WOLF MANAGEMENT THROUGH STAKEHOLDER INVOLVEMENT IN GERMANY

Master Thesis

A comparative analysis of funding schemes to reduce and prevent extra economic burdens for livestock owners posed by wolves

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DECLARATION OF AUTHORSHIP

Hiermit erkläre ich, dass ich die vorliegende Arbeit selbstständig und eigenhändig sowie ohne unerlaubte fremde Hilfe und ausschließlich unter Verwendung der aufgeführten Quellen und Hilfsmittel angefertigt habe.

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ABSTRACT

With growing wolf populations in Germany, compensatory damages is a common means for coping with additional economic burdens posed to livestock herders. Since their effectiveness is largely criticised when solely implemented, it is highly relevant to combine this financial instrument with an incentive to reduce wolf depredation on livestock. It is therefore commonly endorsed to subsidise prevention measures. This thesis analyses how the federal states in Germany have implemented these economic schemes. The existing federal management plans and funding guidelines reveal differences which could be judged based on scientific knowledge and an online research on the current proceedings. Requirements have been derived for how to shape these regulations best under the consideration of four stages of wolf occurrence. Therefore, each federal state's compliance could be evaluated. Results show that Saxony implemented the most advanced regulations for reducing and preventing extra economic burdens for livestock owners, being exemplary for federal states with reproducing wolf packs. Rhineland-Palatinate, however, overtakes this performance as a federal state with less, only transmigrating wolves, which supports the idea of proactive management. The overall compliance with the required aspects of implementation is rather unsatisfying regarding the fact that they have been derived from management practices already existing. Transboundary management has not yet achieved consistency stressing the need for national guidance.

Mit einer wachsenden Wolfspopulation stellen Kompensationszahlungen eine herkömmliche Methode dar, um die zusätzliche finanzielle Last für Nutztierhalter auszugleichen. Da die Effektivität dieses Instruments allein stark kritisiert wird, ist es notwendig es mit Anreizen zu kombinieren, Angriffe von Wölfen auf Nutztiere zu vermeiden. Die Förderung von Präventionsmaßnahmen wird zu diesem Zweck als eine wirkungsvolle Methode angesehen. In dieser Masterarbeit werden die Richtlinien der Bundesländer verglichen. Die Managementpläne und Richtlinien der Bundesländer weisen starke Unterschiede auf, die nach wissenschaftlichen Erkenntnissen und durch eine Internetrecherche der aktuellen Geschehnisse beurteilt werden können. Anforderungen wurden definiert, wie die Richtlinien bestmöglich ausgestaltet werden können unter der Berücksichtigung vier unterschiedlicher Stufen des Wolfsvorkommens. Somit konnte die Übereinstimmung der Bundesländer mit den Anforderungen evaluiert werden. Sachsen implementierte danach die fortschrittlichsten Richtlinien zur Minderung und Vermeidung von durch den Wolf verursachten wirtschaftlichen Belastungen für Nutztierhalter. Es stellt damit ein vorbildliches Beispiel für Bundesländer mit reproduzierenden Wolfsrudeln dar. Jedoch nimmt Rheinland-Pfalz einen überholenden Platz ein, da hier zurzeit nur durchziehende Wölfe vorkommen, was das Konzept eines proaktiven Managements unterstützt. Die Umsetzung der Anforderungen aller Bundesländer ist jedoch nicht zufriedenstellend, da diese von bereits existierenden Praktiken abgeleitet wurden. Grenzübergreifende Zusammenarbeit hat somit nicht zu einer Stringenz geführt, was die Notwendigkeit einer nationalen Koordination unterstreicht.

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LIST OF ABBREVIATIONS

ALFF	Amt für Landwirtschaft und Flurneuordnung
BfN	Bundesamt für Naturschutz
BMUB	Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit *(Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety)*
BNatSchG	Bundesnaturschutzgesetz *(Federal Nature Conservation Act)*
COEX	Improving coexistence of large carnivores. and agriculture in Southern Europe
EC	European Commission
ELER	European Agricultural Fund for Rural Development
EU Platform	EU Platform on Coexistence between People and Large Carnivores
EU	European Union
FCS	favourable conservation status
HMUKLV	Hessisches Ministerium für Umwelt, Klimaschutz, Landwirtschaft und Verbraucherschutz
IFAW	International Fund for Animal Welfare
LANUV	Landesamt für Natur, Umwelt und Verbraucherschutz Nordrhein-Westfalen
LCIE	Large Carnivore Initiative for Europe
LfU	Landesamt für Umwelt
LGD(s)	Livestock guarding dog(s)
LIFE	EU financial Instrument for the Environment
LU	Ministerium für Landwirtschaft, Umwelt und Verbraucherschutz,
LUGV	Landesamt für Gesundheit und Verbraucherschutz Brandenburg
MELUR	Ministerium für Energiewende, Landwirtschaft, Umwelt und ländliche Räume des Landes Schleswig-Holstein
MLR	Ministerium für Ländlichen Raum, Ernährung und Verbraucherschutz
MLU	Ministerium für Landwirtschaft und Umwelt des Landes Sachsen-Anhalt
MLUL	Ministerium für Umwelt, Gesundheit und Verbraucherschutz des Landes Brandenbrurg
MU	Niedersächsisches Ministerium für Umwelt, Energie und Klimaschutz
MULEWF	Ministerium für Umwelt, Landwirtschaft, Ernährung, Weinbau und Forsten Rheinland-Pfalz
MUV	Ministerium für Umwelt und Verbraucherschutz Saarland
NABU	Naturschutzbund Deutschland
NGO(s)	non-governmental organisation(s)
NLWKN	Niedersächsischer Landesbetrieb für Wasserwirtschaft, Küsten- und Naturschutz
RDP	rural development programmes

SMUL	Sächsisches Staatsministerium für Umwelt und Landwirtschaft
StMUV	Bayerisches Staatsministerium für Umwelt, Gesundheit und Verbraucherschutz
TMUEN	Thüringer Ministerium für Umwelt, Energie und Naturschutz
WWF	World Wildlife Fund

1. INTRODUCTION

The grey wolf (*Canis lupus*) is returning to central Europe after having been eradicated 150 years ago (Reinhardt *et al.* 2013). One of the related positive impacts on the environment is the improved ecosystem functionality related to the predator-prey dynamics (IUCN 2008). Wolves cause a better spatial distribution and a stock reduction of hoofed game having a positive impact on the quality of forests and fields (SMUL 2014; LU 2010). Wolves preferably prey weak, very young or older individuals increasing the quality of population. Additionally, the comeback of the grey wolf to Germany means a higher biodiversity as well more naturalness and wilderness which is an attractive factor for ecotourism (SMUL 2014; LU 2010). Mistakenly thought to require wilderness, wolves are very adaptable to different habitats and even tolerate human activities (Kaczensky *et al.* 2012a; Linnell 2013). This potential coexistence leads to conflicts within the dynamics between wolves and humans.

There are only some threats to this top predator species. Mortality of wolves living in cultural landscapes is largely anthropogenic in cause (Reinhardt *et al.* 2013). Road traffic is the main cause of mortality, directly followed by illegal killing (Bathen *et al.* 2010; Reinhardt *et al.* 2012; Kaczensky *et al.* 2012a). The latter is a consequence of conflicts emerging from coexistence, such as livestock depredation, predation on domestic dogs, competition, and fear (Salvatori and Linnell 2005). Wolves are subject to the most polarized attitudes and most intense material and social conflicts. (Linnell 2013; Røskaft *et al.* 2007; Evensen Gangås 2014; Andersone and Ozolinš 2004; Kleiven *et al.* 2004). They are even associated with less positive points of view than species causing more damage (Agarwala *et al.* 2010). Stakeholders who oppose the presence of wolves, might as well try to kill them (Boitani 2000).

Yet, wolves enjoy the highest protection status possible (Bathen *et al.* 2010; BMUB 2015). The grey wolf is protected by the Habitats Directive on a European level. Adopted in 1992, the Council Directive 92/43/EEC designates wolves as a priority species and lists them in annex II requiring Natura 2000 sites and annex IV as strictly protected (Council of the European Union 1992). Likewise, wolves are strictly protected by appendix II of the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention, 1979) and the Convention on International Trade in Endangered Species of the Wild Fauna and Flora (CITES, 1973). In Germany, this conservation status is integrated into the Federal Nature Conservation Act (BNatschG). Wolves are therefore highly protected by Article 7 (2) sub-paragraph 14 and Article 44 BNatschG. The discussion, therefore, is not about whether wolves should be conserved or not. It is about the best ways to accomplish this conservation goal (Reinhardt *et al.* 2013; Linnell *et al.* 2008; Kaczensky *et al.* 2012a).

The overall goal for wolf conservation is to achieve favourable conservation status (FCS) required by the European Union (EU) Habitats Directive (Linnell *et al.* 2008). It has been calculated that such a FCS can probably be achieved in Germany by compromising about 441 packs (with a territory of 200 km²) in 26 connected areas (Deutscher Jagdverband e. V. 2014; BMUB 2015). This estimation is based on a unpublished scientific approach by Knauer (2010) based on the model of Jędrzejewski *et al.* (2008).

Figure 1: Wolf packs of the Central European Lowlands population in Germany
(NABU 2016d)

Figure 2: Wolf distribution in Europe 2006-2011.
Dark cells: permanent occurrence, Grey cells: sporadic.
Compiled by Guillaume Chapron (Kaczensky et al. 2012a)

Up to date, there are 40 wolf packs in Germany, mainly in the north-east of the country (status as of 15th April 2016) as it is shown in figure 1 (NABU 2016d). Wolves have migrated from the Baltic population via north-east Poland. Genetic analysis has shown that these wolves in Germany are still closely related. As a consequence, they are assigned to the Central European Lowlands population together with wolves in Poland. There are also wolves in the German neighbouring countries as presented in figure 2. They are composed of the Alpine population in France, Austria, Switzerland and Italy, the Italian Peninsula population and the Carpathian population in Czech Republic (Kaczensky *et al.* 2012a). Due to its location within Europe, Germany plays an important role to maintain a viable wolf population for genetic exchange (Landtag von Baden-Württemberg 2014). This does not only pose a high responsibility to Germany, but also a challenge to the federal states since enforcement is delegated to them (Reinhardt *et al.* 2012; Bundesregierung n.d.). Currently, wolves are reproducing in five federal states in Germany (NABU 2016d). Nevertheless, they have been sighted in every federal state except Saarland (NABU 2015c). If reproduction rates are maintained, wolves could permanently appear in all German federal states within the next three years (Kaczensky *et al.* 2009).

According to the federalist system, wolf management is decentralised. In order to deal with this extensive future recolonisation, all federal states have developed regional wolf management plans, guidelines or principles, except for the federal-city states. However, there are no management measures acting on the population level. Currently, the jurisdiction ends at the borders of each federal state. Due to Germany's high human population density it becomes apparent that wolf conservation requires active intervention at a local level. The grey wolf being a wildlife species requires the discipline of wildlife management which addresses people who are affected by the presence of wolves. Wildlife management also comprises the active involvement of stakeholders, which clearly shapes the success of management actions (LUGV 2012). Wolf management therefore tries to find ways to achieve a sustainable coexistence (LCIE n.d.; LCIE 2013). Therefore, management plans are important to deal with regional conflict mitigation and management competencies. However, challenges are not only posed by the diversity of conflicts but also by competing beliefs about the best management options between stakeholder groups (Linnell 2013).

Already twenty years ago Boitani (1995) stated that public opinion is the most important issue in wolf conservation. While some stakeholders see the return of the grey wolf as a conservation success, others perceive the predator as a threat to domestic animals with a negative impact on livestock owners (Hermann and Menzel 2013). In fact, the most affected stakeholder group, as well as the most influential one is livestock owners. Their attitudes towards wolves are relatively negative because they experience or expect a negative impact on their activities (Linnell 2013; Reinhardt *et al.* 2013). Indeed, wherever the species "suddenly" occurs, it causes conflicts related to livestock issues. Depredation rates can be economically serious for farmers and can also create negative attitudes towards wolves (LCIE n.d.). The loss of livestock has always been one of the main reasons for the persecution of wolves (Istituto di Ecologia Applicata 2008). Wolf conservation is therefore considerably dependent on preferably low damage rates to livestock (MU 2010).

The key for reducing damages is the acceptance of prevention measures by livestock holders (Kaeser and Zimmermann 2012). It therefore lies in the hands of the federal states to offer incentives to apply such measures as a means of wolf management. Additionally, compensatory damages for killed livestock are seen as one suitable tool in order to reduce extra economic burdens posed by the presence of wolves, if correctly designed. Funding guidelines enforcing these economic schemes can therefore support livestock owners with the change of their husbandry systems as a consequence of comparably new circumstances: the presence of wolves (LUGV 2012). While the species itself can and must not be managed, the management of livestock herders as the most affected stakeholder group is the essential challenge.

2. STATE OF RESEARCH

The grey wolf (*Canis lupus*) is one of five species of large carnivores besides brown bear (*Ursus arctos*), wolverine (*Gulo gulo*), Eurasian lynx (*Lynx lynx*) and Iberian lynx (*Lynx pardinus*) in the European Union (EU). On the European level, many scientists including the members of the Large Carnivore Initiative for Europe (LCIE) have conducted multiple studies on wolves in the last 20 years. Two joint documents have been published targeting European large carnivore conservation with input from a group of experts from each country where large carnivores occur (EC 2012). These documents called "Status, management and distribution of large carnivores – bear, lynx, wolf & wolverine – in Europe" Part 1 & 2 compiled the best available independent data from 2010-2012 (Kaczensky *et al.* 2012a; Kaczensky *et al.* 2012b; EC 2012). Based on these results Chapron *et al.* (2014) showed that the grey wolf has benefited from changes within the past four decades. Besides Europe's protective legislation, it again hosts large populations of wild ungulates. The impact of human land-use activities has also been reduced because of a decline in human presence in rural areas. Besides, there has been a variety of local, cultural, and regulatory practices making coexistence between wolves and people possible. The paper concludes that "the European situation reveals that large carnivores and people can share the same landscape" (Chapron *et al.* 2014).

Up to date human dimensions research on wolves in Europe has been conducted in various European countries. These international analyses reveal that those stakeholders being most affected by the coexistence with wolves oppose their return most. Livestock owners therefore have a relatively negative attitude towards wolves (Linnell 2013; Andersone and Ozolinš 2004; Kaltenborn *et al.* 1999; Wechselberger *et al.* 2005; Bisi *et al.* 2007; Nitze 2012; Nilsen *et al.* 2007). This human-related research has built the foundation for European policy (Linnell 2013; Linnell *et al.* 2013) and research promoted and financed by the European Commission (EC) strongly focusses on the dialogue with stakeholders (EC 2015a). The EC was instrumental in establishing the EU Platform on Coexistence between People and Large Carnivores (EU Platform). It was established in 2014 to promote ways to find solutions to conflicts between people and large carnivores (EC 2016b). Through various workshops the EC sought to gain detailed understanding of the conflicts between stakeholders and large carnivores. Furthermore, it financed pilot actions between 2013-2014, which intended to address areas of conflict between large carnivores and people in order to promote interactions between stakeholders (EC 2015a). Two of these pilot projects proposed conflict solutions for wolves and livestock owners. They assessed that traditional husbandry practices can be adapted to the modern context (EC 2014d; Linnell and Lescureux 2015).

Boitani *et al.* (2015) have also recently prepared a publication for the EC, called "Key actions for Large Carnivore populations in Europe". For the grey wolf it stresses the need for transboundary cooperation and population-level management plans. Moreover, it emphasises that prevention and

compensation measures are needed to reduce livestock depredation. For the Central European Lowlands population it specifically outlines the need for ensuring an information exchange between livestock owners about the best husbandry techniques and effective prevention measures. In fact, this exchange of knowledge is guaranteed since 2000 through the publication "Carnivore Damage Prevention News" which incorporates all relevant scientific contributions in 12 issues. Its main focus lies on the testing of various preventive measures for different target animals from depredation of divergent predators within various geographical contexts.

For Germany, Reinhardt *et al.* (2012) evaluated the effectiveness of wolf damage prevention methods commissioned by the Federal Agency for Nature Conservation (BfN). They found out that even if there is no measure being 100% safe against wolves, damages can be decreased considerably by livestock protection measures. Based on an international survey, they defined three main prevention measures regarded as sufficiently successful (Reinhardt *et al.* 2012).

