientists. While lay knowledge tends to focus to a great degree on the accumulation of anecdotes on which individual experience is based, scientific knowledge tends to disfavor the individual observation in favor of means and trends. Lay knowledge is often acquired in a specific place, whereas scientific knowledge usually is based on generalization and principles to areas beyond where it was produced. Due to the fact that knowledge is a source of power, and that management agencies often give greater weight to scientific knowledge, the struggles for power often entangles the conflicts over whose knowledge counts the most (Skogen et al. 2013). Large carnivores are

such charismatic and large species that many people will feel that they have valid knowledge (Linnell 2013).

#### 1.1.3. Values and norms:

This conflict dimension concerns the different things that people 'believe to be good or bad, or right or wrong'. Intense social conflicts can arise from this. These kinds of conflicts have a strong potential to arise from large carnivores because the animals themselves often trigger strong direct emotions, ranging from extreme admiration, love, and respect to hatred and fear. In general values and norms are slow to change in society, therefore it is important to take into account that the modern biodiversity agenda is relatively recent (Linnell 2013).

#### 1.1.4. Procedure:

The conflicts included in this dimension concern dissatisfaction or disagreement with the 'way things are done'. This is reflected by the relative distribution of power among actors and the perception of justice and is triggered by the establishment of administrative procedures or legislation. Various stakeholders clearly disagree with issues related to the process by which it was developed, the content of conservation legislation, or the way it is interpreted and implemented (or not implemented). The most important thing about legislation and procedures is that the implemented ones are at least perceived as being legitimate by all actors. In order to realize this as much as possible great demands are placed on ensuring that implementation is ensured in a logical and consistent manner with the understanding of all stakeholders, and that the process of developing procedures is conducted in an open and transparent manner (Linnell 2013). European conservation procedures and conservation legislation have been documented as being highly controversial in some settings among some stakeholder groups (e.g. Grozinska-Jurczak & Cent 2011; Hiedenpää 2011). This controversy originates from the fact that the new procedures come from far away, from a level that many rural people feel powerless to influence, and from the substance of it (e.g. land use restrictions and species protection) (Linnell 2013).

#### 1.1.5. Relationships:

The conflicts included in this dimension concern 'how people behave' and is really focused on the behavior of organizations or individual people in their interaction with each other. Even in the most professional organizations the outcome of many interactions is dependent on individual social and personality skills. The key factor in influencing the outcome of any interaction between stakeholders is trust. In order to build trust, time and stability is needed, however, this can be lost easily. Another important factor is the historical relationship between organizations and individuals. Unfortunately, one tendency is for individuals within organizations engaged in a conflict to adopt positions that are ever more polarized in an effort to raise their status within an organization. A great deal of the escalation that occurs can, in principle, be explained by this process of schismogenesis (Brox 2000; Linnell 2013)

### 1.2. Stakeholder engagement in large carnivore governance

Much effort has been spent on studying the conflicts dimension 'substance', and trying to reduce the level of conflict and controversy through mitigation of these conflicts (e.g. Linnell et al. 2002; Treves et al. 2002; Graham et al. 2005; Karlsson & Johansson 2010). However, recently wildlife managers and scientists are recognizing more and more the importance of stakeholder participation and responsibilities in the management of large carnivores (Pellikka and Sandström 2011; Eckerberg et al. 2015; Sjölander-Lindqvist et al. 2015; Young et al. 2016).

Stakeholder engagement in wildlife management can be implemented by two general approaches: top down and bottom up. The **top-down** approach implies that the wildlife management agency has the power to decide upon regulations and policies regarding wildlife management. In this

case it is assumed that they have expert knowledge and know what the 'right' goals are, and how they are to be achieved in the best way. It is a manager-client system, where managers decide for the clients. Stakeholders input is not actively sought for, but can be evaluated if the stakeholder finds a way to reach the management agency (Decker et al. 2012). The **bottom-up** approach implies that voluntary organizations may respond to a perceived environmental-management problem by creating a collaborative group that draws in government actors as participants (Eckerberg et al. 2015). As an example, in Finland and Sweden the management of large carnivores has been restructured from top-down, science-based and single function state agencies with a low degree of public involvement, to a more bottom up approach, with new models of governance, particularly decentralization. Decentralization means the reorganization of authority according to the principle of subsidiarity. In addition, an increase in the participation of regional stakeholders in formal policy processes has occurred. The process of decentralization and increase of participation of local stakeholders in Finland and Sweden is a result of influences from what has been defined as the 'deliberative turn' or even the 'paradigm shift' in environmental governance. These terms rest upon the perspective that broad participation by private and public actors in environmental decision-making will result in more effective and legitimate policy outcomes compared to traditional state-centered control management (Pellikka and Sandström 2011). However, the empowerment of stakeholders can result in conflict with the European Union. In 1992 the Habitats Directive entered in force, with the aim to promote the maintenance of biodiversity, taking account of social, cultural, economic and regional requirements. It forms the base of Europe's nature conservation policy together with the Birds Directive and establishes the EU wide Natura 2000 ecological network of protected areas, protected against developments that are potentially harmful (EU Environment 2016). Cases like Swedish wolf management in 2010 & 11 have collided with this directive. In these years two wolf hunts were allowed by the Swedish Environmental Protection Agency. As a result, Sweden faced the European Union Court on charges of not following the letter of the European Habitat Directive. This happened because shooting individuals in a population that is already highly inbred and shut off for migration is believed to impede the road to a favourable conservation status of the wolf in Sweden (Kaczensky et al. 2013; Chapron 2014).

When looked upon stakeholder engagement in more detail, six general governance approaches can describe the level of stakeholder engagement & responsibility in wildlife management, starting with the lowest level going up to the highest one:

#### 1.2.1. Expert authority approach:

This approach is as top-down as it can get, where wildlife managers take actions and make decisions unilaterally. This approach was the norm during times when managers served a narrow constituency (a group of people who support or authorize the efforts of others to act on their behalf) with whom they shared and identified values. This approach may be useful even nowadays when there are few groups of stakeholders and the stakeholders recognize that the experts share their values (Decker et al. 2012).

#### 1.2.2. Passive-receptive approach:

In this approach, managers only keep their ears and eyes open and note their observations. They do not seek stakeholder input systematically, but when there, it's welcomed. Stakeholders that take the initiative to make their views known are listened to, and their concerns are informally considered. How much weight is given to concerns voiced by stakeholders in the decision making is decided by the wildlife managers. Often other approaches are used together with the passive-receptive approach by wildlife management agencies (Decker et al. 2012).