The first measure which has known to be very effective as a livestock protection is livestock guarding dogs (LGDs). The return of wolves has meant a turn back to the traditional use of LGDs in Europe. For more than 20 years projects involving LGDs have been initiated in many countries. They include fostering, breeding, and propagating dogs. In Germany and France it is recommended to hold two dogs per flock (Reinhardt *et al.* 2012). The breed usually selected is called white Pyrenean mountain dog or patou (Toland *et al.* 2013). The project LIFE COEX, funded by the EC, proved that numbers of sheep attacked by wolves decreased by 61% - 72% in Spain and Portugal per year. For France, Espuno *et al.* (2004) showed that LGDs reduced damages by 39% for sheep in unfenced pastures. With applied fences during the night, this result could even be improved to 81%. A combination of electric fences and LGDs is considered as most effective.

Secondly, Mertens *et al.* (2002) have proven that after the installation of electric fences alone the killing frequency has been considerably reduced to 1.6%. They further calculated that the reduced loss of livestock redeems the installation of an electric fence after only one year. In the context of the LIFE COEX project electric fences proved to be successful; in Portugal there were no further attacks since the installation of electric fences (Istituto di Ecologia Applicata 2008). According to Reinhardt *et al.* (2012) electric sheep nets are the most popular method for fencing in sheep and goats in Germany. When correctly installed they are sufficient because wolves rarely jump over fences. These fences are easy and fast to set up and are feasible for small-sized meadows.

Lastly, there is also the possibility to apply non-electric fences as a preventive measure against wolf attacks on livestock. They are generally only used on small non-commercial pastures for a few sheep on a permanent basis. They are not that common in Germany or other European countries (Reinhardt *et al.* 2012). However, the LIFE COEX project showed that a well-installed massive mesh wire fence in Spain has proven to be 100% safe against wolves and stray dogs (Istituto di Ecologia Applicata 2008). However, a wolf is a highly adaptive species and may quickly learn how to overcome weak

points in a fence. A fence with weak points increases the risk of an attack and it also lowers the protective effect of similar fences in the same area. Wolves might then even try to overcome better installed fences (Hilde and John 2004). It is therefore necessary to keep fences properly maintained (Reinhardt *et al.* 2012).

Livestock owners use these measures as a common practice, in European countries where wolves have always been present. On the contrary, where wolves have been eradicated, these preventive methods were quickly abandoned. By now, these measures have also been applied in Germany where they have also proven to be successful. While in 2007 in Saxony an average of 4.5 sheep were killed by wolves, this number decreased to 1.45 sheep in 2010. The decrease can be explained by the application of good livestock protection since 2008. In 2009 and 2010 wolves mostly only targeted sheep that were insufficiently protected. Most of which belonged to owners which often keep single sheep or very small flocks (Reinhardt *et al.* 2012).

Nevertheless, the implementation of livestock protection measures also depends on the acceptance of wolves by livestock herders (EC 2016a). There have been several studies in Germany revealing attitudes towards this species. Kaczensky (2006) found that Germans have a fairly positive view of wolves when compared to neighbouring countries. Nevertheless, public opinion can easily be swayed with a higher frequency of problems. Only last year, a study commissioned by Naturschutzbund Deutschland (NABU), revealed that every other German citizen (54%) had positive or very positive views of wolves (forsa Politik- und Sozialforschung GmbH 2015). The vast majority of 80%, supports the comeback of wolves to Germany, perceiving them as equally important to other wild species. In contrast to Kaczensky (2006), this study even reveals that 78% think that wolves have a "natural right" to live in Germany, even if problems occur.

Even though only 8% of Germans expect economic disadvantages posed by wolves, livestock depredation is still a concern for those that own them (forsa Politik- und Sozialforschung GmbH 2015). Indeed, livestock owners in Germany are known to have negative attitudes towards wolves, but this has not yet been scientifically confirmed, unlike in other European countries (Linnell 2013; Andersone and Ozolinš 2004; Kaltenborn *et al.* 1999; Wechselberger *et al.* 2005; Bisi *et al.* 2007; Nitze 2012; Nilsen *et al.* 2007). When the acceptance of wolves only increases with decreasing damage rates on livestock, but the application of livestock protection measures is dependent on the acceptance of wolves, a vicious circle evolves. The provision of incentives to apply preventive measures can provide a remedy.

These incentives can be funding schemes for reducing and preventing extra economic burdens for livestock owners posed by the presence of wolves. Even if it is doubted by Agarwala *et al.* (2010) and Naughton-Treves *et al.* (2003) that these schemes actually improve people's attitudes towards wolves, compensatory damages commonly are approved by conservationists (Agarwala *et al.* 2010; Zabel and Holm-Müller 2008). The majority of Germans also endorses compensatory damages to livestock

owners (Kaczensky 2006). Agarwala *et al.* (2010) and Naughton-Treves *et al.* (2003) prove that the existence of compensation programs are generally expected and endorsed, which has been confirmed by other scientists (EC 2016a).

Nevertheless, such programs have broadly been criticised to undermine the willingness to change husbandry practices in order to lower the risk for predation on livestock (Naughton-Treves *et al.* 2003). This well-known problem of ex-post compensation schemes is called moral hazard which leads to suboptimal levels of livestock protection (Zabel and Holm-Müller 2008; Nyhus et al. 2005). One solution is to require livestock herders to adopt damage reduction methods so that they could be eligible for compensation (Nyhus *et al.* 2005; Thiel *et al.* 2012). Co-financing of these preventive livestock protection measures by the state is regarded as good practice, which can be provided by an additional funding scheme (Reinhardt *et al.* 2012; Thiel *et al.* 2012).

When it comes to the implementation of compensation schemes and funding schemes for prevention measures, little is known about the regulations in Germany. Even if BfN is quite active within the scope of the "Framework plan Wolf", published documents have largely neglected guidance on the implementation of funding regulations. The Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) published a document about the ecology, status and management of the grey wolf in Germany (BMUB 2015) announcing that a synopsis and evaluation of existing schemes has been conducted in 2010. However, it is unpublished and outdated. Knowledge about the current practices of compensation payments and funding for prevention measures is therefore still scarce.

The first attempt of a comparative analysis of wolf management measures in the federal states was published online by NABU (Klose 2014). However, due to the complexity of possible measures it did not only focus on funding schemes but also on other aspects (management plans, monitoring structures and public relations). The approach was not based on scientific research or differentiated between federal states with stages of wolf occurrence. Nevertheless, the NGO is intending to do so in the future, stressing the need for a comparative analysis.

BMUB has only recently announced that a revision of the synopsis and evaluation of the existing schemes from 2010 is strived for (BMUB 2015). Since BMUB is also planning to establish a national centre for wolf documentation and advice to provide national guidance, a compilation of the current implementation of funding schemes in the federal states is highly relevant. Nevertheless, tasks are restricted to the nationwide information sharing about other aspects of wolf management (e.g. in conflict situations) (BfN 2016). Therefore, the need for consistent funding requirements for livestock protection and compensatory damages dictated by the federal government and implemented by the federal states has not yet been satisfied (NABU 2016c; SMUL 2014; BundesUmweltPortal 2016). This thesis will contribute to the current state of research by providing a comparative analysis and giving guidance on how to shape the funding schemes by answering the following research question:

Which requirements need to be fulfilled regarding the implementation of funding schemes for reducing and preventing economic burdens for livestock owners by re-colonising wolves in Germany and how do the federal states comply?

In order to answer this research question, it is further necessary to observe (1) which aspects of these schemes are existent and (2) what differences become apparent in the current implementation. Additionally, it shall be compiled (3) what regulations can be regarded as commendable with respect to the different stages of wolf occurrence.

3. METHODOLOGICAL APPROACH

Recognising that there is far more experience in management practices than published, preliminary discussions with practitioners further confirmed the need for this research topic. Input was given by livestock herders' associations, the wolf ecology office "LUPUS", wolf advisors, participants of the EU Platform, members of the LCIE and employees of the non-governmental organisations (NGOs) NABU, World Wildlife Fund (WWF) and International Fund for Animal Welfare (IFAW).

This thesis investigates the regulations of funding schemes, providing ex-post compensation to livestock herders for losses due to wolf predation and providing financial incentives to apply measures for preventing future predation. The methodology used is derived from the various practices to conduct a policy analysis. William Dunn formulated it pointedly: "Policy analysis is an applied social science discipline which uses multiple methods of inquiry and argument to produce and transform policy-relevant information that may be utilized in political settings to resolve policy problems." (Dunn 2012). Policy analysis is "divided and incoherent" with "no accepted paradigm, well-developed body of theory, or set of methods" (Dryzek 1982; Hajer 2003). Therefore, the characteristics of this analysis, can only be described. It is focussing on individual aspects on a micro-scale of the funding schemes implemented. The results presented are analytical, descriptive and of technical nature based on the practice to define evaluation criteria, discuss alternatives and recommend improvements accordingly.

Furthermore, this analysis is comparative. Answering sub-question (1), different regulations of the funding schemes have been identified. In 13 chapters the focus is put on those aspects of implementation most relevant for livestock herders. Furthermore, they ought to reveal significant differences within the scope of the responsibility of the federal state governments. Hence, aspects of the funding schemes that are commonly adapted have been spared. Additionally, the analysis concentrates on those regulations which have a direct effect on those being eligible for funding. Hence, details concerning the process of granting payments could not be included. Same applies to details concerning the funding sources or management competences. Possible restraints of the implementation from a decision-maker point of view and financing opportunities could only be touched within the frame of this thesis.

The choice of literature is based on a non-standardized sampling method and internet research in scientific search engines of the most cited publications in scientific articles. Most of which were found through the internet portals Wiley Online Library, ScienceDirect and the social media network ResearchGate. These scientific publications were mainly utilised for describing aspects of the economic schemes used as a means for wolf conservation. Other aspects of this thesis needed to be drawn from unpublished technical reports available online. In order to outline the differences of the

regulations according to sub-question (2), only information has been obtained which is published online and therefore also available for livestock herders. Therefore, all relevant "grey" literature was reviewed, including all management plans and funding guidelines of the federal states available.

The practices and details of the implementation of the funding schemes could mainly be drawn from the wolf management plans, guidelines or positions published by the 13 federal states (MLR 2013; LfU 2014a; LUGV 2012; HMUKLV 2015; MU 2010; LU 2010; LANUV 2016; MULEWF 2015; MUV 2015; SMUL 2014; MLU 2008; MELUR 2008; TMUEN 2015b). Lower-Saxony, Mecklenburg-Western Pomerania, Schleswig-Holstein and Thuringia have further published funding guidelines that incorporate both funding schemes (compensatory damages and subsidies for preventive measures). In Brandenburg, Saxony and Saxony-Anhalt the funding guidelines are split into different funding regulations. Other federal states have not published any guidelines, even if according to the management plans, compensatory damages are paid. An overview about the publications on funding regulations available is given in table 1.

Table 1: Cited sources of management plans and funding guidelines of the federal states

	management plan	compensation guideline	funding guideline for prevention measures
Baden-Wuerttemberg	MLR 2013 (stage one)	no guideline published	
Bavaria	LfU 2014a (stage two)	no guideline published	
Brandenburg	LUGV 2012 (amendment)	MLUL 2011	no guideline published
Hesse	HMUKLV 2015	no guideline published	
Lower-Saxony	MU 2010 (principles)	MU 2015b	
Mecklenburg-Western Pomerania	LU 2010	LU 2013	
North Rhine-Westphalia	LANUV 2016 (stage two)	no guideline published	
Rhineland-Palatinate	MULEWF 2015	no guideline published	
Saarland	MUV 2015	no guideline published	
Saxony	SMUL 2014 (amendment)	no guideline published	Freistaat Sachsen 2014
Saxony-Anhalt	MLU 2008 (guiding principles)	ALFF 2014	MLU 2014
Schleswig-Holstein	MELUR 2008 (position paper)	MELUR 2015	
Thuringia	TMUEN 2015b (amendment)	TMUEN 2015a	

Some federal states publish additional information on their official websites. Through a complementary internet research an up-to-date picture could be drawn about the current proceedings, events, claims and discussions relevant to discuss commendable practices according to sub-question (3). Requirements how to design funding schemes were summarised in a table 5 with respect to four different stages of wolf abundance: no occurring wolves, transmigrating wolves; single residential wolves; residential wolf population with reproduction. This table of requirements is further underlying a scoring system which is provided for evaluating the compliance of the federal states. The requirements outlined do not only incorporate ideal future practices, but also include practices that should already be realised. For each requirement outlined in the table, one point is given, according to the underlying scoring system. The scoring system makes it possible to compare the compliance of each federal state relatively to the stage of wolf abundance.

4. MOTIVES BEHIND IMPLEMENTING FUNDING SCHEMES

Research targeting the implementation of compensation programs have been conducted on a broad scale (e.g. Treves *et al.* 2009; Agarwala *et al.* 2010; Naughton-Treves *et al.* 2003; Nyhus *et al.* 2005; Boitani *et al.* 2010). Most European countries implemented governmental compensation systems to cover for losses caused by wolves (Reinhardt *et al.* 2012; Kaczensky *et al.* 2012a; Kaczensky *et al.* 2012b). They commonly reimburse people who experienced damages caused by wildlife. Compensation can be paid as cash or in-kind assistance (Nyhus *et al.* 2005). Funding typically comes from tax money, NGO funds, private funding or stakeholder fees (Klemm 1996). Furthermore, compensation schemes can be arranged as ex-post compensation or as compensation in advance (Schwerdtner and Gruber 2007).

In Germany, only ex-post compensation for wolves are existent which are state-sponsored and partly subsidized by NGOs. There is no legal obligation to compensate losses of livestock since the state is generally not responsible for damages caused by wildlife. Still, compensation can be integrated in the nature conservation act of the federal states, as it is done in Saxony-Anhalt according to § 33 (3) NatSchG LSA. Saxony is also referring to the possibility to receive compensation in its Nature Conservation Act stated in § 40 (6) SächsNatSchG. Ex-post compensation schemes have been implemented in most federal states, mainly to increase acceptance of livestock herders towards wolves (Landtag von Baden-Württemberg 2014). Some of which further define the motive to reduce and prevent economic burdens for livestock owners posed by re-colonising wolves in Germany.

In terms of wolf conservation, compensation payments are meant to reduce economic reasons for farmers to protect their property by killing wildlife (Treves *et al.* 2009; Naughton-Treves *et al.* 2003; Zabel and Holm-Müller 2008; Klemm 1996). From a political point of view, they also serve as a means of avoiding EU sanctions for potential wolf poaching (Thiel *et al.* 2012). Even though financial incentives are still little explored there are several schemes that proved to be successful tools with regard to large carnivore conservation (Linnell *et al.* 2008). There are, various ways how to shape such compensation payments including different motives and funding sources (Treves *et al.* 2009).

Agarwala *et al.* (2010) compared two different compensation programs in Wisconsin (USA) and Solapur (India) where wolves live in areas dominated by agriculture and pasture. While the compensation program in Wisconsin was based on contributions from volunteers to pay affected individuals, in Solapur damages were reimbursed by government-supported compensation payments. Even if there are contextual differences, both places showed that people view wolves more negatively than other animals causing more damage to property. Further, residents at both sites did not report any change in attitude towards wolves as a result to compensation payments. People even considered them as inadequate, regarding the emotion invested in each animal over years and their suffering when

killed by a wolf. Still, the existence of such programs were supported or expected. As a result Agarwala *et al.* (2010) conclude that compensation fails in changing perceptions of wolves but residents are content about mechanisms to reduce economic burdens offered by the state.

A similar outcome has been achieved by Naughton-Treves *et al.* (2003). They used a mail-back survey in order to determine the tolerance of rural citizens of wolves. They also analysed if compensation payments improved this attitude. Results show that livestock owners that have received compensation payments did not have a more positive attitude towards wolves than those who have not received any. In fact, a more important aspect to determine attitudes was the social group. All stakeholders were in line with the approval of compensation payments as a management strategy.

The study of Treves *et al.* (2009) also confirms these findings. Two-thirds of the respondents of the survey endorsed compensation for wolf damage to livestock. The study emphasizes that public opinion regarding payment rules needs further research given its widespread use. The publication reports payment policies and public attitudes towards compensation in Wisconsin (USA). Attitudes were compared between those contributing to the state's voluntary compensation fund and those of non-contributors. The study concluded that compensation is popular. However, the various payment rules significantly shape attitudes.

Acknowledging the findings of Agarwala *et al.* (2010) and Naughton-Treves *et al.* (2003), that compensation does not shape people's opinion on wolves as well as the conclusions of Treves *et al.* (2009) that public attitudes on the rules of compensation payments and the programs themselves are not broadly examined, the question arises what justifies its implementation besides the fact that it is generally expected? Treves *et al.* (2009) argue that compensation can be justified based on moral grounds since the costs of conserving wildlife species is carried by a minority. Based on the principle that wolf conservation is in the interest of society as a whole, costs should be equally distributed instead of being carried by the directly affected people only (Linnell *et al.* 2008). State governments therefore might feel a sense of responsibility for reduced property values for farmers by re-colonizing wolves and their protection (Agarwala *et al.* 2010). Besides the importance of redistributing economic inequalities for society, compensation is also more economical for the federal states than relocating those species (Agarwala *et al.* 2010; Treves *et al.* 2009).

Given that compensation payments are solely based on an economic reasoning neglecting non-monetary motivations to conserve wolves, there are further doubts evolving (Agarwala *et al.* 2010). Even if compensation might be more economical than direct enforcement of wildlife protection (Agarwala *et al.* 2010; Treves *et al.* 2009), costs can potentially be very high and be unfairly distributed (Agarwala *et al.* 2010; Nyhus *et al.* 2005). This is due to the fact that costs will increase with a successful recovery. A second problem is that according to Treves *et al.* (2009) a majority of people wants payments to continue even when wolves are no longer threatened. Hence, compensation systems are creating expectations towards the government's liability for wildlife. This can lead to a

lack of incentives towards changing husbandry practices in order to decrease predation on livestock (Naughton-Treves *et al.* 2003).

This problem of ex-post compensation schemes is called moral hazard which leads to insufficient levels of livestock protection (Zabel and Holm-Müller 2008; Nyhus *et al.* 2005; Swenson and Andrén). With only compensation being paid, there is the risk that livestock owners are not only less likely to improve their current systems for prevention but also might even reduce their current efforts for preventive measures in order to receive payments (Nyhus *et al.* 2005; Bulte and Rondeau 2005; Swenson and Andrén). There are different ways how to shape conservation programs in order to prevent moral hazard, some of which are insurance systems or payments based on the conservation performance (Zabel and Holm-Müller 2008; Nyhus *et al.* 2005). One other solution is to require livestock herders to adopt damage reduction methods before they are eligible for compensation (Nyhus *et al.* 2005; Thiel *et al.* 2012).

The provision of grants or subsidised loans for technical support and materials is strongly recommended as an incentive to implement these measures. Such payments can cover most of the initial costs associated with adapting new husbandry systems (Linnell *et al.* 2008). Since in most European countries people are used to wolves, livestock holders commonly apply preventive measures. Consequently, funding is less common than simply compensating damages. Therefore, preventive measures are rather subsidized in countries where wolves have newly settled (Reinhardt *et al.* 2012; Reinhardt *et al.* 2013). Funding of preventive livestock protection measures is regarded as good practice in other countries such as France or Sweden (Reinhardt *et al.* 2012). Subsidies have been endorsed by other scientists since this policy is meant to foster acceptance of wolf populations by livestock owners (Thiel *et al.* 2012).

According to Nyhus *et al.* (2005) compensation schemes alone are insufficient and need to be part of a comprehensive approach. Knowing of pitfalls and loopholes can help decision-makers to find workable solutions. Their success is highly dependent on their design, including guidelines that link payment to sound management practices, a long-term funding source and a transparent process. Often these constrains of implementation are plentiful. What design of funding schemes turns out to be the best approach, is also highly dependent on the cultural and socio-economic context. This is one aspect why funding schemes differ largely dependent on where they are implemented. These differentiations refer to what or who is eligible for compensation, the value compensated, species or species groups targeted and further conditions set to receive compensation payments, like the application of prevention measures or the area in which compensation is granted.

5. Results & Discussion

5.1 Analysis of the implementation

Acknowledging these variations within the regulations of compensation schemes outlined by Nyhus *et al.* (2005), their different implementation in the federal states shall be analysed comparatively in the following chapters. They do not strictly separate compensation and funding for prevention measures, because these two economic schemes are unescapably bound to each other. Nevertheless, due to reasons of understanding the focus will lie on compensation first and then incorporate the funding of prevention measures.

Figure 3: Stages of current wolf occurrence in the federal states

Firstly, the following chapters present the common practices of each federal state underlining the main differences. For these aspects the current state is outlined giving a comparison of the implementation of all 13 federal states (without city states). Secondly, a discussion part is following the current state in order to define requirements for funding. In the end of each chapter there is a summary of the requirements given of how to implement the above mentioned points depending on the stage of wolf occurrence in the federal states. These stages have been defined according to the three different stages of a management plan (stage 1 - transmigrating wolves; stage 2 - single residential wolves; stage 3 - residential wolf population with reproduction (NABU 2016b)). The defined requirements, summarized in chapter 5.2, need to be adaptive to the respective stage of wolf occurrence of each federal state. Figure 3 shows the four stages of wolf occurrence, which will be relevant for the evaluation of the federal states' compliance with the outlined requirements in chapter 5.3.

Federal states with residential wolves need to implement different regulations than federal states where only transmigrating wolves occur. Where wolves become residential, wolf areas get designated. Commonly this area comprises a radius of 30km around where the wolves settle. The precondition to designate a wolf area is that at least one wolf has been detected by monitoring for at least half a year (Freundeskreis freilebender Wölfe e.V. 2015b; TMUEN 2016). Wolf packs are known to be occurring in five federal states in Germany. They consist of a pair with mostly two to ten puppies or young wolves. Currently there are 40 packs in Germany. Saxony has 12 wolf packs, in Brandenburg there are 10 wolf packs residential, Lower-Saxony has 9 packs, Saxony-Anhalt gives home to 6 wolf packs and in Mecklenburg-Western Pomerania two wolf packs are residential (status as of 15th April 2016) (NABU 2016d). In some federal states single wolves became residential by founding a territory. This is currently the case in Bavaria (NABU 2016b), Schleswig-Holstein (MELUR 2015a) and Thuringia (TMUEN 2015b). All other federal states are known to host single transmigrating wolves except of Saarland (NABU 2016d). For Bavaria a special situation occurs, since it has only recently achieved this stage 2 and is now hosting single residential wolves (NABU 2016b). Even if the respective management plan (LfU 2014a) has not been implemented yet (NABU 2016b), it is the most recent document available. It therefore builds the base of the following evaluation on condition that Bavaria will follow these regulations promptly.

1. EVIDENCE FOR COMPENSATION

Figure 4: Evidence required of wolf/canid attack in the federal states

CURRENT STATE

When it comes to compensation for killed or injured livestock by wolves, it needs to be looked at the preconditions for receiving these payments. One of these aspects is the kind of evidence needed. In some cases of depredation it is not possible to clearly determine the wolf as the culprit species for attacks on livestock. Whether or not doubtful cases get compensated, depends on the different regulations of the federal states.

As it is shown in figure 4, two main differences occur regarding evidence for compensation. Most federal states express

in their management plans that compensation is paid if a wolf cannot be excluded as the culprit species. Consequently, the determination of a canid species is sufficient, which also includes the possibility of a dog to have caused the damage. This is the case in the federal states with reproducing wolves Saxony and Mecklenburg-Western Pomerania (SMUL 2014; LU 2010). Furthermore, Bavaria, Schleswig-Holstein and Thuringia pay compensation if a wolf cannot be excluded (Landesportal Schleswig Holstein 2016b; LfU 2014a; TMUEN 2015a). In all these three states single residential wolves occur. Saarland and Rhineland-Palatinate are the only federal states with currently no residential wolves that also state in their management plans to follow the same principal (LfU 2014a; MULEWF 2015; MUV 2015).

Sachsen-Anhalt even differentiates between cases inside and outside of the designated wolf area. Within the wolf area, the federal state demands evidence that a wolf cannot be excludes as the attacker on livestock. But outside of this area, clear evidence is required (ALFF 2014). In cases without clear evidence Baden-Wuerttemberg and Lower Saxony do not pay compensation at all (MU 2015b; Landtag von Baden-Württemberg 2014). North Rhine-Westphalia also requires clear evidence. However, it is stated in the management plan that this requirement will change as soon as wolves settle permanently (LANUV 2016). Brandenburg, demands clear evidence stating that the wolf needs to be the culprit species with "sufficient certainty" (*mit hinreichender Sicherheit*) (LUGV 2012). Hesse is the only federal state that has not implemented any compensation scheme (HMUKLV 2015).

DISCUSSION

Reinhardt *et al.* (2012) emphasise that in Germany it is reasonable to also compensate uncertain cases as well. The compensation of such cases is important due to two main reasons. Firstly, a clear differentiation between wolves and dogs can be difficult at times (Boitani 2000; Reinhardt *et al.* 2012). Hence, even if a wolf was likely to have caused the damage, no compensation would be paid. Secondly, most livestock owners only blame wolves for livestock kills (Boitani 2000; Reinhardt *et al.* 2012). Therefore, in cases where it is unclear whether a dog or a wolf has been attacking the herd, the acceptance of the wolf would suffer significantly if not compensated. Moreover, the species could likely be blamed for inequalities of the compensation system.

Indeed many attacks have been caused by dogs as it has been outlined in Lower Saxony (MU 2016). Same has been reported in Saxony. In 2015, 56 out of 73 damage cases were compensated because the wolf could not be excluded as the culprit species. Out of these 56 damage cases only 33 attacks were clearly caused by wolves. Still, the other 23 were compensated since a canid species was determined at the culprit species (Kontaktbüro Wolfsregion Lausitz 2016). DNA-analysis represents an important tool for proof. When an expert witness cannot clearly state whether or not a wolf has been attacking a herd within 24 hours, a DNA-analysis is necessary to either find proof for a canid attack and/or a wolf

attack. Especially, when the value of the livestock is high, proof is important. Nevertheless, DNA cannot always be found (Wotschikowsky 2015).

Slovenia and Switzerland, however, demand clear evidence that a wolf is responsible for caused damages in order to compensate the losses (Reinhardt *et al.* 2012; Reinhardt *et al.* 2013). Nevertheless, due to the facts stated, it is not reasonable to request clear proof of the wolf being the culprit species. Neither is it recommended to follow the example of Saxony-Anhalt, which applies two different conditions for receiving compensation. One livestock herder might not receive compensation in a canid attack, but another livestock herder would. These different requirements for proof create a patch situation in Germany, which puts some livestock herders in a disadvantaged position.

Recommendation

By now, every single federal state can be expected to be recolonized by wolves. In cases with unclear evidence the wolf could potentially be the culprit species in every case. Different requirements for evidence are not reasonable within Germany. For reasons of acceptance towards wolves and towards the compensation systems such legal disadvantages should be abolished. Consequently, every federal state should provide compensation under the precondition, that a canid species caused the damage and a wolf can be excluded.

2. Direct and indirect costs compensated

Figure 5: Compensation of direct and indirect costs in federal states

Current state

Even if federal states grant compensation for livestock losses, not all kinds of damages get equally compensated in every state. Differences between the federal states are illustrated in figure 5.

Baden-Wuerttemberg is the only federal state outlining that compensation is solely paid for killed livestock or injured animals requiring immediate homicide (Landtag von Baden-Württemberg 2014). Saxony, on the contrary, does not specifically outline that indirect costs are included in

the compensation scheme. Nevertheless, the term "damage to livestock" usually includes indirect costs as well (SMUL 2014). Saxony-Anhalt outlined in its management plan from 2008 that only direct damage would get compensated and indirect damages should be covered by insurance (MLU 2008). However, this regulation has been amended in 2014; compensation now also includes indirect costs (ALFF 2014). With this change, Saxony-Anhalt is now following the principal of most other federal states, compensation veterinary costs and disposal of the carcasses. So do Brandenburg, Lower Saxony, Mecklenburg-Western Pomerania, North Rhine-Westphalia and Schleswig-Holstein (LUGV 2012; MU 2015b; LU 2013; LANUV 2016; MELUR 2015b).

However, some federal states provide compensation for extensive indirect costs. Rhineland-Palatinate, for example, states that compensation is also provided for damages to fences (MULEWF 2015). These damages are also covered by Bavaria and Thuringia which include property damage (LfU 2014a; TMUEN 2015b). Bavaria, additionally compensates the amount of work related to the wolf attack on livestock (LfU 2014a). Saarland even grants an entertainment allowance for this purpose (MUV 2015).

Direct costs for killed livestock get compensated by 100% in all federal states with only two exceptions. Bavaria only gats a financial support up to 500€ for each killed animal (LfU 2013). Lower Saxony, on the contrary, determines the maximum value of a sheep/goat up to the tenfold of 5.000€ (MU 2014b). Indirect costs for veterinary costs and disposal of carcasses are only subsidised by 80% in Lower Saxony and by 75% in Thuringia (TMUEN 2015a; MU 2015b). All other states, except of Baden-Wuerttemberg provide 100% compensation for direct and indirect damages (ALFF 2014; SMUL 2014; LU 2013; MELUR 2015a; LfU 2013; LANUV 2016; MULEWF 2015; MUV 2015; MLR 2013). Nevertheless, the full amount of compensation can in some cases only be provided up to a limit of 15.000€ as outlined in the following chapter.

DISCUSSION

While a livestock holder already faces an emotional loss when his/her livestock gets killed, the economic loss should not add to the disadvantage posed to livestock herders by the reintroduction of wolves. Reinhardt and Kluth (2007) therefore recommend replacing the total replacement value, or alternatively 100% of the income loss. It is therefore necessary to compensate killed livestock or injured animals requiring immediate homicide. This also means that upper limits of compensation are not reasonable since they do not always correspond with the actual value of the animal. Still the federal states follow different validation processes and some even set limits. Usually the price is set by a table stating the current market value. Bavaria sets considerably low limits and only grants payments up to 500€. In Saxony, on the contrary, the table of valuation for livestock has been agreed upon between livestock associations and the regional Authority "*Sächsisches Landesamtes für Umwelt,*

Landwirtschaft und Geologie" (SMUL 2014). This is a good example of how to participate affected stakeholders in decision-making.

When it comes to the definition of direct kills, the devil is in the detail. Whereas some animals die from injuries or "direct killing", some perish due to stress and panic (TMUEN 2015b; LfU 2014a; LU 2013). It is therefore sometimes unclear whether or not these damages can be compensated. Lower Saxony and Mecklenburg-Western Pomerania, however, clearly determine that cases are treated equally where animals perish only after a wolf attack (MU 2015b; LU 2013). Still, most management plans state that consequential damages do not get compensated. Such a delayed decease can therefore even be excluded from compensation. Presumably, it is too difficult to determine whether or not such as decease has been caused by a wolf attack. Such cases might not occur within the mentioned 24 hours in which an expert witness examines the caused damage. Nevertheless, there are clear cases, for example when a stillborn happened right after an attack. Consequential damages should be regarded as direct killing and should therefore be fully compensated. Nevertheless, since this attempt is rarely practiced, the implementation can remain optional at first.

There are certain conditions under which a differentiation between direct and indirect costs is crucial. Ideally, the full amount of direct and indirect costs gets compensated. However, as it is outlined in a paper about the current work of the "round table wolf management" in Schleswig-Holstein, there is an obligation by the EC to only fund indirect costs by max. 80%, when having issued a notification for the extension of the De Minimis Notice, as outlined in the following chapter. The paper rates this condition as a having a negative effect on livestock herders (MELUR 2015b). Still, it makes it necessary to clearly outline what kind of damages is referred to as direct and indirect. Nevertheless, most federal states do not fully list all damages included in the compensate scheme. Only Lower Saxony specifically states in its funding guideline, that only those damages mentioned are included (MU 2015b).

Especially indirect damages are rarely defined. The national ministry recommends in BMUB (2015) that the costs for injured animals should be covered, up to the costs of replacement or the income loss. Only a few federal states refer to additional damages covered by the compensation scheme, such as payments for property damage and the amount of work. With respect to the basic principle that the state is generally not liable to damages caused by wildlife, the compensation of such extensive indirect costs might break the mould when broadly applied. Still, damages to fences often occur due to panic by livestock (TMUEN 2015b; LfU 2014a). Therefore property damage to fences for livestock should be included in the compensation scheme. Since these measures should continuously serve their purpose, the compensation of damages to this kind of property should be regarded as ideal.

Recommendation

All federal states should provide full compensation of direct and indirect damages. However, there should be a differentiation between necessary and optional regulations. Since livestock killed due to stress as a consequential damage can be regarded as a direct damage, its compensation is reasonable. Nevertheless, it is not practiced in any federal state so far and should rather be optional. The same recommendation applies to the indirect costs for property damage and the amount of work. Both do not need to be included in the compensation scheme since the related costs can be considerably high. Nevertheless the restoration of preventive measures should be added to all compensation schemes. Compensation is further required for veterinary costs and the costs for the disposal of carcasses. Since these damages are inevitably linked to a wolf attack, such costs should be included, just like direct killing.

3. De Minimis Notice

Figure 6: Limits to compensation according to the De Minimis Notice in the federal states

Current state

Currently, most of the German federal states set upper limits according to the De Minimis Notice. It is stated in the Commission Regulation (EU) No 1408/2013 and prohibits any competitive advantage due to governmental subsidies (EU 2013; EC 2014b) expressed in Article 101(1) of the Treaty on the Functioning of the European Union. The De Minimis Notice grants financial aid given to an agricultural enterprise only up to 15.000€ within 3 years.