### 1.2.3. Inquisitive approach:

When using this approach information about stakeholders is systematically searched for in order to inform an anticipated management decision. When evaluating programs that are in place (i.e., to refine goals or management policies, activities, or regulations), wildlife managers also reach out to stakeholders. Managers using this approach seek input from many members of each stakeholder group out of a broad array of stakeholders. Systematic surveys are employed to be more scientific in their efforts to understand stakeholders (Decker et al. 2012).

### 1.2.4. Intermediary approach:

Instead of only gaining information of stakeholder positions (via the inquisitive approach), the intermediary approach allows individual stakeholders to explain their opinion about certain matters. It is a two-way communicational approach, between the wildlife management agency and individual stakeholder groups. However, the dialogue among stakeholder groups is not allowed. The wildlife management agency acts as an intermediary in deciphering differences and similarities in stakeholder positions and interests. Often, managers regularly take part in one-on-one discussions at open-house-style public meetings, and attend scheduled meetings of stakeholder groups (Decker et al. 2012).

### 1.2.5. Transactional approach:

When managers want to engage stakeholders in a choice that must be made about how to prioritize different stakes, they take a transactional approach. Instead of the wildlife manager acting as an intermediary, the stakeholders describe their tasks to each other and collaborate to prioritize these stakes. This approach may even permit the stakeholders to make a binding decision within some bounds set by the wildlife management agency, but this depends on the policy of the agency, and the confidence of the wildlife manager. In the transactional approach wildlife managers have two important roles: to facilitate productive interactions between the stakeholders and the agency, and among the stakeholders. The participants in this process need not be formal representatives of interest groups organized to represent those stakes in a political sense, and the process should include people who reflect various key stakes in the wildlife management decision. The other role of wildlife managers in this approach is to ensure that stakeholders are well informed about socioeconomic and biological facts and legal considerations pertinent to the issue. This creates the groundwork for informed decisions and discussions (Decker et al. 2012).

### 1.2.6. Co-management:

Is defined as: 'a situation in which two or more social actors negotiate, define and guarantee amongst themselves a fair sharing of the management functions, entitlements, and responsibilities for a given territory, area, or set of natural resources'. This approach has been implemented in many developing countries where non-governmental organizations (often international) have interest in encouraging conservation and are willing to invest money and expertise, but the country itself does not have the institutional capacity to manage wildlife resources.

An important distinction between the co-managerial approach and the other approaches is that the other approaches are approaches in which wildlife management agencies grant a role to stakeholders in their decision-making processes. Stakeholders may have lesser or greater degrees of control over the decision, but it is the manager that decides how much that will be. In co-management, however, Wildlife management agencies must work in partnership with others because the authority and resources necessary for effective management are so fragmented. The authority, as well as the responsibility, for wildlife management is shared and specifics of these partnerships are negotiated on a case-by-case basis (Decker et al. 2012).



### 1.3. Aim of the project

Several studies have addressed the theory that public participatory processes increase conflict resolution potential of large carnivore management (Carpenter et al. 2000; Pellikka and Sandström 2011; Sjölander-Lindqvist et al. 2015). However, to date, there has been limited empirical evidence to confirm the claim that conservation conflicts can be resolved through effective or more public participation (Young et al. 2016). Therefore, I will attempt to evaluate how effective an increase of public participation and responsibility in the management of the four large carnivores of Europe is in mitigating conflicts. As an indicator of whether conflict potential is high or low for a given country, I have used general attitudes toward the four large carnivore species. General attitudes have little to do with specific behaviors. The more specific an attitude is towards behavior, the better it predicts the behavior. When an attitude measures the time, action, context, and target of the behavior, it better predicts the corresponding action. More general attitudes influence a greater variety of relevant behaviors but at weaker levels (Heberlein 2012). A meta – analytic approach was chosen for this study. This approach was chosen in order to avoid producing a project that lacks several research needs, identified by Dressel et al. 2012. Which include: a limited scope of most of the studies that have been conducted in Europe, both temporally and spatially. Therefore, providing only snapshots of information, failing to provide insights into long term changes that might have occurred over time. In addition, a limited geographical scope, providing little information on transnational trends within Europe. For my meta-analysis I have four research questions, which are:

1. What changes in natural resource management have allowed the restoration of the four large carnivores of Europe?
2. Does, per stakeholder group, the mean positive attitude toward a species change when the governance type in a country changes?

## 2. Methods

I included a total of 12 countries in my meta-analysis: Sweden, Norway, Finland, Germany, Poland, France, Spain, Italy, Switzerland, Slovakia, Croatia, and Slovenia. The selection is based on the current expansion of the wolf population in Europe. The wolf (*Canis lupus*) was chosen because it is the most widespread species out of the four large carnivores of Europe (wolf (*Canis Lupus*) brown bear (*Ursus arctos*), lynx (*Lynx lynx*), and wolverine (*Gulo gulo*)) (Deinet et al. 2013).

The data gathering and processing was done in five steps: 1) set up a framework for the systematic literature search, 2) conduct the literature search, 3) exclude irrelevant material, 4) extract the data, and 5) analyse the data.

The chosen timeframe was between 1950 – 2016. For each country, data on five different subjects were collected: protection, hunting regulations, governance structures, stage of re-appearance, and attitudes. Every article had to connect at least one of these subjects to one of the species, and countries. My literature search started by using three electronic databases: Web of Science, Scopus, and Pro-Quest. To avoid the risk of bias toward published studies I included grey literature in my analyses. This was necessary due to the fact that some relevant articles were not published in peer-reviewed journals (Dressel et al. 2014). I maximized the completeness of the database search according to the recommendations of Rosenthal (1991) in several ways: web sites of organizations that protect, study, or manage large carnivores in Europe were investigated, national social research institutes were contacted, and Web sites mentioning articles were located by using Web search engines. I scanned the reference list of identified articles to find previously unknown relevant articles, this process was repeated until no additional articles could be found. I searched the literature from March 2016 up to October 2016 and retrieved a total of 245 documents. Thereafter I scanned the documents in order to exclude irrelevant ones.

The exclusion criteria differed for each subject. Articles regarding protection and hunting regulations had to identify to what degree the species in a specified country was protected, and the type of hunting that was in place (table 1 & 2).

Table 1. Protection class definitions.

Class	Definition
Not protected	Hunting permitted year-round (Salvatori et al. 2002).
Partially protected	Depending on the geographical area within the country, the species is either protected or not.
Protected	Protected, with special permits being issued for cases of ‘problem individuals’ (Salvatori et al. 2002).
Fully protected	The species is not allowed to be hunted throughout the whole country (Salvatori et al. 2002).

Table 2. Hunting regulation class definitions.