It is applied in most federal states and specifically mentioned by Saxony, Mecklenburg-Western Pomerania, Lower Saxony, Thuringia, Rhineland-Palatinate and Saarland (SMUL 2014; LU 2013; MU 2015b; TMUEN 2015a; MULEWF 2015; MUV 2015). North Rhine-Westphalia does not express any further details on this matter (LANUV 2016). Neither does Saxony-Anhalt or Baden-Wuerttemberg refer to the De Minimis Notice in their management plans or funding guidelines (ALFF 2014; MLU 2008; MLR 2013). An overview of which federal states follow the limits of the De Minimis Notice and which ones have issued a notification is presented in figure 6.

This notification is an exception to this 15.000€-limit which can be granted by the EC for subsidies in the agricultural and forestry sector where no advantage is precipitated towards the receiver. Saxony has been the forerunner to receive a notification by the EU for the extension of the 15.000€-limit in 2010 (Stier 2014a). Schleswig-Holstein is therfore currently evaluating this option (MELUR 2015b). Only two years after Saxony, Bavaria issued the same exception (LfU 2013). In the same year Mecklenburg-Western Pomerania published the funding guideline outlining that compensation can be granted above this limit (LU 2013).

For Brandenburg a special case applies. Its management plan outlines that two different funding schemes are available. Accordingly, compensation can be paid in the frame of the De Minimis Notice or the funding guideline of the federal state. The latter would not be restricted by the 15.000€-limit but compensation would only be possible up to 80% (MLUL 2011; LUGV 2012). While both alternatives are presented in the management plan, only the latter is outlined on the webpage (MLUL 2015). For Bavaria, always 80% are subsidised from the governmental budget. The remaining 20% are covered by other contributors of the fund "Ausgleichsfonds Große Beutegreifer" (LfU 2013). Saxony provides a comparable example, where 80% of the total costs are provided by the government. Due to subsidies of 20% by the NGO „Gesellschaft zum Schutz der Wölfe e.V." the whole 100% of the market value can be compensated (SMUL 2014).

Mecklenburg-Western Pomerania and Saxony, on the contrary, only limit the compensation sum to 80% for cases exceeding the limit of the De Minimis Notice (LU 2013; SMUL 2014). On the contrary, Schleswig-Holstein outlines that the limitation of funding by 80% only applies to indirect costs, when a notification has been issued (MELUR 2015b). This is according to the new "framework regulation of the European Commission for state subsidies in the agricultural and forestry sector and rural areas 2014-2020" (EC 2014e), that has been published following the renewal of the Common Agricultural Policy (CAP) in 2013 (EC 2014b). Accordingly, this change in 2014 implicates that killed animals could always be compensated by 100% of the market value and indirect costs could only be compensated by 80% (MELUR 2015b; EC 2014e). Presumably, the same condition applies to Mecklenburg-Western Pomerania and Saxony now, since the fact that 80% of funding is only available for indirect costs, has only recently been established.

Discussion

The De Minimis Notice usually only applies to livestock owners in main occupation (BMEL 2014). Nevertheless, some federal states apply this regulation to other livestock herders as well. Hence, Lower Saxony outlines in its funding guideline that the same principal applies to hobby livestock herders and those in secondary occupation (MU 2015b). The interesting aspect about the European De Minimis Notice is that funding for prevention measures and compensation payments both fall under

this limit of 15.000€. The rule not to allow different subsidies to accumulate makes it difficult to combine these subsidies.

While there has been no case where compensation alone has actually exceeded this limit for any livestock herder in Saxony and Brandenburg up to 2010; fears of livestock holders not to receive enough financial support need to be taken seriously (NABU Schleswig-Holstein 2010). Nevertheless, in Schleswig-Holstein, the 15.000€-limit was exceeded due to two wolf attacks on one herd within a short time. Therefore governmental funds were not sufficient anymore and additional 3.877€ have been granted by a fund for wildlife issues by several conservation organisations this January (Wolfsinformationszentrum Schleswig-Holstein 2016a). The question arises, whether subsidies for preventive measures would still be available after compensation has reached this limit.

The initial purpose of this fund for wildlife issues of 20.000€ was for compensating damages exceeding the 15.000€-limit (MELUR 2015b). After the potential notification, however, this fund could be used for the additional 20% of costs for indirect costs, following the example of Saxony and Bavaria. The cooperation with NGOs ensures a total compensation of 100% of all costs while governmental funds only comprise 80% complying with the strict rules set by the notification of the EU. This form of financing is an exemplary way, since it is unrelated to the definition of direct and indirect costs. With the support of NGOs to cover the remaining 20% of indirect costs, an important step for animal welfare can be done. Otherwise livestock holders might eventually not invest the additional 20% themselves and rather let the animal die (Verein für Neue Medien Kiel e.V. 2015).

However, only a few federal states have actually issued such extensions. Since the Saxonian example lays five years back, a significant change of this regulation among the federal states would have been desirable by now. Nevertheless, the administrative effort for every federal state to do so seems to be relatively high. Furthermore, the need for additional financiers to cover the 100% of all costs can be regarded as a disadvantage. This is generally criticized, because NGOs take on responsibility for duties of the responsible state and the common interest in wolf conservation gets ignored (Klemm 1996). However, this criticism mainly applies to states where no federal wolf management is in place and responsibility remains with the NGOs. With the current experience, the example of Saxony and Bavaria can be seen as a good practice to cooperate with NGOs while clearly separating and coordinating the duties.

RECOMMENDATION

A sufficient financial support can be granted by establishing a fund. It can step in to compensate losses for cases exceeding 15.000€ as wolves migrate to an area. As soon as funding for preventive measures is provided additionally to compensation payments, the overall costs can exceed this limit. Therefore, the need for an extension of the 15.000€ is considerably important with the establishment of a wolf

area. Consequently, federal states with residential wolves should issue a notification. Since indirect costs can then only be covered by the government up to 80%, such a fund comes in handy when supporting livestock herders with the remaining 20%. Presumably, cases of depredation and the amount of compensation decreases in federal states with established prevention measures.

4. ANIMALS COMPENSATED

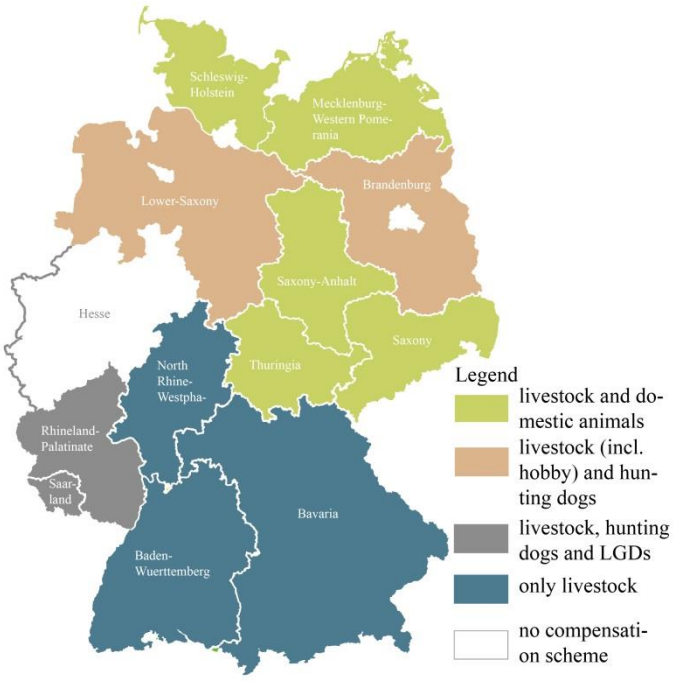

Figure 7: Compensation for livestock and/or domestic animals in the federal states

CURRENT STATE

Another important question is what kind of animal compensation is grated for. This question refers to whether or not other animals than sheep and goats are targeted. Furthermore, the question incorporates if their holding must be for commercial purposes. These two aspects are intertwined here because the wording inevitably links them. The specific differences among the federal states are shown in figure 7.

Lower Saxony is the only federal state that clearly lists the species targeted by its compensation scheme. Those animals included are sheep, goats, fenced game, cattle, horses, hunting dogs, LGDs and sheepdogs (MU 2015b). It is the only state including the most important species likely to be attacked by wolves. Most federal states are not as clear about the species targeted. Since the terminology used is not always specific enough, the animals targeted, must sometimes be interpreted.

Brandenburg, for example, uses the terminology "grazing animals" (LUGV 2012). Since this word addresses grazing ungulates in general, sheep, goats, horses and cattle are included. Brandenburg even subsidises preventive measures for Lamas, Alpakas and agriculturally held game (Investitionsbank des Landes Brandenburg 2015). Most likely, the terminology "grazing animals" probably also addresses these species within the compensation scheme. All other federal states generally only refer to the species as "livestock". This terminology includes the above mentioned grazing animals for sure. However, the hobby or commercial purpose is rather up for interpretation. While in this thesis the term livestock holder or owner includes the commercial and hobby or non-commercial use, this

terminology in management plans or funding guidelines does not specifically address hobby livestock owners, since a strict interpretation of this term underlines a commercial use.

Following this interpretation, Bavaria, Baden-Wuerttemberg and North Rhine-Westphalia exclude any hobby livestock herders (MLR 2013; LfU 2014a; LANUV 2016). They are even specifically excluded in the management plan of North Rhine-Westphalia (LANUV 2016). On the contrary, Brandenburg, Lower Saxony and Sachsen-Anhalt specifically include hobby livestock herders (MU 2015b; LUGV 2012; ALFF 2014). However, hobby livestock does not include other important domestic animals related to livestock, like dogs.

Thuringia, Saxony, Schleswig-Holstein and Mecklenburg-Western Pomerania are the only federal states specifically stating that all domestic animals are included in their compensation regulation (TMUEN 2015a; SMUL 2014; MELUR 2015a; LU 2013). All other states do not name domestic animals to be targeted or only state hunting dogs to be included in the regulation, such as Brandenburg and Lower Saxony (MU 2015b; LUGV 2012). Despite the fact that Saxony and Mecklenburg-Western Pomerania already include domestic animals, they also specifically address hunting dogs to be compensated when hurt or killed by a wolf (SMUL 2014; LUGV 2012; LU 2013; MU 2015b). Rhineland-Palatinate and Saarland do not include domestic animals but precisely mention hunting dogs and even LGDs to be included in the compensation regulation (MUV 2015; MULEWF 2015).

Discussion

Since sheep and goats are most targeted as prey by wolves, these need to be included in any compensation scheme. Nevertheless, international studies have verified that horses are also potential prey for wolves (NABU Bundesverband 2015). This issue becomes even more important in the light of the recent wolf attack on a pollen proven by DNA analysis in November 2015 and April 2016 in Saxony-Anhalt (NABU 2016a; NABU 2015b). Even though the chance that horses get attacked by wolves is low, attacks cannot be excluded (NABU 2015a). The same applies to cattle. In Lower Saxony alone, there have been four kills of calves in October 2014, December 2014, July 2015 and November 2015 that have all been proven to be caused by a wolf (Wildtiermanagement Niedersachsen 2016). Additionally, fenced game can be targeted by wolves, too. In Lower-Saxony, for example there were 25 cases where fenced game was attacked by a wolf between November 2013 and February 2016 (Wildtiermanagement Niedersachsen 2016). Statistically, this would mean that every ninth case is an attack on fenced game. Cases of an attack on lamas and alpacas are not known yet. Nevertheless, herders should optionally be supported, since the term “livestock” also refers to these animals.

When arguing for compensation horses and cattle, it needs to be mentioned that in most cases horses are held as domestic animals and even single sheep or goats can fall under this category. Generally, the differentiation between commercial and private use is not easy, e.g. when horses are used for

tournaments. A distinction between the specific purposes of animals is therefore not reasonable due to reasons of acceptance, as outlined in the management plan of Schleswig-Holstein (MELUR 2008).

The specific inclusion of domestic animals is highly important, especially when it comes to hunting dogs, LGDs and sheepdogs that can also be killed or injured when encountering wolves. Since they are no livestock, they need to be addressed in the management plan or regulation specifically. Whereas here, these kinds of dogs are interpreted to be included in the term "domestic animals", dogs used for working purposes might as well not fall under this terminology. With regard to hunters being one of the stakeholder groups most opposing the presence of wolves (Reinhardt *et al.* 2013; Boitani 2000; Linnell 2013), the compensation for killed hunting dogs should be included in the regulation, which has been done by many federal states.

The inclusion of LGDs and sheepdogs, on the contrary, is rather rare. LGDs are well known to be an efficient preventive measure. Hence, their inclusion in the compensation scheme should be mandatory, whereas the inclusion other animals used for protecting flocks, like sheep-dogs, donkeys, lamas and alpacas, is important but not mandatory. The reasoning behind the necessary compensation for LGDs is equal to the argumentation to compensate damages to fences. It is considerably important to keep up the functionality of preventive measures. If a LGD gets killed by a wolf and no financial support is given, the purpose of compensation and funding for preventive measures is void.

Recommendation

All federal states should include sheep, goats, fenced game, cattle and horses in their compensation schemes. The specific inclusion or exclusion of certain species as well as a differentiation between their purposes is not recommendable. Hence, the regulation should refer to species held for agricultural, commercial and domestic reasons.

5. Precondition to apply preventive measures

Current State

After 2008, damages to livestock in Saxony have dropped noticeably. This was due to the fact that the application of successful protection measures was set as a precondition to receive compensation (Reinhardt *et al.* 2012). Until now, this regulation is unquestioned in Germany, since all federal states have bound compensation payments to prevention or plan to do so in the future (referred to as "precondition").

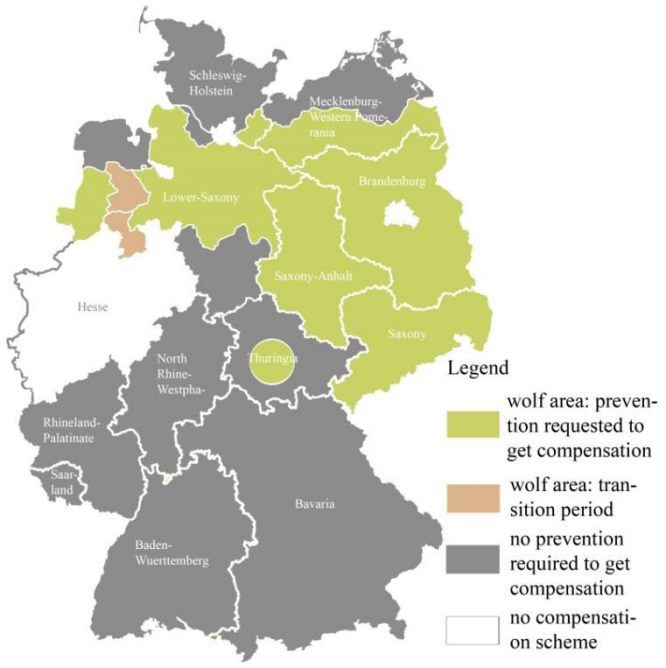

Figure 8: Current size and delineation of wolf areas

In newly designated wolf areas, preventive measures are usually only mandatory after a transition period of one year in which compensation is paid, even when preventive measures have not been applied. This transition period has been mentioned in nearly all federal sates that have designated wolf areas (SMUL 2014; MLUL 2011; MU 2015b; MELUR 2015a; TMUEN 2015a; ALFF 2014). Schleswig-Holstein simply states that preventive measures are requested in designated wolf areas when compensation has been applied for (MELUR 2015a). Figure 8 shows in which areas preventive measures are currently set as precondition to receive compensation. At the moment, Lower Saxony is the only state being in a transition right now until December 2016. Two districts do not need to apply preventive measures, yet, in order to receive compensation, yet (MU 2015a). The transition period of the wolf area in Thuringia has recently ended in June 2016 (TMUEN 2016).

Bavaria and Rhineland-Palatinate specifically mention to introduce a transition period with the designation of a wolf area (LfU 2013; MULEWF 2015). However, this has not been done yet in the case of Bavaria. North Rhine-Westphalia only states that the current status of the wolf does not preclude compensation payments without preventive measures, yet (LANUV 2016). Baden-Wuerttemberg also refers to the precondition, by constituting that prevention is not prioritized before compensation, as long as wolves have not become residential (MLR 2013). Saarland on the contrary, does not mention prevention as a precondition nor a planned transition period (MUV 2015).