Class	Definition
Bounty hunting	In return for killing individuals of the species a bounty, paid by locally raised taxes, is paid to the hunter (Linnell et al. 2010).
Open season	The species can be hunted during a certain season with no limited number.
Quota harvest	A certain number of animals are harvested annually (Caughley & Sinclair 1994).

Articles mentioning governance structures had to describe stakeholder and/or authority role in the large carnivore management decision making process. The articles concerning attitudes toward the four large carnivores had to describe quantitative surveys, and the attitude subject had to be the large

carnivore species (e.g. surveys measuring attitudes toward large carnivore conservation were excluded). The initial amount of 245 articles were screened according to the above mentioned criteria. A total of 102 were excluded after the screening process, leaving 143 documents left. Data was extracted from 44 attitude, 48 protection and hunting regulation, 35 type of governance, and 77 large carnivore stage of re-appearance investigating documents.

The extraction of the data was done using Microsoft Office Excel 2016. The coding for the articles regarding the subjects hunting regulations, governance structures, and distribution was done by reading the article and drawing conclusions based on the classification descriptions given in table 1, 2, and 3. Prior to coding the attitude articles, I noted per article the study design, general attitude question(s) asked in the survey, attitude object, included stakeholders, questionnaire design, sample size, response rates, sampling method, sampling frame, year of sampling, and country of interest. The possible answers per question were generally the same, in terms of like or dislike, agree or disagree etc., and were measured on bipolar rating scales with 3, 5, or 7 points. I condensed the results into a trichotomous scale in which the attitudes of the respondents were coded as negative, neutral, or positive. Often the surveys investigated the attitudes of multiple respondent groups, or were conducted at the national/regional level. In this case, the results for each group was coded and analyzed separately. The respondent (stakeholder) groups included in this survey are shown in table 3. After data extraction, the analysis started.

*Table 3. Stakeholder class definitions.*

Class	Definition (according to Dressel et al. 2014)
General public	Respondents of national samples.
Public within large carnivore area	Residents of an area where the species is permanently present and which were therefore selected for the study.
Farmers	Including shepherds. Livestock holders and cereal farmers.
Hunters	Hunters and gamekeepers.

For the analysis of the data, Microsoft office Excel and SPSS were used. Firstly, an overview of the types of governance, protection and hunting regulation versus the 10-year periods was created. This was done by analyzing frequencies in SPSS and copying the results in Excel tables. Since multiple classifications per variable were found, I decided to show per cell the least amount of classes that together (or alone) represented >50% of the total amount of classes found for that cell. For example, if in the column 'far away' for the variable 'Protection', the class 'Not protected' was found in >50% of all the classes found in that cell, it would be shown. To give an overview of the attitude data, I created several boxplots. In SPSS I created boxplots showing the mean positive attitude of general public and public within large carnivore area versus the species, and versus the types of governance. For the sample size of all the boxplots, I used an average per country. Thus, the number of samples equals the number of different countries with data for the specific variable.

### 3. Results

The first research question was: What changes in natural resource management have allowed the restoration of the four large carnivores of Europe?

As time passes, the protection and hunting regulation change from no protection and hunting, to full protection and no hunting (table 4). For the type of governance, the transactional approach emerges at the time period 2000-2009. The country specific tables are shown in appendix II.

Table 4. Types of governance, Protection, and Hunting regulation versus different time periods.

All countries + all species	Year						
	1950 - 1959	1960 - 1969	1970 - 1979	1980 - 1989	1990 - 1991	2000 - 2009	2010 - 2016
Types of governance	Expert authority + Passive receptive, n=10	Expert authority + Passive receptive, n= 11	Expert authority + Passive receptive, n=24	Expert authority + Passive receptive, n=26	Expert authority + Passive receptive, n=33	Expert authority + Passive receptive and Transactional, n=35	Expert authority + Passive receptive and Transactional, n=33
Protection	Not protected, n=21	Not protected and Protected, n=24	Not protected and Protected, n=27	Protected + Fully protected, n=35	Protected, n=37	Protected, n=32	Protected + Fully protected, n=34
Hunting regulation	Free to hunt and No hunting, n=20	Bounty, Free to hunt, and No hunting, n=23	Free to hunt, Open season, Quota, and No hunting, n=27	Quota and No hunting, n=35	No hunting, n=37	No hunting, n=32	No hunting, n=33

Regarding the type of governance, it is notable that for the brown bear in Italy it has been co-management since 1960 – 1969. For the other countries, an increase in stakeholder participation is visible starting from 1990 – 1999, which is also the year that the Habitats Directive was put into force (figure 1). Finland is the only country that has retracted from the transactional approach to the intermediary approach in the final time period of this study.

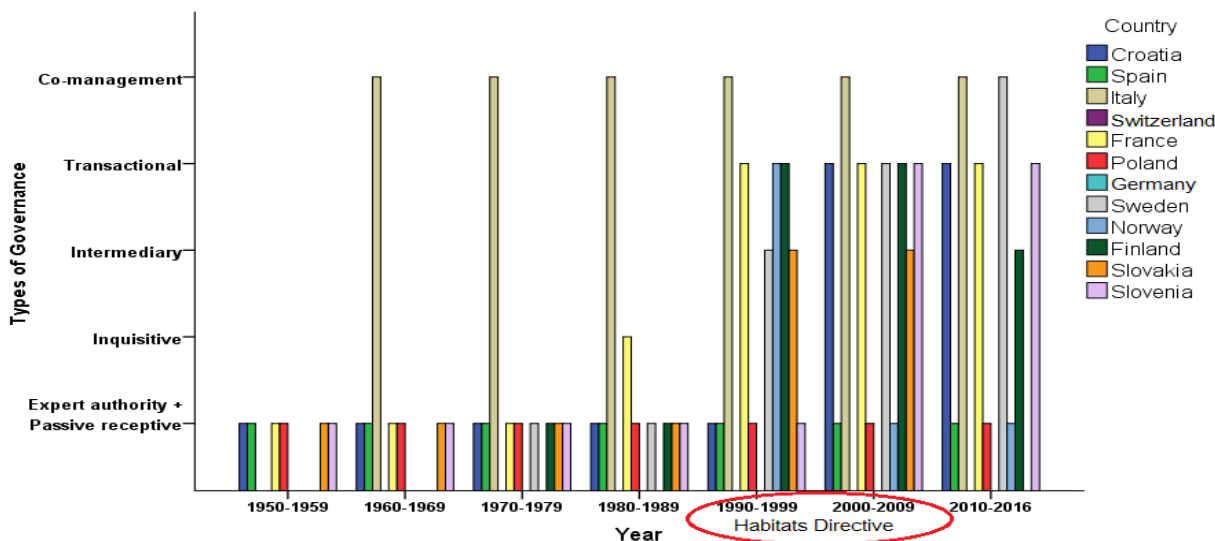


Figure 1. The type of governance versus 10-year time periods per country for the brown bear. The circle saying “Habitats Directive” shows the time periods over which the habitats directive was put into force in Europe

For the wolf the same increase in stakeholder participation is visible starting from the period 1990 – 1999 (figure 2).