Even if this precondition is important, there are exceptions for when prevention measures should not be needed for receiving compensation. Some federal states, for example, grant an exception for cases where funding is not possible. Brandenburg, further constitutes that non-commercial sheep owners are not expected to apply preventive measures, because funding is not possible for this target group, yet (LUGV 2012). Furthermore, Rhineland-Palatinate specifically outlines that in the future, compensation can be paid for cases without applied preventive measures, if an application for funding of preventive measures has been denied (MULEWF 2015). Lower Saxony further states in its funding guideline that exceptions apply to areas where preventive measures are not applicable, e.g. on dikes. Additionally, livestock herders of cattle and horses are excluded from the precondition (MU 2015b).

Similar conditions are granted for livestock holders of cattle in Saxony-Anhalt (ALFF 2014). They still get compensation paid in cases of damage due to a wolf attack (WWF Deutschland 2014).

Usually, this precondition does not apply to areas that have not been designated as wolf areas. Neither does it apply within the transition period of a wolf area. Still, there are exceptional cases where the application of prevention measures should be required. Brandenburg has designated the whole federal state as a wolf area. Within the transition period, livestock herders in Brandenburg were not required to apply prevention measures, but only until first damages occurred. Consequently, for livestock holders that have already lost livestock to wolves, special conditions applied (LUGV 2012). In Lower Saxony the funding guideline specifically outlines that even outside of a wolf area preventive measures are expected within one year after a wolf attack on livestock (MU 2015b). In Schleswig-Holstein, the same exception applied in a real case. When a livestock owner outside of the designated wolf area repeatedly lost many sheep to a wolf, the fund for wildlife issues decided to require preventive measures in order to receive further compensation (Wolfsinformationszentrum Schleswig-Holstein 2016a).

DISCUSSION

Even if the precondition to apply protection measures in order to receive compensation is common in Germany, such a regulation is rare in Europe. Up to 2012 only Sweden, Slovenia, Poland and some Spanish provinces have compensation linked to the application of preventive methods (Reinhardt *et al.* 2012). Still, European and German scientists recommend to implement this precondition with regard to wolf conservation (Boitani 2000; Reinhardt *et al.* 2012; Reinhardt and Kluth 2007). The reason is that proactive prevention is always better than just reactive measures. Hence, it is the only successful system to reduce damages (Linnell *et al.* 2008; Reinhardt *et al.* 2012). If compensation was paid even though the flock was not accordingly protected, the scheme would be contra productive (LCIE 2013). A problem would occur, called moral hazard (Zabel and Holm-Müller 2008; Nyhus *et al.* 2005; Swenson and Andrén). In order to prevent insufficiently protected flocks, the precondition to adopt damage reduction methods for being eligible for compensation can be an effective solution (Nyhus *et al.* 2005; Thiel *et al.* 2012).

However, in federal states with no residential wolf populations, the request for a broad application of preventive methods is not reasonable. The likelihood of killings where the distance from the designated wolf area is greater than 30 km, are too low to justify compulsory protective measures. If these measures were still expected in order to be eligible for compensation payments, the overall acceptance by livestock owners would probably be reduced. Furthermore, from a financial point of view these measures would disproportionately burden the state budget if funding is provided (Thiel *et al.* 2012). According to Franziska Paul, a biologist who gave advice for the wolf management in

Hesse, prevention only makes sense when a wolf area is designated (Bueltemann 2014). Therefore, compensation alone can in fact be the only reasonable means outside of the wolves' normal range (Linnell *et al.* 2008).

When an attack on livestock has already happened, it is still necessary to prevent wolves from getting used to livestock as their prey. It is further essential to stop them from an attack on the same herd again. This is especially important since some wolves might even teach their offspring and/or establish a territory in this area (Fass 2015). In order to be stringent in the reasoning of binding prevention to compensation, it is necessary to demand strict application of preventive measures wherever a wolf has attacked a herd. Nevertheless, this demand would be considerably dependent on possible funding of preventive measures, as outlined in chapter 7. For cases outside of a wolf area funding for preventive measures is usually not available. Flexible funding should be aimed for.

On the other hand exceptions can be granted for when preventive measures do not need to be applied. In cases where the application of prevention measures would pose an unreasonable challenge to the livestock herder, some federal states have already implemented differing conditions. This could be in areas where preventive measures are not applicable, e.g. on dikes (MU 2015b). Furthermore, whole livestock herder groups might be exempted because of funding reasons for their preventive measures and/or because knowledge on the required standards for certain animals is not available.

Minimum standards are currently only available for sheep and goats, which will be looked at in the following chapter. Hence, funding is usually not available for cattle and horses as outlined in chapter 13. Therefore, the cattle farmers' association in Mecklenburg-Western Pomerania stresses similar exceptions like in Saxony-Anhalt or Lower-Saxony. They published a letter to the federal ministry requesting to receive compensation without the necessity to apply preventive measures, since the minimum protection standards are not suitable for cattle and need to be adjusted (Rinderzuchtverband Mecklemburg-Vorpommern e.G. 2015). For horses, NABU has only recently published a brochure defining protection methods applicable (NABU Bundesverband 2015). Reasons for a necessary exception could therefore be the applicability of preventive measures, the lack of knowledge about these preventive measures or a lack of funding for certain measures or livestock herder groups. In these cases the precondition is not applicable. However, even if Saxony-Anhalt grants exceptions for cattle owners, the federal state does not receive a point in the evaluation process. This is due to the fact that no exception for hobby livestock owners is granted to receive compensation even if funding for prevention measures is not provided as outlined in chapter 12.

Recommendation

The requirements for compensation need to be different inside and outside of wolf areas (Reinhardt and Kluth 2007; LUGV 2012). Due to low levels of predation on livestock in Germany; it is only recommended to expect prevention measures in wolf areas (Reinhardt *et al.* 2012). Hence, the precondition is only applicable in federal states with residential wolves, and within these states only inside of designated wolf areas. A transition period of one year is common practice to adapt husbandry systems. This transition period therefore applies to federal states where wolves have recently established and only single wolves are residential. For federal states with transmigrating wolves the necessity to apply prevention measures in the future needs to be communicated including the reasons behind it. Furthermore, a transition period should be announced for the purpose of clarification. Prevention measures should not be mandatory to receive compensation for reasons of funding or applicability. Still, outside of wolf areas or within the transition period some cases require an exception. Victims of a livestock attack should always apply preventive measures in order to receive further compensation. This applies to federal states with residential and transmigrating wolves.

6. Minimum standards

Current state

Table 2: Compliance of minimum standards for fences with Reinhardt *et al.* (2012)

Blue: standards set by Reinhardt *et al.* (2012); green: compliance; brown: no compliance

	non-electric fence (fixed)	electric fences	electric fences
	e.g. mesh wire fences	electric sheep nets	permanent e-wire fence
minimum standards defined by Reinhardt et al. (2012) for livestock (sheep & goats)	• 120 cm high, preferably 140 cm • measures against digging: - 100 cm wide strip of mesh wire fixed to the ground and to the fence - electric wire 20 cm above ground and 15 cm in front of the fence - dug 50cm in the ground	• at least 110 cm high • at least 4000–5000 V • with stiff vertical plastic mesh	• 5 wires: 20, 40, 60, 90, 120 cm • max. 20cm above the ground • at least 4000–5000 V
Brandenburg (LUGV 2012)	• at least 140 cm high • tension wire on the ground	• at least 90 cm high, recommended min. 110cm • at least 2500 V	• at least 90 cm high • fences with five wires or cords • at least 2500 V
Bavaria	no minimum standards set	no minimum standards set	no minimum standards set

Lower Saxony (MU 2015b)	• at least 120 cm high • protection against digging: - 100 cm wide strip of mesh wire fixed to the ground and to the fence - electric wire 20 cm above ground and 15 cm in front of the fence - dug 30cm into the ground	• at least 90 cm high, completely closed • min. 1 joule discharging energy • wire at max.20cm above the ground	• at least 90 cm high, completely closed • min. 1 joule discharging energy • wires at max. 20 cm above the ground
Mecklenburg-Western Pomerania (LU 2010)	• at least 120 cm high, completely closed • max. 20cm above the ground	• at least 90 cm high, completely closed • at least 2000 V • at least 1 joule discharging energy • max. 20 cm above the ground	• at least 90 cm high, completely closed • at least 2000 V • at least 1 joule discharging energy • max. 20 cm above the ground • wires or cords every 20cm
Rhineland-Palatinate (MULEWF 2015)	• at least 140 cm high • measures against digging: - tension wire on the ground - electric wire 20 cm above ground	• at least 90 cm high • at least 2500 V	• at least 90 cm high • at least 2500 V • max. 20cm above the ground
Saarland (MUV 2z015)	• at least 140 cm high • measures against digging: - tension wire on the ground - electric wire 20 cm above ground	• at least 90 cm high • at least 2500 V	• at least 90 cm high • at least 2500 V • max. 20cm above the ground
Saxony (SMUL 2014)	• at least 120 cm high, completely closed • tension wire on the ground	• at least 90 cm high • at least 2000 V	• five wires or cords • at least 90 cm high • at least 2000 V
Saxony-Anhalt (ALFF 2014)	• at least 140 cm high • measures against digging: - either 100 cm wide strip of mesh wire fixed to the ground and to the fence - or an electric wire 20 cm above ground with at least 3000 V - or dug 40cm into the ground	• at least 90 cm high, completely closed • at least 3000 V, recommended 5000 V • min. 1,5 Joule discharging energy	• five wires or cords • at least 90 cm high, completely closed • at least 3000, recommended 5000 V • min. 1,5 Joule discharging energy • wires or cords at max. 20cm above the ground • for testing: four wires or cords (20, 40, 65, 80 cm above the ground)
Schleswig-Holstein	no information available	no information available	no information available
Thuringia (TMUEN 2015a)	• at least 120 cm high • measures against digging: - 50 cm wide strip of mesh wire fixed to the ground and to the fence - dug 30 - 50 cm in the ground - electric wire 20 cm above ground	• at least 90 cm high • at least 2000 V • at least 1 joule discharging energy • max. 20 cm above the ground	• at least 90 cm high • at least 2000 V • at least 1 joule discharging energy • wires at max. 20 cm above the ground

When prevention is set as a precondition for compensation, the required measures are usually stated in the funding guidelines or management plans of the federal states. These requested kinds of prevention measures for compensation shall be referred to as minimum standards. This terminology is important in order to distinguish the required prevention standards for receiving compensation from those standards that are funding is available for. An overview of these different standards is given in table 2.

In the regulations of the federal states minimum standards are generally referred to as basic or minimum protection (*Grundschutz; Mindestschutz*). With regard to an incentives to apply them, the question arises whether or not these minimum standards are sufficiently wolf-proof. Mecklenburg-Western Pomerania, Brandenburg and Saxony for example require the basic protection to be reasonable or appropriate for the livestock herders (*zumutbar*) (LU 2010; LUGV 2012; SMUL 2014). Saxony-Anhalt on the contrary demands "sufficient basic protection" (*hinreichende Maßnahmen des Grundschutzes)* in order to receive compensation (ALFF 2014). These terms rather indicate that the required measures do not comply with an actual wolf-proof fence.

The effectiveness of wolf-proof protection measures has been analysed by Reinhardt *et al.* (2012) in the context of the BfN-funded project "Rahmenplan Wolf". Compared to these scientific results, rarely any state follows the recommendations within their minimum standards. Table 2 gives an overview about the actual compliance with the recommendations. Only some minimum standards for non-electric sheep fences comply with these recommendations. Most federal states require a tension wire on the ground or a maximum gap of 20cm between the fence and the ground. A wolf-proof fence, however, would need measures against digging. These are only outlined by Lower-Saxony, Saxony-Anhalt and Thuringia (MU 2015b; ALFF 2014; TMUEN 2015a). Still, no federal state complies with the correct height and voltage for electric sheep nets or permanent e-wire fence with wires or cords. Schleswig-Holstein and Bavaria do not set official binding standards at all. Bavaria has only recently confirmed that minimum standards are not set yet, since wolves have not been residential so far (LfU 2015). However, this has changed by now (NABU 2016b). Most minimum standards only require e-fences to be at least 90 cm high, whereas 110 cm are recommended for electric sheep nets and 120cm for e-fences with five wires. The recommendations of 4000–5000 V are as well undercut by setting 2000-2500V as sufficient minimum standards to receive compensation payments.

The minimum standards for Brandenburg and Saxony are summarized in the brochure Kluth and Reinhardt (2010). Since, the authors are wolf experts who also have published Reinhardt *et al.* (2012), they even outline in the brochure that the required height is insufficient. Nevertheless, Rhineland-Palatinate and Saarland have prepared the content of their management plans accordingly. They base their recommended measures on Kluth and Reinhardt (2010). However, both states also added measures against digging to the required minimum standards. Hence, the requirements can be evaluated as wolf-proof for non-electric sheep fences. On the contrary, it should be highlighted that the minimum standards for e-fences required by Lower Saxony are not sufficient even if referring to them

as a “wolf-proof basic protection” (*wolfsabweisender Grundschutz*) (MU 2015b). Saxony specifically outlines that further protection measures can be applied when divergent measures have been approved as wolf-proof (SMUL 2014).

Discussion

The distinction of the requested prevention standards for receiving compensation from measures that funding is available for is not always apparent. While funded measures are considered to be wolf-proof, those required to receive compensation are usually only meant to be minimal. The actual difference between these standards is outlined in chapter 9. Behind the background that funding is available for wolf-proof measures, it remains unclear, why lower standards should be set to receive compensation.

The requirement of applying “prevention measures” that are not wolf-proof means that a positive outcome is not guaranteed even if husbandry systems are expected to change. Wolves potentially try to overcome other fences when they have been successful with fences elsewhere (Kluth and Reinhardt 2010). Hence, the weaknesses of a fence can affect the effectiveness of fences in another state. If a wolf finds a way to overcome inappropriate fences, the application of prevention measures could possibly be questioned by herders in total. Furthermore, the frustration could be respectively high, if a considerable effort has been put into the application of preventive measures that turned out to be insufficient.

This logical presumption has been confirmed by a contribution of a member of the European Landowners' Organisation (ELO) at the Regional Workshop of the EU Platform, in Berlin on 18-20 April 2016. The participant stated that he felt that different advice was given on correct protection measures. He referred to different standards being published. Further, he said that he felt advice would change over time and higher and higher fences were demanded. Ilka Reinhardt replied that a fence following minimal protection standards is a measure which is required to be eligible for compensation and that wolf-proof measures might differ (EC 2016a).

It might rather be in the interest of herders to demand wolf-proof protection measures. To expect livestock herders to apply effective fences, poses a lower disadvantage to them, than to expect them to request them to improve their fences once more after further losses. Furthermore, the application of effective fences is not only in the interest of livestock herders but also in the interest of the conservationists: wolves that repeatedly overcome fences can legally be killed according to § 45 (7) BNatSchG.

Whether or not measures are “sufficient” (*hinreichende Maßnahmen des Grundschutzes)* as outlined in Saxony, would only show the actual effectivity against wolves. Since the analysis by Reinhardt *et al.*

(2012) is based on statistical results as well as on international experience, the lack of coherence with these recommendations is not understandable nor reasonable. The management plans of Mecklenburg-Western Pomerania and Thuringia even refer to the necessity of adapting their required measures after the insights of Reinhardt *et al.* (2012) (TMUEN 2012; LU 2010). However, even though Thuringia has recently updated its management plan, no adjustment has been following. Since these insights have been published four years ago, consistency could have been achieved already. Differences between federal states are especially risky, since wolves naturally span borders.

Additionally, the minimum standards outlined in the federal states and the knowledge gathered in Reinhardt *et al.* (2012) only refer to sheep and goats. As outlined in chapter 13, prevention measures are not broadly funded for cattle and horses, even though attacks have been happening already. As outlined in chapter 5 an exception from the precondition must be granted for these livestock herder groups in these cases. Nevertheless, the application of prevention measures is the only means to achieve coexistence between humans and wolves. The precondition should be strived for all livestock herders that might suffer from wolf attacks. Hence, the goal should not only be to improve the minimum standards set for sheep and goats, but also to define applicable standards for horses and cattle.

Recommendation

Federal states with residential wolves, that request prevention measures in order to get losses compensated, need to clearly outline under which standards they need to meet. These measures need to be wolf-proof and should not differ from those measures funding is available for. Since the application of preventive measures is only compulsory in wolf areas, the standards outlined by Reinhardt *et al.* (2012) only apply to federal states with residential wolves. Additionally, measures should be defined for cattle and horses. Even if this is not the case yet it shall be required in order to achieve this in the near future. As outlined above, the application of prevention measures is also necessary as soon as a wolf attack has been taken place. Since this can also happen outside of a wolf area, federal states with transmigrating wolves need to define minimum standards for emergency cases, too. Nevertheless, these standards are sufficient to be defined for sheep and goats since attacks on these animals are rare but more likely.

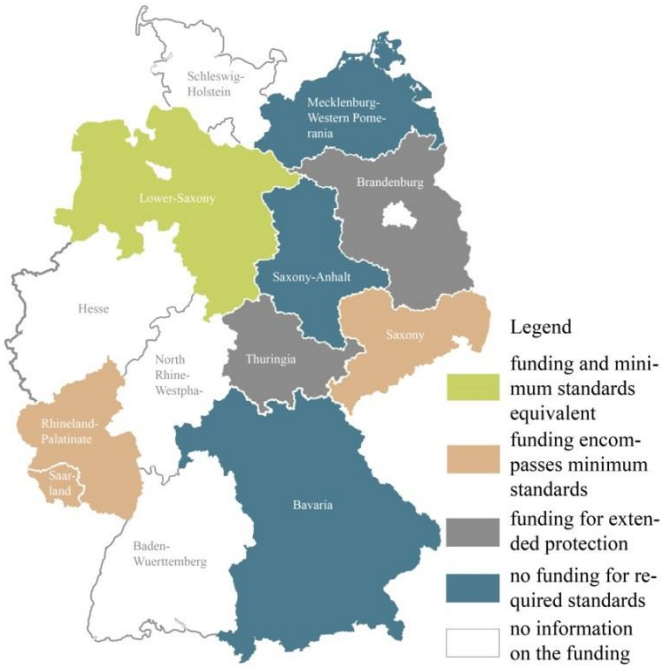

Figure 9: Funding of minimum standards in the federal states

CURRENT STATE

When considering funding possibilities for prevention measures, it is considerably interesting to investigate if the mentioned minimum standards are actually regarded as sufficient to receive funding for.

As outlined in figure 9, only Lower Saxony clearly sets the same standards for measures that can get funded and those are required to receive compensation. The regulation lists the required standards for livestock and fenced game in the annex of ins funding guideline (MU 2015b).

Rhineland-Palatinate, Saxony and Saarland on the other hand differentiate between these standards. In these states funding is available for the minimum standards; however more advanced protection measures are as well possible to get funding for, as outlined in chapter (MULEWF 2015; MUV 2015; SMUL 2014). Whether or not these eligible costs for grants incorporate the acquisition of "standard equipment" (*übliche Standardausstattung*) is not clearly stated. Brandenburg, however, specifically excludes such "standard equipment", since eligible costs are only those for "additional protection measures" (*zusätzliche Schutzmaßnahmen*) (LUGV 2012). Thuringia follows the same principle but further explains that funding is only possible for measures which improve standard fences. Hence, funding is provided for measures against digging and electric fences (TMUEN 2015b). Consequently, funding encompasses the required minimum measures for Brandenburg and Thuringia despite the standard equipment of fences.

The management plan of Mecklenburg-Western Pomerania states that funding is only provided for "extended protection measures" (*erweiterte Schutzmaßnahmen*) and that "basic protection measures" (*Grundschutz*) do not get funded (LU 2010). Nevertheless, it is outlined that electric fences indeed get funded, even if they are listed as "basic protection measures" (*Grundschutz*). Hence, the word is used in different contexts which can confuse the reader when it comes to these details. On the one hand it is used equivalently to the word "minimum standards" with reference to the precondition to receive compensation. On the other hand it is rather used in the sense of "standard equipment" like in Thuringia, when it is outlined that these measures are not getting funded. Nevertheless, as shown in

figure 9, the wording is taken literally and Mecklenburg-Western Pomerania is marked as not to be funding the required minimum standards.

Saxony-Anhalt, does not fund the required minimum standards since only for electric fences fnding is available for (ALFF 2014). Bavaria is the only federal state with residential wolves that does not broadly grant funding for minimum standards, yet (LfU 2013). However, a fund has been established, so subsidies for preventive measures can be given on a flexible basis even if a funding area has not officially been designated, yet (LfU 2010). For Schleswig-Holstein no information is available. All other federal states do not set standards for prevention measures and/or do not offer funding at all.

Additionally, there are cases in which preventive measures need to be applied outside of wolf areas, where funding is not available. Lower Saxony is providing flexible funding for these cases, as outlined in its funding guideline (MU 2015b). When flexible funding for a permanent solution outside of funding areas is not provided, it is, however, important to offer help to livestock holders by providing mobile fences. These are provided by Bavaria, Hesse, North Rhine-Westphalia, Rhineland-Palatinate and Schleswig-Holstein (LfU 2014a; HMUKLV 2015; LANUV 2016; MULEWF 2015; Wolfsinformationszentrum Schleswig-Holstein 2016a).

Discussion

Following the reasoning of the latter two chapters the precondition to apply preventive measures in order to receive compensation needs to be slightly adjusted for exceptional cases. Some of these exceptions are necessary because of a lack of funding. Thus, when compensation is bound to the application of preventive measures, it also means that compensation should be bound to the funding of these preventive measures. Because both schemes are provided and required in designated wolf areas, there naturally is a connection between these two funding schemes. Ideally, there should not occur a situation where preventive measures are requested but their funding is not possible. Acknowledging this fact, some federal states already grant exceptions for livestock herder groups (hobby, cattle and horses) for which funding is not possible yet.

The ideal regulation would follow the example of Lower-Saxony, which sets identical standards for funding and compensation. This is the only way to request wolf-proof prevention measures for compensation and at the same time provide funding. There is no need to request livestock herders to completely pay for the required minimum standards or the so-called standard equipment. Since funding is usually provided, comprising only 80% of the acquisition costs, an own contribution of the livestock herder is already implicit. Furthermore, flexible funding for an emergency acquisition of wolf-proof fences is necessary in order to support livestock herders who have been experiencing an attack on their flock already. Only Lower Saxony is currently, doing so. Other federal states provide mobile fences for emergency cases outside of funding areas.

Recommendation

For federal states with residential wolves the minimum standards required to receive compensation must be funded following the reasoning above. Furthermore these states need to guarantee help for emergency cases of a wolf attack outside of funding areas. This could be provided by flexible funding or alternatively by providing mobile fences. The latter also applies to federal states with no funding areas (transmigrating and no wolves).

8. Funding area

Figure 10: Current funding areas of the federal states

Current state

Figure 10 gives an overview of the areas in Germany where prevention measures are currently subsidised. Subsidies for prevention measures are currently provided in all federal states with residential wolves, within the funding areas, which are currently equivalent to the designated wolf areas.

Rhineland-Palatinate, Saarland and North Rhine-Westphalia have recently prepared a management plan mentioning the need for subsidies in case of a likely recolonization of wolves (MUV 2015; MULEWF 2015; LANUV 2016). Most detailed is the preparation of Rhineland-Palatinate due to the designation of large funding areas. While Saarland mentions measures that can get funded in the future, North Rhine-Westphalia only states that a funding regulation is getting prepared for when wolves settle permanently. Baden-Württemberg on the contrary, only mentions that conflicts with livestock are getting analysed to estimate future damages (MLR 2013). Moreover, Bavaria established a fund for subsidising prevention measures since 2010. It is provided by the federal state government and the federal ministry (StMELF). The goal is to test effective measures within pilot projects (LfU 2010). The application of such measures is voluntary but recommended in certain areas (LfU 2014b). Nevertheless, with the confirmation of a single residential wolf, no broader state funding has been implemented yet.

Lower-Saxony, Mecklenburg-Western Pomerania and Thuringia restrict subsidies to certain parts of the federal state, designated as wolf areas. Lower Saxony adds whole administrative districts to the funding area step by step (MU 2015a). Mecklenburg-Western Pomerania and Thuringia, on the contrary, provide funding only in the precise area of wolf occurrence and within a radius of 30km (TMUEN 2016; LUNG 2015). In Brandenburg, Saxony and Saxony-Anhalt on the other hand, the whole federal state is a funding area or designated as a wolf area (Wolfsregion Lausitz 2015; Kontaktbüro Wolfsregion Lausitz n.d.; MLU 2014). For Schleswig-Holstein it is not clearly mentioned if funding is differentiated within and outside of a wolf area. It is mentioned in a report that funding for preventive measures outside of wolf areas is provided simultaneously with compensation (MELUR 2015b). On the contrary, an article on the official website outlines that funding is only available in wolf areas (Land Schleswig-Holstein 2015). Its designation follows the example of Lower-Saxony, since administrative districts are completely added to the area

Discussion

While the funding outside of wolf areas is optional, the size of funding areas can considerably reduce the cases where such an exceptional funding would be necessary. Currently, funding is available possible where a wolf area has been designated. Most of the time, the term "wolf area" is equivalently used with "funding area". A wolf area can only be designated when monitoring confirms the presence of a wolf for at least half a year. It also entails the analysis of livestock kills. A wolf area can then be designated when damages to livestock occur repeatedly over a period of half a year (TMUEN 2015b).

Hence, cases of livestock damage can be comparably high before a wolf area gets designated and funding is provided. Therefore, funding areas should not be enlarged piece by piece. There should rather be larger areas which can be added to the funding area in stages. If funding areas were larger than the actual wolf area, livestock holders would get the chance to adapt their husbandry systems before a wolf actually causes damage in their area. Consequently, larger funding areas could reduce the number of wolf attacks outside of a funding area. The schematic example in figure 11 shows that there are five potential wolf attacks on unprotected flocks, when funding is restricted to the wolf area. But if larger funding areas are provided, prevention would avoid three of these potential wolf attacks.

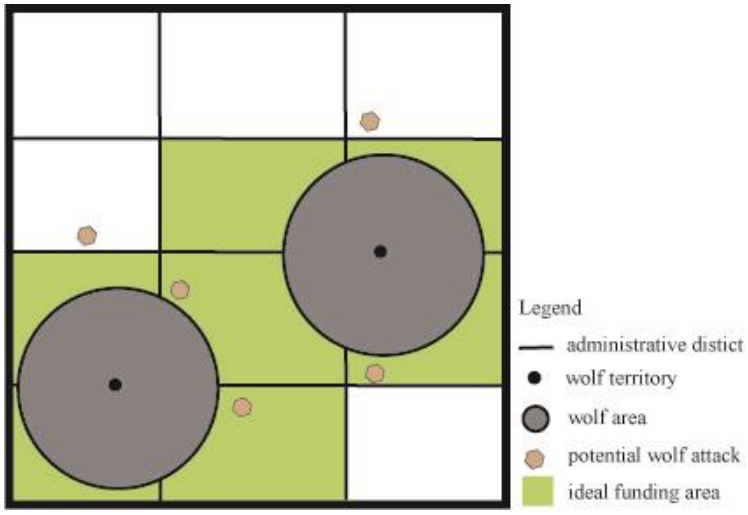

Figure 11: Schematic example of how funding areas could be set up

Since wolf areas encompass the area where a residential wolf has been monitored plus as radius of 30km, the area covered of approx. 2827.5 km² seems to be sufficient for funding, regarding the size of an average wolf territory of 172 km² (49 - 375 km²) (BfN 2011). Since Thuringia and Mecklenburg-Western Pomerania provide funding in the designated wolf areas, a sufficiently large area is covered by funding. Other federal states do not fund within a radius, but designate whole administrative districts as a funding area. Figure 11 shows that the size of an administrative district is potentially too small. This is especially because young wolves can travel 70km overnight (BfN 2011).

As it is shown in figure 10, Schleswig-Holstein's wolf area, coloured in green, is for example, much smaller than the wolf area designated in Thuringia. Therefore the funding areas of Schleswig-Holstein and Lower Saxony do not seem to be large enough to cover the common area around a wolf territory. Since Lower Saxony has become a federal state with many wolf packs, the precise designation of a funding area seems debatable. The wolf area has recently been enlarged in 2015 (MU 2015a). It now nearly covers the whole area of the federal state, leaving only a few areas unattended. However, since every year young wolves leave their pack to establish a new territory, it is more reasonable for federal states with larger wolf populations to apply funding to the whole state.

Even if wolf areas might be large enough for funding, Mecklenburg-Western Pomerania shows that the exact designation within a radius of 30km makes it difficult to understand which areas are funding areas. The approach to designate wolf areas along administrative districts is therefore better in terms of comprehension and transparency. Furthermore, the provision of funding along administrative borders is more reasonable in order to decide which administrative districts are included and responsible.

Even if Rhineland-Palatinate has no residential wolves yet, their preparation of funding is most advanced. The management plan comprises the preparation of ten large funding areas entailing several administrative districts (MUV 2015; MULEWF 2015). Nevertheless, one disadvantage might be that

the funding area is only orientated to administrative borders but not necessarily corresponding with future wolf presence. Following the reasoning stated so far, the ideal funding area, would therefore comprise the designated wolf area (territory plus a radius of 30km) plus the area within the borders of the respective administrative district. This concept is schematically explained in figure 11. Whether or not the radius of a wolf area needs to be 30km is up for debate, regarding the fact that the funding area would get enlarged depending on the size of the administrative district.

RECOMMENDATION

Funding areas should only be set by federal states with residential wolves. One reason for it is not to outweigh the benefits of prevention measures by the costs. Further, the change of husbandry systems for livestock holders might not be necessary when no residential wolves have been monitored. Nevertheless, federal states with transmigrating wolves should prepare funding areas. For federal states with single residential wolves the designation of funding areas seems reasonable. However, for areas with wolf populations and reproducing wolves, the whole federal state should be expected to get recolonised. For federal states with single residential wolves and for federal states with reproducing wolves, the funding area should be unequal to the wolf area. It should rather be designated according to administrative districts. Nevertheless, the funding area must be large enough to encompass an appropriate area around the wolf territory (p.r.n. radius of 30km).

9. *FUNDING OF WOLF-PROOF FENCES*

CURRENT STATE

Table 3: Compliance of standards with Reinhardt *et al.* (2012) for fences funding is available for

Blue: standards set by Reinhardt *et al.* (2012); green: compliance; brown: no compliance

	non-electric sheep fence (fixed)	electric fences	electric fences
	e.g. mesh wire fences	electric sheep nets	permanent e-wire fence
minimum standards defined by Reinhard et al. (2012) for livestock (sheep & goats)	• 120 cm high, preferably 140 cm • measures against digging: - 100 cm wide strip of mesh wire fixed to the ground and to the fence - electric wire 20 cm above ground and 15 cm in front of the fence - dug 50cm in the ground	• at least 110 cm high • at least 4000–5000 V • with stiff vertical plastic mesh	• 5 wires: 20, 40, 60, 90, 120 cm • max. 20cm above the ground • at least 4000–5000 V

Brandenburg (LUGV 2012; Kluth & Reinhard 2010)	• at least 140 cm in height • measures against digging: - 100 cm wide strip of mesh wire fixed to the ground and to the fence - electric wire 20 cm above ground and at least 2500 V - dug 40cm in the ground	• at least 90 cm high recommended min. 110cm • at least 2500 V on the fence	• at least 90 cm high recommended min. 110cm • at least 2500 V on the fence • one wire or cord at max. 20cm above the ground
Bavaria (LfU 2015)	• at least 140 cm in height • measures against digging: - 60 cm wide strip of mesh wire fixed to the ground and to the fence - dug 50cm in the ground	• at least 90 cm high • at least 2000 V on the fence	• at least 90 cm high • at least 2000 V on the fence • 5 wires: • one wire or cord at max. 20cm above the ground
Lower Saxony (MU 2015b)	• at least 120 cm high • protection against digging: - 100 cm wide strip of mesh wire fixed to the ground and to the fence - electric wire 20 cm above ground and 15 cm in front of the fence - dug 30cm into the ground	• at least 90 cm high, completely closed • min. 1 joule discharging energy • wire at max.20cm above the ground	• at least 90 cm high, completely closed • min. 1 joule discharging energy • wires at max. 20 cm above the ground
Mecklenburg-Western Pomerania (LU 2010)	• measures against digging: - electric wire 20 cm above ground - dug 20cm in the ground	• electric sheep nets: at least 110 cm high	no funding
Rhineland-Palatinate (MULEWF 2015; Kluth & Reinhard 2010) not funded yet	• at least 140 cm in height • measures against digging: - 100 cm wide strip of mesh wire fixed to the ground and to the fence - electric wire 20 cm above ground and at least 2500 V - dug 40cm in the ground	• at least 90 cm high recommended min. 110cm • at least 2500 V on the fence	• at least 90 cm high recommended min. 110cm • at least 2500 V on the fence • fences with five wires or cords: one wire or cord at max. 20cm above the ground
Saarland (MUV 2015; Kluth & Reinhard 2010) not funded yet	• at least 140 cm in height • measures against digging: - 100 cm wide strip of mesh wire fixed to the ground and to the fence - electric wire 20 cm above ground and at least 2500 V - dug 40cm in the ground	• at least 90 cm high recommended min. 110cm • at least 2500 V on the fence	• at least 90 cm high recommended min. 110cm • at least 2500 V on the fence • fences with five wires or cords: one wire or cord at max. 20cm above the ground
Saxony (Kluth & Reinhard 2010)	• at least 140 cm in height • measures against digging: - 100 cm wide strip of mesh wire fixed to the ground and to the fence - electric wire 20 cm above ground and at least 2500 V - dug 40cm in the ground	• at least 90 cm high recommended min. 110cm • at least 2500 V	• at least 90 cm high recommended min. 110cm • at least 2500 V on the fence • fences with five wires or cords: one wire or cord at max. 20cm above the ground

Saxony-Anhalt (MLU 2014)	not funded	• at least 90 cm high, completely closed • at least 3000 V, recommended 5000 V • min. 1,5 Joule discharging energy	• five wires or cords • at least 90 cm high, completely closed • at least 3000 V, recommended 5000 V • min. 1,5 Joule discharging energy • wires or cords at max. 20cm above the ground • for testing: four wires or cords (20, 40, 65, 80 cm above the ground)
Schleswig-Holstein (Wolfsinformationszentrum Schleswig-Holstein n.y.)	• at least 120 cm high • against digging: - 100 cm wide strip of mesh wire fixed to the ground and to the fence - dug 20 - 50 cm in the ground	• 90 - 110 cm high • at least 3000 - 5000 V	• 3 - 4 wires or cords • max. 20 cm above the ground
Thuringia (TMUEN 2015a)	• increase fence height >120cm • measures against digging	• at least 90 cm high • at least 2000 V	• at least 90 cm high • at least 2000 V

Chapter 6 evaluated which minimum standards are wolf-proof according to Reinhardt *et al.* (2012). This chapter will outline if the measures funded differ from the minimum standards and if they can be called wolf-proof under the same conditions. The results are presented in table 3. While chapter 7 analysed if the minimum standards are also eligible for funding, it also already gave an insight in whether or not higher standards are set for funding. The respective differences will be explained hereinafter.