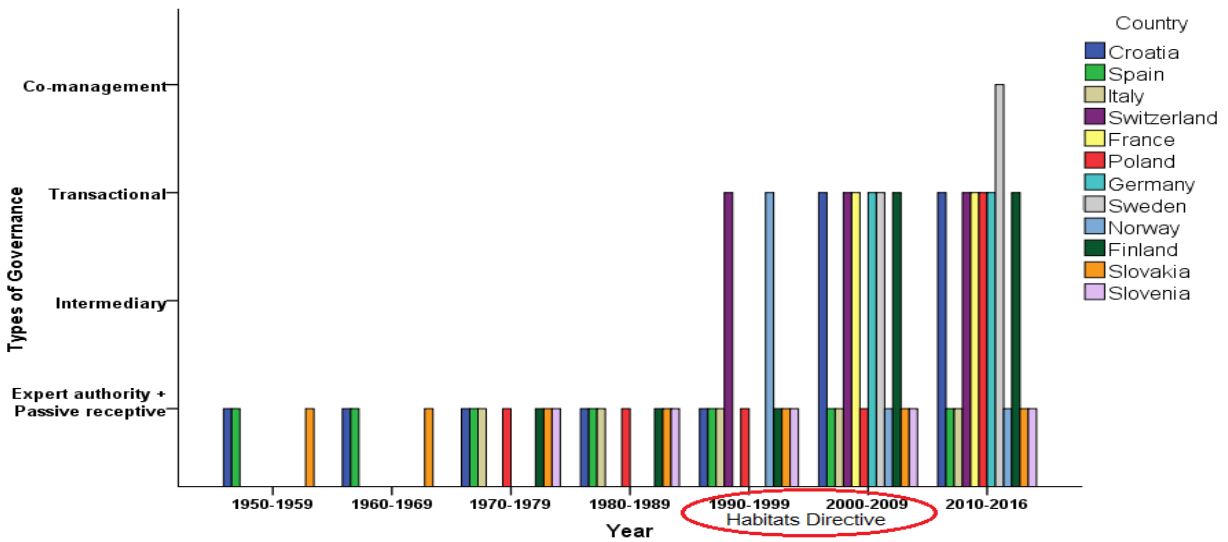


Figure 2. The type of governance versus 10-year time periods per country for the wolf. The circle saying “Habitats Directive” shows the time periods over which the habitats directive was put into force in Europe

The same is observed for the lynx (figure 3).

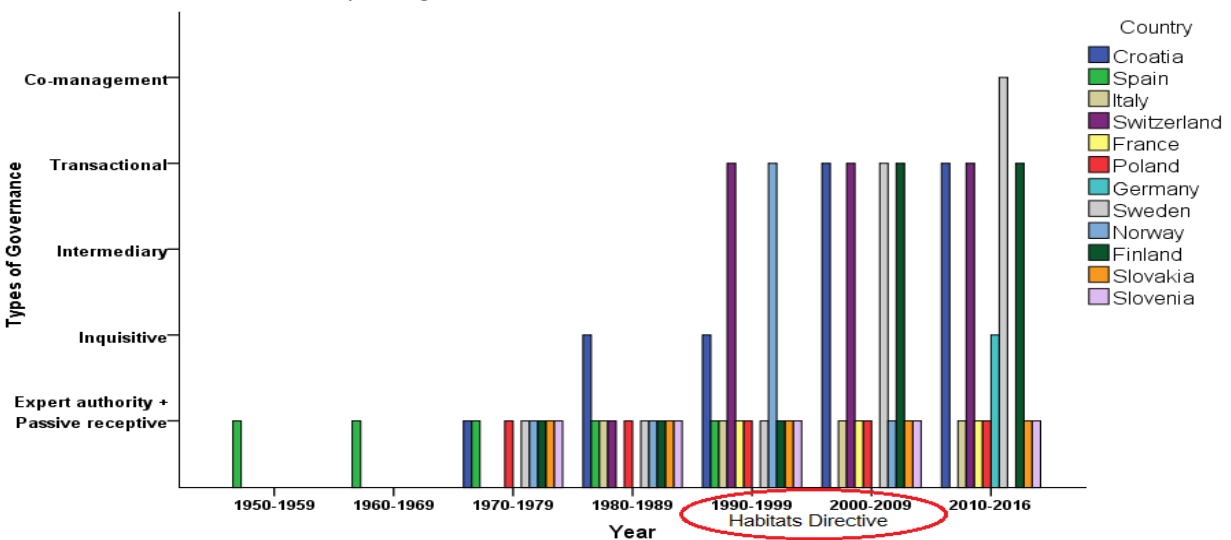


Figure 3. The type of governance versus 10-year time periods per country for the lynx. The circle saying “Habitats Directive” shows the time periods over which the habitats directive was put into force in Europe

Research question two was: Does, per stakeholder group, the mean positive attitude toward a species change when the governance type in a country changes?

For the brown bear, the attitudes of GP and PLCA are relatively equal, whereas for the wolf the mean of PLCA is lower. When comparing the brown bear and wolf, the brown bear tends toward a higher mean than the wolf for both stakeholder groups. Figure 4a & b show the mean positive attitude (%) of respectively the general public (GP) and the public within large carnivore area (PLCA) for each species. Since not enough relevant surveys investigating the attitude of the stakeholder groups hunters

and farmers, these groups are not shown. In addition, the wolverine and lynx are not shown due to a too small sample size.