Before going into detail with the standards funded, it should be outlined that not all federal states do actually fund all measures required for compensation. Mecklenburg-Western Pomerania specifically outlines to only fund non-electric fences and electric sheep nets. Permanent e-wire fences are accepted for receiving compensation, however, it is not mentioned in the management plan to be funded (LU 2010). Saxony-Anhalt on the contrary only funds electric fences (MLU 2014; ALFF 2015).

Brandenburg is referring to the recommended measures outlined by Kluth and Reinhardt (2010). These are stated in the annex of the management plan (LUGV 2012). Saxony does not outline the brochure, even if its title is “information for hunters, foresters and livestock holders in Saxony and Brandenburg”. The federal state does not mention any required standards for the measures funding is available for (SMUL 2014). When evaluated according to the standards set in the brochure, however, the outcome for Saxony is comparable to Brandenburg. The significant difference between recommended measures and the required minimum standards are measures against digging for non-electric fences. Furthermore, the standards for permanent e-fences get intensified by a wire or cord at max. 20cm above the ground. Even if the recommended height of 110 cm complies with the recommendations, the voltage and the height of both electric fences (90cm; 2500 V) are below the recommended standards. Hence, only the funded non-electric fences are indeed wolf-proof.

As stated above, Rhineland-Palatinate and Saarland refer to the same brochure in the annex of their management plans (MULEWF 2015; MUV 2015). However, the difference to the minimum standards is not as big as in Brandenburg and Saxony. Both states require measures against digging, even if an electric wire 20 cm above the ground is not the only way. Nevertheless, all efficient measures against digging get funded. What should be highlighted here is that the brochure only recommends the non-electric fences to be 40cm dug into the ground. Reinhardt *et al.* (2012), however, recommend 50cm. Consequently, when strictly evaluated, even non-electric don't comply with the recommendations.

Schleswig-Holstein does not set official binding standards, neither for compensation nor for funding. Hence, a comparison is not possible. However, the official website refers to a brochure published by an initiative called "Freundeskreis freilebender Wölfe e.V." (Wolfsinformationszentrum Schleswig-Holstein n.y.; Freundeskreis freilebender Wölfe e.V.). The standards outlined in the brochure for non-electric sheep fences as well as for electric sheep nets are in accordance with the wolf-proof standards defined by Reinhardt *et al.* (2012). However, requirements for a permanent e-wire fence are not specifically outlined. It is further up for interpretation if the recommended voltage of 3000 - 5000 applies to both types of electric fences.

Mecklenburg-Western Pomerania and Thuringia both do not provide funding for standard equipment. Nevertheless, both states finance measures against digging. These respective measures are already set as minimum standards for Thuringia. Furthermore, Thuringia funds the increase of the height of non-electric fences above 120cm (TMUEN 2015a). With regard to electric fences both federal states do not outline required standards for funding in more detail than the minimum standards. Mecklenburg-Western Pomerania only states that e-fences are only funded with a required height of 110cm (LU 2010). The fact that the required voltage of both states is still below the recommended standards, however means, that only the non-electric fences are in accordance with wolf-proof measures. When strictly evaluated, the same conclusion applies as for the recommendations by Kluth and Reinhardt (2010). In Mecklenburg-Western Pomerania fences only need to be 20cm dug into the ground instead of 50cm.

Lastly, Bavaria and Saxony-Anhalt do not recommend any further standards for measures to be funded (MLU 2014; LfU 2015). In an instruction sheet Saxony-Anhalt only refers to the required minimum standards (ALFF 2015). As outlined in chapter 6 the required standards for electric fences (non-electric fences are not funded) are not according to the recommended wolf-proof standards. Even if the height of 90cm is still regarded as too low, the required voltage is the highest among all federal states. Since at least 3000 V are required and even 5000 V are recommended, this criterion actually coincide with the recommendations by Reinhardt *et al.* (2012). In Bavaria, funding is not yet provided on a broad scale. Nevertheless, recommendations are given that contain measures against digging but do not request sufficient voltage (LfU 2015).

All in all, no federal state complies with the recommendations by Reinhardt *et al.* (2012) for all three measures. Most of them only comply with these standards when it comes to non-electric fences. Nevertheless, some states enhanced the minimum standards by adding measures against digging required for receiving subsidies. The brochure by Schleswig-Holstein is the only one also recommending sufficient voltage for electric sheep nets. Lower Saxony is the only federal state that published its funding guideline online clearly indicating that the standards funded and the minimum standards required for compensation are identical (MU 2015b). When looking at the standards outlined in the management plans of Rhineland-Palatinate and Saarland, this aspect is well adapted. The specific details of the two standards only differ slightly (MULEWF 2015; MUV 2015).

DISCUSSION

According to Reinhardt and Kluth (2007) it is important to set binding standards for prevention measures. Nevertheless, when it comes to the technical requirements of each federal state, practices get very diverse. The most occurring difference between the recommendations of Reinhardt *et al.* (2012) and the measures funded by the federal states is the required height of electric fences and their electric voltage. None of them are actually in accordance with the recommended standards. Furthermore, different requirements are set for how deep to dig the fence into the ground as a measure against digging. They vary between 20 and 50cm. Only Saxony-Anhalt and Schleswig-Holstein request 3000-5000 V. When usually only 2500 V are required, the question comes up, if funding would actually be provided for the additional costs for higher voltage. This loophole leads back to the initial idea outlined in chapter 6 and 7. Minimum standards should be set that are wolf-proof and funded. Lower Saxony is a good example how to achieve consistency between the standards.

When insufficient measures get funded there is a dangerous massage behind it. On the one hand the livestock owners are given the impression that the applied measures would be enough to protect their flock. On the other hand the risk gets taken that sheep might get attacked. Consequently, frustration could be considerably high when it turned out that the required measures are actually insufficient. It is sheer not understandable why each federal state comes up with different requirements, especially since scientific knowledge is available. Coherence could have been especially possible, since all federal states get together in the national and federal working group for nature protection (LANA) in order to discuss standards. However, since helpful print materials, such as SMUL (2015) and Kluth and Reinhardt (2010) are existent and the standards outlined have been adapted in the management plans of two federal states (which are preparing for a future recolonization of wolves) improvement can be noticed regarding the coherence.

Most federal states with wolf areas subsidise all three kinds of effective fences: non-electric fences, electric sheep nets and permanent e-wire fences. Saxony-Anhalt, in contrast, does not financially

support non-electric fences and Mecklenburg-Western Pomerania excludes permanent e-wire fences from funding (MLU 2014; ALFF 2015; LU 2010). Not all measures are applicable and the herder should decide which measures to best apply and co-finance. Consequently, there is no reason to specifically exclude any of these measures from funding.

RECOMMENDATION

As stated before, all federal states should integrate compensation schemes. As soon as wolves become residential funding schemes should be implemented and orientated to the standards set to receive compensation. Hence, only measures should get funded that are proven to be sufficiently wolf-proof. This includes all kinds of effective fences: non-electric fences, electric sheep nets and permanent e-wire fences.

10. FUNDING OF LGDS

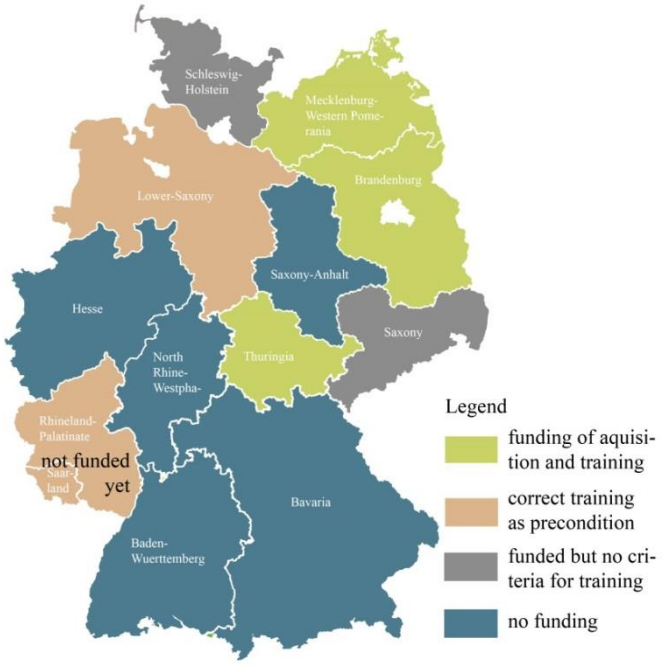

Figure 12: Funding for acquisition and training of LGDs in the federal states

CURRENT STATE

LGDs have been proven to be very successful in preventing wolf attacks on livestock (Espuno *et al.* 2004; Reinhardt *et al.* 2012; Ribeiro and Petrucci-Fonseca 2007). Therefore this form of prevention gets subsidized in most federal states with wolf occurrence. Only Saxony-Anhalt solely focuses on the funding of electric fences (MLU 2014). LGDs are only recommended as a good protection method (MLU 2008). Same applies to Bavaria which recommends the keeping of LGDs as a protection method but has not announced to provide funding, yet (LfU 2015).

While some federal states only state to fund the acquisition of LGDs, others also financially support the training and correct upbringing of the dogs. Mecklenburg-Western Pomerania already provides funding for the training of LGDs since 2010 (LU 2010). Brandenburg, on the contrary has only recently announced that LGDs have been integrated (Investitionsbank des Landes Brandenburg 2015).

Thuringia also outlines in its funding guideline to support the acquisition and the training of suitable LGDs (TMUEN 2015a). The differences of funding among the federal states are shown in figure 12.

Thuringia and Lower Saxony are the only federal states specifically outlining which breeds are financially supported. Both only subsidise dogs of the breeds Chien de Montagne des Pyrénées or Patou (*Pyrenäenberghund*) and Maremmano-Abruzzese (TMUEN 2015a; MU 2015b). Lower Saxony further states that the correct upbringing is a precondition and defines that the recommended number of dogs. For a herd of at least 100 sheep two dogs are required up to 200 sheep. For any 100 sheep one additional dog is required respectively. Furthermore, herders need to pass a test to be allowed to own a LDG (MU 2015b). Brandenburg, Saarland and Rhineland-Palatinate refer to the brochure Kluth and Reinhardt (2010) (MUV 2015; MULEWF 2015; LUGV 2012). Besides the mentioning of the correct upbringing and training of the dogs, scientific results are integrated in these recommendations since it is referred to the fact that LGDs are most effective if the flock if fenced during the night. For Saxony and Schleswig-Holstein, the breeds, number or necessary behaviour components of LGDs are never officially stated (Freistaat Sachsen 2015; Freistaat Sachsen 2014; Land Schleswig-Holstein 2015). The respective standards are only outlined in the above mentioned materials.

DISCUSSION

Using LDGs is one of the most successful and most traditional ways to prevent a wolf attack. Therefore it is inevitable to financially support the use of LGDs for livestock herders. Saxony-Anhalt sticks out as a negative example, which is still not providing funding. However, it has been announced that funding will be possible this year. The respective regulation is said to be already in the making (MDR Sachsen-Anhalt 2016). Still, the funding of the acquisition alone is not expedient as it is currently done in half of the states with a wolf area. For the success of LDGs it is inevitable to provide expert advice on their raising and training (Reinhardt *et al.* 2012). LDGs grow up within a flock and develop a protective and social behaviour towards the sheep and towards humans (Arbeitsgemeinschaft Herdenschutzhunde e.V. n.d.; Hahnel n.d.). According to Ribeiro and Petrucci-Fonseca (2007), necessary behaviour components are attentiveness, trustworthiness and protectiveness. Their results show that these characteristics are the basis for the efficiency of LGDs.

Nevertheless most federal states do not even mention these binding conditions. Since this method is relatively new to most livestock herders more background knowledge and consulting is desirable. Generally, Brandenburg could be seen as one good example. Even if Brandenburg was one of the last federal states including LDGs in the funding, together with Lower Saxony and Schleswig-Holstein, in 2015, the training of the dogs is ensured and the system behind the distribution of the dogs is sound. It has even been discussed for Brandenburg to subsidies the first two years of living costs of the dogs (Kontaktbüro Wolfsregion Lausitz n.d.). According to an interview with a livestock herder, this

support would be very helpful, since the living costs of a LGD sum up to 1,000 € per year (Hahnel n.d.). This has also been supported by a livestock herder while the field trip of the workshop of the Eu Platform (EC 2016a). IFAW has supported the "Arbeitsgemeinschaft Herdenschutzhunde e.V." for one year between 2014 and 2015 by providing 30 tons of dog food to livestock herders. According to a livestock herder this temporary support has already been helpful (EC 2016a). IFAW is now requesting politics to take action in this regard (IFAW 2015).

For those federal states that financially support the correct training of the dogs the organisation behind such a "certified dog" is considerably interesting. In Brandenburg the federal ministry cooperates with an association founded to breed LGDs and to support livestock herders in the correct application of these dogs, called "Arbeitsgemeinschaft Herdenschutzhunde e.V.". Together with the "Landesamt für Gesundheit und Verbraucherschutz Brandenburg" (LUGV) a brochure has been published stating the correct behaviour and treatment of an LGD (Arbeitsgemeinschaft Herdenschutzhunde e.V. n.d.).

In Thuringia and Mecklenburg-Western Pomerania the correct training cannot be guaranteed through a breeding system. In Thuringia currently only one wolf is residential, but a future growth of the population is expected. Therefore similar breeding programmes are strived for, but currently not centrally organised. Currently, single breeders are planning to integrate an information point (Ehrlich 2015) and the association for sheep breeding (*Schafzuchtverband*) attend to the topic (according to the facebook-page of the "Arbeitsgemeinschaft Herdenschutzhunde e.V."). Mecklenburg-Western Pomerania is also planning to found a breeding association (Landesschafzuchtverband Mecklenburg-Vorpommern e.V. 2012). Nevertheless, after three years, no result can be found. Since Saxony and Schleswig-Holstein financially only support the acquisition of a LDG without further defining the respective standard of such, no guarantee of a positive outcome can be given.

The brochure of the LUGV and the "Arbeitsgemeinschaft Herdenschutzhunde e.V." is recommending LDGs for different kinds of herds. Even if experiences are mainly available for sheep, the dogs can also be integrated in herds of goats, cattle, buffalos, horses, fenced game and even poultry (Arbeitsgemeinschaft Herdenschutzhunde e.V. n.d.). Still, NABU outlines that in special cases the use of LGDs is not applicable. In one case after a wolf attack on horses, it was outlined that LDGs cannot protect the herd in the future because of the size of the area the animals are living in. (NABU 2016a). A publication specifically dealing with the use of protection measures for horses, states that insufficient experiences are available (NABU Bundesverband 2015). In May 2016 puppies were given to a cattle breeder in order to let the dogs grow up with the cattle (Freundeskreis freilebender Wölfe e.V. 2016b). When a dog is integrated in the herd when they are still small, they can adapt to cattle. Nevertheless, for this project a different breed has been chosen than usually applied for sheep, called Kangal (Freundeskreis freilebender Wölfe e.V. 2016a). In this pilot study the experiences with these dogs shall give insights for future actions. Ideally, federal states should follow this example and test the use of LDGs for different kinds of animals.