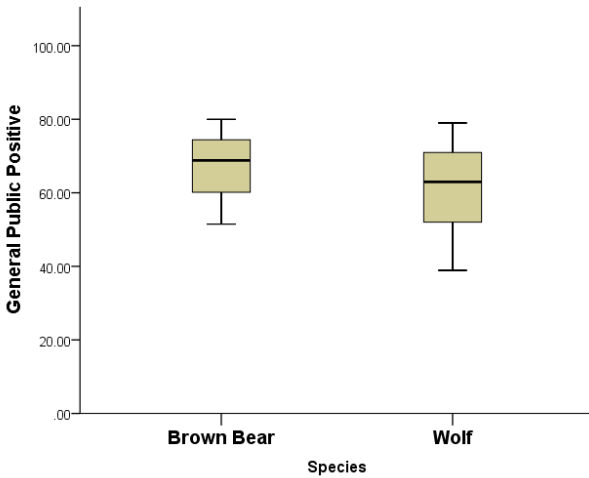


Figure 4a) The mean positive attitude (%) of the general public for each large carnivore species, n brown bear=3; wolf=5

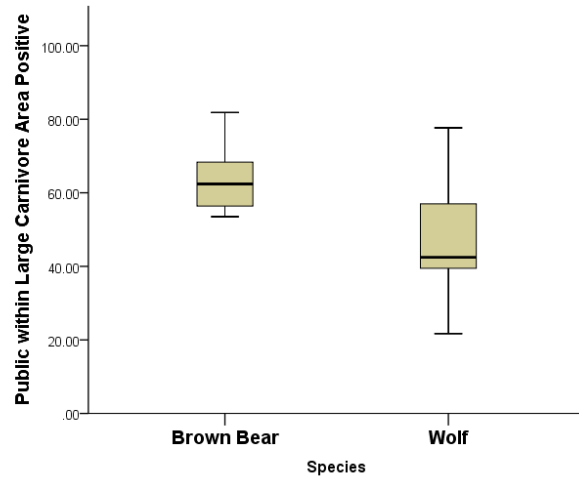


Figure 4b) The mean positive attitudes (%) of the public within large carnivore area for each species, n brown bear=6; wolf=9

The mean positive attitudes among the GP for exp. authority + passive receptive is lower than for transactional and co-management. For both stakeholders the co-management has a higher mean than the other types (figure 2a & b). Between the GP and PLCA the main difference is visible in the difference between the transactional approach, where attitudes for the wolf are lower among the PLCA than the GP, whereas for the brown bear this is not the case. No surveys were found that investigated attitudes of the GP for the types of governance: inquisitive, and intermediary. For the PLCA, this was the case for the inquisitive approach. The species wolverine and lynx are not shown due to a too small sample size.

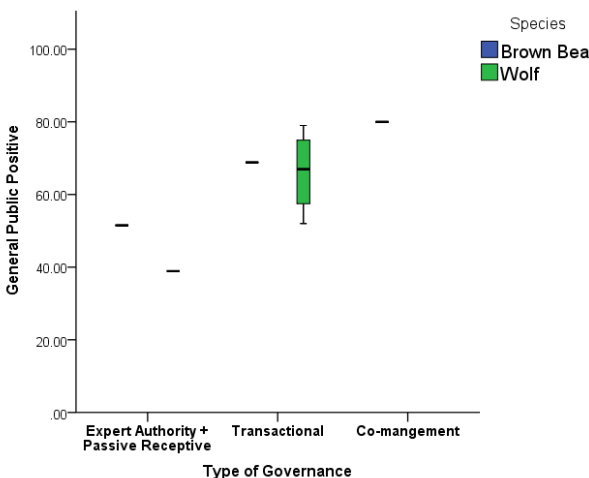


Figure 5a) The mean positive attitudes (%) of the general public towards the wolf and brown bear, per type of governance. n exp. auth. + pass. rec. wolf=1, brown bear=1; transactional wolf=4, brown bear=1; co-management=1.

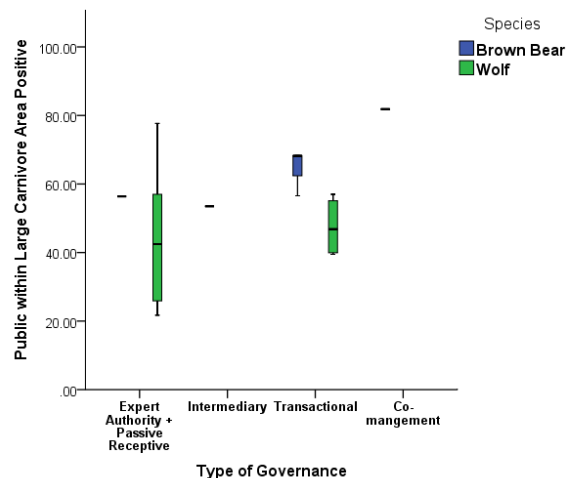


Figure 5b) The mean positive attitudes (%) of the public within large carnivore area towards the wolf and brown bear, per type of governance. n exp. auth. + pass. rec. wolf=5, brown bear=1; intermediary brown bear=1; transactional wolf=4, brown bear=3; co-management brown bear=1.

## 4. Discussion

I have found an indication that (especially for the public within large carnivore area) the mean positive attitudes towards the brown bear seem to be higher than toward the wolf. In addition, for the brown bear I have found indications that the mean positive attitudes toward the species increases as stakeholder involvement increases. Whereas for the wolf I did find this indication for the general public, but not for the public within large carnivore area. On top of that I have found indications of a general trend regarding the changes in natural resource management for the chronological time course (from 1950 – 2016) for the brown bear, wolf, and lynx. The expert authority + passive receptive approach seems to have dominated until the 1990's. Starting from 2000, the transactional approach has emerged, indicating a general increase of stakeholder involvement of large carnivore management in Europe as time passes. The protection of the four large carnivores in Europe seems to have shifted from unprotected to protected over the years. For hunting regulation, a shift is visible from free to hunt and bounty hunts to no hunting at all. During the time periods of these changes, the Habitats Directive was implemented in Europe.

My results give an indication that attitudes are higher toward brown bears than toward wolves (which is more apparent among the public within large carnivore area). This finding has been reported before (e.g. Røskaft et al. 2007; LIFE COEX 2008; Gilkman et al. 2012; Dressel et al. 2014). Suggested reasons behind this difference in attitudes are that wolves are more often perceived as a threat to livestock (LIFE COEX 2008) and competitor for big game, self-reported fear and concern for oneself and others are higher for wolves (Røskaft et al. 2007), knowledge about the species (more knowledge about bears lead to more positive attitudes toward bears) (Gilkman et al. 2012), and the allowance of hunting bears, but not wolves (Dressel et al. 2014).

I have found an indication that attitudes toward wolves among the public within large carnivore area do not increase when public involvement in the wolf governance increases, in contradiction to my finding for the brown bear. It is interesting that, in general, attitudes toward wolves seem to be more negative, and that they do not seem to increase when stakeholder participation increases. Even though scientists nowadays recommend to increase public involvement in large carnivore management to mitigating conflicts (Carpenter et al. 2000; Pellikka and Sandström 2011; Sjölander-Lindqvist et al. 2015; Young et al. 2016). I suggest three possible explanations for these findings.

Firstly, it could be that the current way of stakeholder engagement and involvement for wolf management fails to succeed in mitigating conflicts. Von Essen & Hansen 2015. have shown the need to critically diagnose the democratic deficits of the current stakeholder engagement and involvement model. They have analyzed a case study in the Swedish wolf management and illustrated how the stakeholder approach failed to mitigate the escalating conflict between citizens or increase legitimacy. Their aim was to determine what structural barriers in the stakeholder model led delegates to subordinate communicative attempts to systemic collaboration in their case study. Four barriers were identified:

1. A strong sense of accountability, by which, loyalty to delivering results in one's constituency and to one's employer discouraged delegates from engaging in dialogue that threatened changing their positions and thus risking a conflict between the will of the organization and one's personal will.
2. An overly purposive atmosphere whereby stakeholders that would refrain from questioning for fear of being wrong, tended to be excluded by the top-down, technocratic conduct of the county administrative board.
3. An over emphasis on a decision as a final outcome, that in turn didn't welcome reflection on important issues, and through which, the final decision functioned as mere accumulation of private interests that had been determined prior to the stakeholder meeting.

4. The stakeholders perceived an inability to influence, whereby some experienced that their work only consisted of re-phrasing Swedish Environmental Protection Agency's (SEPA) directives. Their article suggests that these democratic deficits prohibit the contestation and counsel necessary to legitimate conservation policy. As the wolf is, in general, a more controversial species than the brown bear (Skogen et al. 2008; Linnell 2013) the above mentioned suggestion might be applicable to wolf management, but not to brown bear management.

My other suggestion is that European laws, like the Habitats Directive, could limit the implementation of certain inputs from stakeholders in wolf governance. As can be seen in figure 1, 2, and 3 of my results, the years that the Habitats Directive was put into force were also the years that in many countries the governance systems changed to a higher level of stakeholder engagement. Therefore, the guidelines bestowed upon the studied countries by the Habitats Directive could directly affect the extent to which management actions can be implemented. I speculate that, out of the reasons I gave for why attitudes toward bears seemed to be higher than toward wolves, for the first four reasons (a perceived threat to livestock; competition with game; fear; knowledge) attempts have already been made by management agencies to solve these problems (Linnell 2013). Therefore, the other reason that is left (hunting), would be the main addition to wolf management by an increased stakeholder input. However, I have already explained in the introduction that the hunting of wolves is often not accepted by the Habitats Directive (Kaczensky et al. 2013). Thus, it could be that the options to accept and execute stakeholder input in wolf governance are very limited due to overarching legislative bodies such as the Habitats Directive.

Poaching is a widespread conservation problem for many species. The poaching of wolves in Sweden, for example, is believed to be responsible for approximately half of the total wolf mortality, greatly reducing population growth (Liberg et al. 2011). Where human-large carnivore conflicts are high, poaching has more potential to be present and accepted among the public (Gangaas et al. 2013). Therefore, poaching can reflect a negative attitude toward the species and high levels of conflicts experienced among some stakeholders. Gangaas et al. 2013 suggest that the main factors inducing conflicts associated with large carnivores in Scandinavia are rural cultural values and identity (e.g. sheep herder, big game hunter). Thus, I suggest that as long as the mentioned rural cultural values and stakeholder identities are not taken into account by the governance system, attitudes toward large carnivores could remain the same regardless of the level of stakeholder engagement in large carnivore governance.

However, one should interpret my results and conclusions with extreme caution. The limited data on attitudes toward large carnivores is a serious limitation to my study. Many articles regarding attitude surveys were written in other languages than English, making it difficult to implement in my study. In addition, I found many articles that measured the attitude towards different attitude subjects than the species. Instead, attitude objects like carnivore conservation, willingness to pay, or fear of large carnivores were also common. Thus, I have been unable to statistically test my results. Therefore, my study can give an impression of the studied subjects, but not definite results.

For the three species, brown bear, wolf, and lynx, the level of stakeholder participation in large carnivore governance seems to change as time passes. The expert authority + passive receptive approach dominated until the 1990's. Starting from 2000, the transactional approach has emerged, indicating a general increase of stakeholder involvement of large carnivore management in Europe as time passes. The protection of the four large carnivores in Europe seems to have shifted from unprotected to protected over the years. For hunting regulation, a shift is visible from free to hunt and bounty hunts to no hunting at all. I speculate that this change in natural resource management has occurred mainly due to the change in the way how humans perceive large carnivores in Europe. In general, the species were valued as pests until the mid-19<sup>th</sup> century, whereas, over time the intrinsic values of respecting the animals as a part of nature became more common. On top of that, the



realization that large carnivores are a species that can have a great impact on their ecological environment became apparent when ungulate species started to increase in areas with low carnivore abundance, damaging the forests more and more (Schwartz et al. 2013). Thus, when people started to realize that prosecuting the carnivores threatened their existence in Europe, and that they didn't want their populations to disappear entirely, protection of the species started to increase. In addition, several international and European laws (e.g. CITES, EU habitats directive, and the Bern convention) have stimulated the protection of the large carnivores in Europe (Linnell and Boitani 2011).

## 5. Conclusions & Recommendations

My study suffers from a great attitude data deficit as discussed before. This is the main limitation that makes interpretations of my results unreliable due to a high potential of biased results and a lack of statistical testing. However, my study sheds a light on interesting subjects that can be useful to investigate in future studies. I have found indications that, in general, attitudes toward brown bears are higher than toward wolves. In addition, I found indications that stakeholder engagement in wolf governance seems not to contribute to higher attitudes toward wolves among public within large carnivore area, which contrasts with brown bears. However, as explained before, one cannot accept these indications as reliable results. Therefore, I have several recommendations for future studies.

My recommendations for future studies are firstly to re-do a meta-analysis like this one where careful attention should be paid to maximizing the sample sizes for more reliable results. In addition, I recommend to repeat this kind of meta-analysis as time passes in order to determine trends in time. Secondly, large carnivore governance can be studied more thoroughly in how it deals with stakeholder engagement in order to determine how to achieve the maximal conflict mitigation potential. I suggest that, for this kind of studies, the question of how to account for cultural values and stakeholder identities forms an important aspect.

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## Appendix I

History of the species' extinction and re-establishment patterns in response to shifts in their management in Europe

The four large carnivores of Europe have persisted for several thousand years in landscapes that have been extensively transformed by human land use. However, through direct persecution by humans and indirect human exploitation of forests and wild ungulates, their distributions and densities have been constantly and dramatically impacted by humans. In general, the end of the 19<sup>th</sup> century and the beginning of the 20<sup>th</sup> century represented the downfall of Europe's large mammals and their forest habitats. From that time on, and mostly during the last 30 years, the fate of many large mammal populations has changed dramatically, as forest area has increased, wild ungulate populations have been restored, and many large carnivore populations have expanded.

The Grey wolf (*Canis lupus*) was once the world's most widely distributed animal. However, currently its range is more restricted due to severe persecution by humans due to fear of attack and predation of livestock. In Europe, wolves were still found in most areas towards the end of the 18<sup>th</sup> century, but during the 19<sup>th</sup> century wolf abundance decreased considerably due to the rise in human population. The decline of the species continued throughout the 20<sup>th</sup> century, especially during the Second World War. The wolf was present only in parts of southern and north-eastern Europe by the 1970s. However, due to increased legal protection and public acceptance, an increase in wild ungulate numbers, and subsequent natural dispersal, the wolf has regained much of its former territory. Presently it occurs in ten populations in a near continuous distribution from northern Ukraine to Finland, around the Carpathians, throughout the Balkan countries in Eastern Europe, along the Italian peninsula and the Alps, and Portugal and northern Spain, with smaller populations in southcentral Spain, across Poland and Germany, and in central Scandinavia. The species has started to spread into Western Europe and is expected to continue expanding its range. Therefore, the focus of wolf management ought to be mainly on mitigating conflicts between wolves and humans (Deinet et al. 2013).

The first appearance of the Eurasian lynx (*Lynx lynx*) in Europe was during the late Pleistocene, where it inhabited the Iberian Peninsula. The species has been in decline in Europe during the past 500 years, probably due to hunting pressure on both the lynx and its prey species, and deforestation. Survival occurred particularly in mountainous areas where habitat was left largely intact (e.g. the Carpathians; the Balkan Peninsula), in small fragmented populations. Most other populations declined significantly by the end of the 19<sup>th</sup> century. Over the past 50 years populations have more than quadrupled in abundance. This increase was made possible by reintroductions and translocations, legal protection, and natural recolonization. Globally an estimated number of 50,000 individuals exist. The European population (excluding Belarus, Ukraine and Russia) accounts for a minimum of 18% or 9,000-10,000 of these. The lynx in Europe can be found in 10 populations, of which the largest occur in Karelia (excluding Russia, 25%), the Carpathians (excluding Ukraine, 23%), Scandinavia (18%) and the Baltic (15%), all together accounting for about 81% of the European population. Most European populations are increasing or stable (Deinet et al. 2013).

The wolverine (*Gulo gulo*) used to be widespread in eastern Europe and Scandinavia, but declined in abundance and distribution from the mid-19<sup>th</sup> century due to intense human persecution. By the 1960's the species was considered functionally extinct in southern Norway, and by the end of the 20<sup>th</sup> century it had declined in Finland, Russia, and Sweden. Since then some protection was offered by legislation in Scandinavia, although in Norway extensive culling is still employed. In some countries recovery started from the 1970s due to legal protection, the implementation of a conservation performance payment system and natural recolonization. Currently the wolverine occupies over one third of its historical range, but expansion to vast available areas of suitable habitat is still limited by high levels of culling in some areas (Deinet et al. 2013).

The Brown bear (*Ursus arctos*) used to be widely distributed through Europe. They ranged over the entirety of the European continent except for large islands like Gotland, Corsica, Iceland and Sardinia. However, during the 19<sup>th</sup> century the populations in most European countries declined dramatically due to increased persecution and widespread deforestation. Since then the population sizes have increased in Europe due to legislation, education and species management. Currently the species occurs mainly in mountainous and inland forested areas with low human activity (Deinet et al. 2013).

## Appendix II

Country specific tables showing the type of governance, protection, and hunting regulation versus the 10-year period.

Croatia + all species	Year						
	1950 - 1959	1960 - 1969	1970 - 1979	1980 - 1989	1990 - 1991	2000 - 2009	2010 - 2016
Types of governance	Expert authority + Passive receptive, n=2	Expert authority + Passive receptive, n=2	Expert authority + Passive receptive, n=3	Expert authority + Passive receptive, n=3	Expert authority + Passive receptive, n=3	Transactional, n=3	Transactional, n=3
Protection	Not protected, n=3	Not protected, n=3	Not protected, n=3	Not protected, Game species, and Fully protected, n=3	Protected, n=3	Protected, n=3	Protected, Game species, and Fully protected, n=3
Hunting regulation	Bounty, Open season, and No hunting, n=3	Bounty, Open season, and No hunting, n=3	Bounty, Free to hunt, and Open season, n=3	Bounty, Quota, and No hunting, n=3	Quota, n=3	Quota, n=3	Quota, n=3

Spain + all species	Year						
	1950 - 1959	1960 - 1969	1970 - 1979	1980 - 1989	1990 - 1991	2000 - 2009	2010 - 2016
Types of governance	Expert authority + Passive receptive, n=3	Expert authority + Passive receptive, n=3	Expert authority + Passive receptive, n=3	Expert authority + Passive receptive, n=3	Expert authority + Passive receptive, n=3	Expert authority + Passive receptive, n=2	Expert authority + Passive receptive, n=2
Protection	Not protected + Fully Protected, n=2	Not protected + Fully Protected, n=2	Fully protected, n=2	Fully protected, n=3	Fully protected, n=3	Fully protected + Partially protected, n=2	Fully protected + Partially protected, n=2
Hunting regulation	Free to hunt + No hunting, n=2	Free to hunt + No hunting, n=2	No hunting, n=2	No hunting, n=3	No hunting, n=3	Quota + No hunting, n=2	Quota + No hunting, n=2

Italy + all species	Year						
	1950 - 1959	1960 - 1969	1970 - 1979	1980 - 1989	1990 - 1991	2000 - 2009	2010 - 2016
Types of governance		Co-management, n=1	Expert authority + Passive receptive and Co-management, n=2	Expert authority + Passive receptive, n=3	Expert authority + Passive receptive, n=3	Expert authority + Passive receptive, n=3	Expert authority + Passive receptive, n=3
Protection	Fully protected, n=1	Fully protected, n=1	Fully protected, n=2	Fully protected, n=3	Fully protected, n=3	Fully protected, n=1	Fully protected, n=3
Hunting regulation	No hunting, n=1	No hunting, n=1	No hunting, n=2	No hunting, n=3	No hunting, n=3	No hunting, n=1	No hunting, n=3

Switzerland + all species	Year						
	1950 - 1959	1960 - 1969	1970 - 1979	1980 - 1989	1990 - 1991	2000 - 2009	2010 - 2016
Types of governance				Expert authority + Passive receptive, n=1	Transactional, n=2	Transactional, n=2	Transactional, n=2
Protection		Protected, n=1	Protected, n=1	Protected, n=3	Protected, n=2	Protected, n=2	Protected, n=3
Hunting regulation		No hunting, n=1	No hunting, n=1	No hunting, n=3	No hunting, n=2	No hunting, n=2	No hunting, n=3



France + all species	Year						
	1950 - 1959	1960 - 1969	1970 - 1979	1980 - 1989	1990 - 1991	2000 - 2009	2010 - 2016
Types of governance	Expert authority + Passive receptive, n=1	Expert authority + Passive receptive, n=1	Expert authority + Passive receptive, n=1	Inquisitive, n=1	Expert authority + Passive receptive and Transactional, n=2	Transactional, n=3	Transactional, n=3
Protection	Game species, n=1	Game species, n=1	Protected, n=1	Protected + Fully protected, n=2	Protected, n=3	Protected, n=3	Protected, n=3
Hunting regulation	No hunting, n=1	No hunting, n=1	No hunting, n=1	No hunting, n=2	No hunting, n=3	No hunting, n=3	No hunting, n=3

Poland + all species	Year						
	1950 - 1959	1960 - 1969	1970 - 1979	1980 - 1989	1990 - 1991	2000 - 2009	2010 - 2016
Types of governance	Expert authority + Passive receptive, n=1	Expert authority + Passive receptive, n=1	Expert authority + Passive receptive, n=3	Expert authority + Passive receptive, n=3	Expert authority + Passive receptive, n=3	Expert authority + Passive receptive, n=3	Expert authority + Passive receptive, n=3
Protection	Protected, n=3	Protected, n=3	Protected, n=3	Protected, n=3	Protected, n=3	Protected, n=3	Fully protected, n=3
Hunting regulation	Free to hunt and No hunting, n=2	Free to hunt and No hunting, n=2	Open season, Quota, and No hunting, n=3	Open season, Quota, and No hunting, n=3	No hunting, n=3	No hunting, n=3	No hunting, n=3

Germany + all species	Year						
	1950 - 1959	1960 - 1969	1970 - 1979	1980 - 1989	1990 - 1991	2000 - 2009	2010 - 2016
Types of governance						Transactional, n=1	Inquisitive and Transactional, n=2
Protection			Partially protected, n=2	Fully protected and Partially protected, n=2	Fully protected, n=1	Fully protected, n=2	Fully protected, n=2
Hunting regulation			Free to hunt, n=2	Open season and No hunting, n=2	No hunting, n=1	No hunting, n=1	No hunting, n=2

Sweden + all species	Year						
	1950 - 1959	1960 - 1969	1970 - 1979	1980 - 1989	1990 - 1991	2000 - 2009	2010 - 2016
Types of governance			Expert authority + Passive receptive, n=2	Expert authority + Passive receptive, n=2	Expert authority + Passive receptive, n=3	Transactional, n=4	Co-management, n=4
Protection	Not protected and Game species, n=2	Protected, Game species, and Fully protected, n=3	Protected, Game species, and Fully protected, n=3	Protected, Game species, Fully protected, and Partially protected, n=4	Protected, n=4	Protected, n=4	Protected, n=3
Hunting regulation	Free to hunt and Open season, n=2	No hunting, n=3	No hunting, n=3	Open season, Quota, and No hunting, n=4	Quota and No hunting, n=4	Quota and No hunting, n=4	Quota, n=3

Norway + all species	Year						
	1950 - 1959	1960 - 1969	1970 - 1979	1980 - 1989	1990 - 1991	2000 - 2009	2010 - 2016
Types of governance			Expert authority + Passive receptive, n=1	Expert authority + Passive receptive, n=1	Transactional, n=4	Expert authority + Passive receptive, n=4	Expert authority + Passive receptive, n=3
Protection	Not protected, n=3	Not protected, n=3	Not protected and Protected, n=4	Not protected and Protected, n=4	Protected, n=4	Protected, n=3	Protected, n=3
Hunting regulation	Bounty, n=3	Bounty, n=3	Bounty, Free to hunt, and No hunting, n=4	No hunting, n=4	Quota, and No hunting, n=4	Quota, n=3	Quota, n=3

Finland + all species	Year						
	1950 - 1959	1960 - 1969	1970 - 1979	1980 - 1989	1990 - 1991	2000 - 2009	2010 - 2016
Types of governance			Expert authority + Passive receptive, n=3	Expert authority + Passive receptive, n=3	Expert authority + Passive receptive and Transactional, n=4	Transactional, n=4	Transactional, n=3
Protection	Not protected, n=3	Not protected, n=4	Not protected, Protected, and Partially protected, n=4	Protected and Partially protected, n=4	Protected, n=4	Protected, n=4	Protected, n=3
Hunting regulation	Free to hunt, n=3	Bounty, Free to hunt, Open season, and No , n=4	Free to hunt, Open season, and No hunting, n=4	Free to hunt, Open season, and Quota, n=4	Open season, Quota, and No hunting, n=4	Open season, Quota, and No hunting, n=4	Quota and No hunting, n=3

Slovakia + all species	Year						
	1950 - 1959	1960 - 1969	1970 - 1979	1980 - 1989	1990 - 1991	2000 - 2009	2010 - 2016
Types of governance	Expert authority + Passive receptive, n=2	Expert authority + Passive receptive, n=2	Expert authority + Passive receptive, n=3	Expert authority + Passive receptive, n=3	Expert authority + Passive receptive, n=3	Expert authority + Passive receptive, n=3	Expert authority + Passive receptive, n=2
Protection	Not protected and Game species, n=2	Not protected and Game species, n=2	Not protected and Protected, n=2	Protected, n=2	Protected, n=3	Fully protected, n=3	Protected, Fully protected, and Partially protected, n=3
Hunting regulation	Bounty and No hunting, n=2	Bounty and Quota, n=2	Bounty and Quota, n=2	Open season and Quota, n=2	Open season, n=3	No hunting, n=3	No hunting, n=3

Slovenia + all species	Year						
	1950 - 1959	1960 - 1969	1970 - 1979	1980 - 1989	1990 - 1991	2000 - 2009	2010 - 2016
Types of governance	Expert authority + Passive receptive, n=1	Expert authority + Passive receptive, n=1	Expert authority + Passive receptive, n=3	Expert authority + Passive receptive, n=3	Expert authority + Passive receptive, n=3	Expert authority + Passive receptive, n=3	Expert authority + Passive receptive, n=3
Protection	Fully protected, n=1	Partial protected, n=1	Protected and Partially protected, n=2	Protected and Partially protected, n=2	Protected, n=3	Protected, n=3	Protected, n=3
Hunting regulation	No hunting, n=1	Free to hunt, n=1	Free to hunt and Quota, n=2	Free to hunt and Quota, n=2	Quota, n=3	Quota, n=3	No hunting, n=3

## Appendix III

Reference list of literature used in the meta-analysis.

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