Recommendation

As mentioned above all kinds of effective wolf-proof protection measures should be financially supported in order to give a choice to the livestock herder in terms of applicability and finance. These measures do not only include all three kinds of non-electric and electric fences but also the use of LGDs. Nevertheless, their correct upbringing and training is considerably important and should be bound as a precondition to their funding. Since the training of LGDs takes some time and the herders need to accommodate to their use, the early organisation and consultation of the upbringing is considerably important. Besides the acquisition of the dogs, the training should as well be financially supported, providing livestock herders the possibility of a second income as breeders. Ideally, the LDGs should also receive financial assistance for the living cost.

11. Funding amount

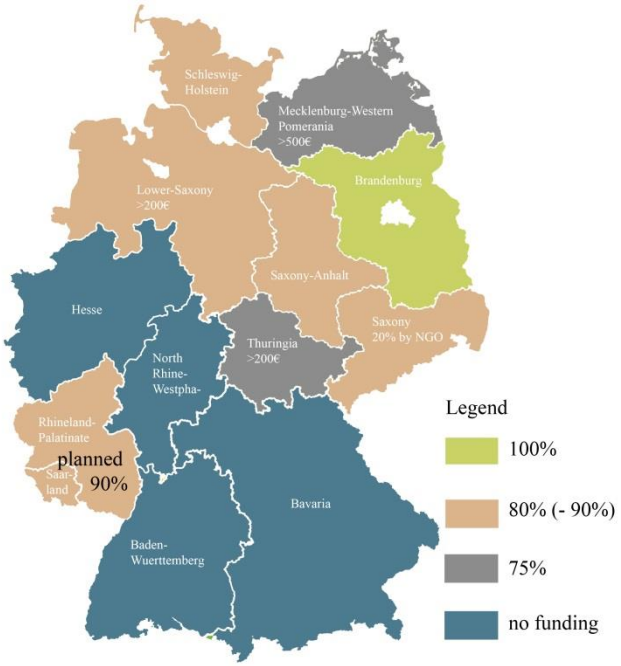

Figure 13: Amount of funding for preventive measures of the federal states

Current state

The amount of provided subsidies for prevention measures varies considerably among the federal states as outlined in figure 13. Brandenburg outlines in its management plan that it supports livestock holders by subsidising 100% of the costs for preventive measures (LUGV 2012). The same applies to Saxony, which increased the subsidies by the federal state from 60% to 80% last year (Freistaat Sachsen 2015). The additional 20% of the costs get funded by the foundation "Heinz Sielmann Stiftung" for a testing period of two years (Freistaat Sachsen 2015).

Lower-Saxony, Schleswig-Holstein and Saxony-Anhalt subsidise 80% of the respective costs (MU 2015b; MLU 2014; Wolfsinformationszentrum Schleswig-Holstein 2016a). Mecklenburg-Western Pomerania and Thuringia, on the contrary, only subsidise 75% of the costs (TMUEN 2015b; LU 2010). Saarland and Rhineland-Palatinate even plan to implement regulations that introduce funding of 90%, as soon as a wolf area gets be designated (MULEWF 2015; MUV 2015). Nevertheless, not all

costs for preventive measures are fundable. Thuringia and Lower Saxony only subsidise costs above 200€. Saxony-Anhalt and Mecklenburg-Western Pomerania even determine a minimum limit of 500€.

Discussion

It is recommended by Linnell *et al.* (2008) to let livestock holders make an own contribution in terms of labour and funds. This is because it would increase their sense of ownership and responsibility towards the maintenance of the preventive measures. Nevertheless, it is never really stated how much this own contribution of livestock holders should actually be. The subsidies differ between 75% up to 100%. Since the approach of 90% has not been implemented yet and no experience is available, the successful example of Saxony is presumably, the best approach. The federal state subsidises 80% by governmental funds which can be regarded as sufficient, because many other federal states have been following this example. Since the "Heinz Sielmann Stiftung" subsidise the remaining 20% of the costs for a testing period of two years, more information about the effectiveness of the 100%-funding can be drawn in the future. Lower limits might make sense concerning the administrative effort. The minimum amount of 200€ cam be seen as a sufficient "own contribution" of the livestock herder. Regarding the costs of an LGD of 800€ - 3500€ (Hausding 2015) and electric fences costing about 600-900€ (WWF Deutschland 2014), costs lower than 200€ should be rare.

Recommendation

It is recommended for all federal states with residential wolves to fund preventive measures by 80% inside of wolf areas. If lower limits are needed for administrative reasons, a limit of 200€ is reasonable, since most effective preventive measures cost more.

12. Beneficiary funding is available for

Current state

Regarding the funding of prevention measures, some federal states exclude non-commercial livestock holders or hobby livestock holders. The summary in table 4 shows which federal states are known or interpreted to also grant funding for hobby livestock herders are marked in green. Those federal states that refer to livestock herders in general are coloured in brown. The federal states that clearly do not include hobby livestock herders are marked in blue.

Table 4: Beneficiary groups funding is available for in the federal states

	Prevention	Compensation
Baden-Wuerttemberg (MLR 2013)	no prevention	livestock holders in general
Bavaria (LfU 2014a)	no prevention	livestock holders in general
Brandenburg (LUGV 2012)	commercial agricultural animal owners in main and secondary occupation; funding of hobby livestock herders is currently not possible	commercial agricultural animal owners in main and secondary occupation and private non-commercial livestock owners
Hesse (HMUKLV 2015)	no prevention	no compensation
Lower-Saxony (MU 2014b; MU 2015b)	no further specification	commercial agricultural animal owners in main and secondary occupation and hobby livestock owners
Mecklenburg-Western Pomerania (LU 2010; LU 2013b)	commercial and hobby livestock owners	livestock and domestic animals
North Rhine-Westphalian (LANUV 2016)	no prevention	livestock holders in general
Rhineland-Palatinate (MULEWF 2015)	livestock holders in general	livestock holders in general
Saarland (MUV 2015)	livestock holders in general	livestock holders in general
Saxony (SMUL 2014)	commercial agricultural animal owners in main and secondary occupation and hobby livestock herders	livestock and domestic animals
Saxony-Anhalt (MLU 2014;ALFF 2014)	agricultural and forestry enterprises in main and secondary occupation with keeping of sheep, goats and fenced game	commercial agricultural animal owners in main and secondary occupation and hobby livestock owners
Schleswig-Holstein (MELUR 2015a)	generally legal entities	commercial and non-commercial livestock owners of domestic animals
Thuringia (TMUEN 2015a;TMUEN 2015b)	commercial agricultural animal owners in main and secondary occupation and hobby livestock herders	livestock and domestic animals

Funding of prevention measures is not always granted for all types of livestock herders. Chapter 4 gives an overview with regard to the animals that can get compensated. It also addresses whether or not compensatory damages are available for hobby or commercial reasons. Since chapter 4 has only outlined these two facts by reference to a map, the beneficiary for compensation is also outlined in table 4, making a comparison possible with the beneficiaries for funding of prevention measures. In contrast to chapter 4, these two aspects are looked at separately with regard to the funding of prevention measures. The animals that funding for prevention measures is available for will be outlined in the following chapter.

The importance to include hobby owners in the funding regulation is highlighted by the position paper of Schleswig-Holstein: "A differentiation between commercial and hobby groups is not made due to reasons of acceptance" (MELUR 2008). Still, some federal states do not comply with this principal. In 2013, Saxony-Anhalt only supported hobby sheep owners according to Reinhardt *et al.* (2013). By now, the complete opposite applies. The federal state only subsidises prevention measures for „agricultural and forestry enterprises in main and secondary occupation with keeping of sheep, goats and fenced game" (MLU 2014). Consequently, any domestic animals are not payed for. The same situation applies to Brandenburg. Its management plan states that funding for preventive measures for hobby livestock owners is not possible yet. Nevertheless, it also raises the necessity of doing so (LUGV 2012). Funding of preventive measures for commercial and hobby sheep holders is therefore only possible as an exception with good reasoning (MUGV 2010). When comparing these beneficiaries to the ones receiving compensation, it becomes apparent that these states are the only ones making a difference. This means in detail, that funding is not available for hobby livestock herders, but they can get compensated.

Mecklenburg-Western Pomerania, Thuringia and Saxony, on the contrary, specifically outline that hobby livestock holders are targeted as well as commercial animal owners (LU 2010; SMUL 2014). Thuringia follows the same principal, but referring to animal owners with commercial and non-commercial purpose (TMUEN 2015b). Lower Saxony, does not specifically include or exclude hobby purposes of livestock owners (MU 2014b; MU 2015b). Schleswig-Holstein states that beneficiaries are all "generally legal entities" (MELUR 2015a). Hence, presumably hobby herders are included.

Rather difficult is the interpretation of the wording of Saarland and Rhineland-Palatinate. Both only generally refer to livestock holders (MUV 2015; MULEWF 2015). Following the interpretation outlined in Chapter 4, this would mean that solely commercial purposes are included. However, in Saarland, hobby livestock owners are mentioned in the annex of the management plan with regard to the recommendations of prevention measures for livestock herders. This annex is referred to in the chapter dealing with the funding of prevention. Consequently, it is likely that hobby livestock herders also get financially supported (MUV 2015). While the rest of the annex is identical, Rhineland-Palatinate did not include this phrase but replaced it with reference to the possibility to lend flexible

electric fences (MULEWF 2015). Anyway, since both federal states do not fund prevention measures, yet, the impact of the funding scheme on hobby herds is not yet that relevant.

Discussion

According to Frank Faß, expert of the wolf Center in Dörverden, hobby livestock holders also need support if they want to protect their stock (Bayrisches landwirtschaftliches Wochenblatt 2015). Same is claimed by Klose (2014) and BUND (n.d.) with reference to Brandenburg. Both NGOs demand the federal state to include non-commercial herders in the funding regulations for preventive measures. While in the management plan itself the urgent need to do so is mentioned (LUGV 2012), no change has been happening since 2012. Especially, with the new funding period of the European Agricultural Fund for Rural Development (German: ELER) in 2014 a change could have been possible. For Saxony-Anhalt the same situation applies to. Even if its mission statement from 2008 is not quite advanced, changes of the funding regulation have been implemented in 2014 with the release of the funding guideline. Nevertheless, no funding for hobby livestock owners is available, even if wolves are known to be residential in Saxony-Anhalt since 2008. So this federal state is violating the before mentioned demand to always offer funding support when demanding to apply preventive measures. Both federal states also go against the principle to favour prevention before compensation.

As mentioned above, some federal states potentially include hobby livestock owners in the funding regulation like Saarland, Lower Saxony and Schleswig-Holstein. Others rather exclude them by not mentioning hobby livestock owners, like Rhineland-Palatinate. For some federal states an interpretation of the terminology “livestock holder” is needed in order to estimate whether or not hobby livestock herders are included in the funding scheme. It is recommended to specifically outline that hobby purpose is included in the funding. Hence, if are not addressed, but only “livestock holders” are mentioned as a terminology, it should not be evaluated as sufficient.

Recommendation

Those federal states that provide funding for preventive measures should always include hobby as well as commercial livestock holders in the regulation. If this is not possible or not done yet, an exception must be made for hobby livestock owners to apply preventive measures to receive compensation, as outlined in chapter 5. Furthermore, there should not be room for interpretation of the group or type of livestock owner targeted by the funding regulation. The beneficiary of the funding scheme should therefore be specifically outlined. This condition also applies to federal states with transmigrating wolves since hobby livestock herders should get the chance to invest their resources in adequate prevention instead of hoping for future funding.

13. ANIMALS FUNDING IS AVAILABLE FOR

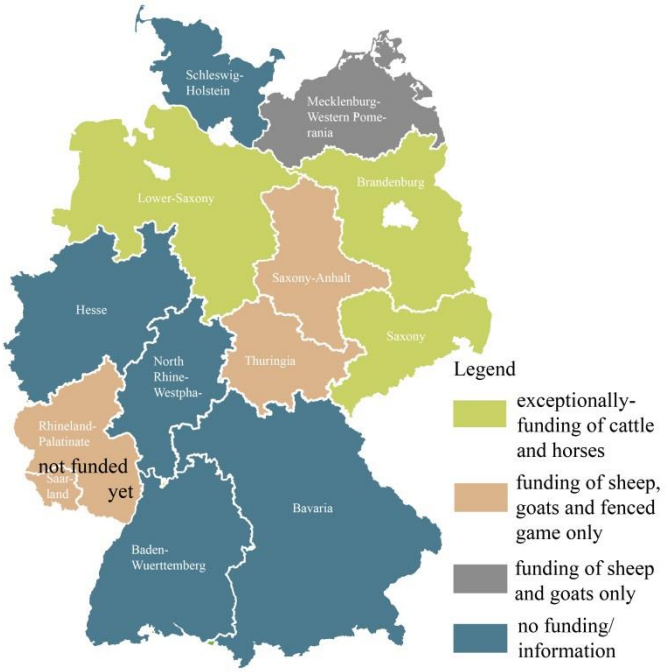

Figure 14: Animal types funding for prevention is available for in the federal states

CURRENT STATE

The focus for prevention measures traditionally lies on goats and sheep. Even if these kinds of livestock are most targeted by wolves, cattle and horses have also already been attacked. Nevertheless, most funding guidelines exclude cattle and horses from funding. Figure 14 outlines which federal states still grant funding for cattle and horses.

For Brandenburg a leaflet even outlines the financial support of alpacas and lamas. Besides these two, the most targeted animals by wolves are also mentioned: sheep, goats and fenced game (Investitionsbank des Landes Brandenburg 2015). Those are also integrated in the funding regulation by Saxony-Anhalt and Lower-Saxony, as well as in the management plans of Saarland and Rhineland-Palatinate (MLU 2014; MU 2015b; MUV 2015; MULEWF 2015). Thuringia does not specifically mention these forms of livestock in the funding guideline (TMUEN 2015a). However, it requests prevention measures in order to receive compensation for these animal types (TMUEN 2015b). Mecklenburg-Western Pomerania is the only federal state only subsidising protection measures for goats and sheep, leaving owners of fenced game out of the funding benefits. Lastly, Schleswig-Holstein does not specifically mention any species for which preventive measures are funded (MELUR 2015a; MELUR 2008).

Even if horses and cattle producers are generally neglected by the funding regulations, there are some examples where exceptional funding is provided. Saxony, for example, provides funding for „livestock“ which has been targeted by wolves before. Even if it does not refer to specific animals (SMUL 2014), an information leaflet for funding has been distributed among livestock herders of sheep, goats and fenced game (SMUL 2015). The management plan additionally outlines that further animals can be added to the funding scheme if they get attacked. Lower Saxony specifically outlines that the protection of cattle and horses can be subsidized as an exception. This exception is granted when the applicant has suffered from a wolf attack on his/her herd already or when wolf attacks have

been known in the area in at least three cases within a radius of 30 km per year (MU 2014b). Following the same principle, Brandenburg has applied preventive measures for a cattle producer as an exception in cooperation with IFAW after a wolf attack (top agrar online 2014). Funding was provided for the protection of mother cows with an amount of 99,496 € between October 2014 and February 2015. This sum was granted for three applications in 2014 and fourteen applications in 2015 (LfU Brandenburg 2016b).

Discussion

The common practice in Germany is to financially support preventive measures for sheep and goats, since they are most targeted by wolves. Nevertheless, as outlined in chapter 4, fenced game can be targeted by wolves, too. Furthermore, NGOs request the funding for all kinds of livestock as outlined in Klose (2014). The report stresses the importance to financially support all livestock producers with the application of preventive measures. However, categorical funding of larger livestock would not be reasonable following a simple cost-benefit analysis. The costs presently outweigh the benefits. Abundance of wild ungulates is high and wolves are not likely to attack large livestock (Reinhardt *et al.* 2012). Lower Saxony and Saxony therefore open up the binding paragraphs of the funding regulation for exceptional cases. This is especially needed with regard to cattle and horses. The need for occasional financial support has been shown in Saxony and Brandenburg already.

Furthermore, Bavaria has been analysing different husbandry systems with regard to assistance and advise to livestock holders, including cattle producers (LfU 2014a). Nevertheless, currently there are few recommendations for successful prevention measures for cattle and horses. Since Lower Saxony has most horse owners in Germany, NABU has recently published a brochure defining protection methods applicable for horses (NABU Bundesverband 2015). However, information by the state administrations is lacking. It only outlines binding requirements for fenced game (MU 2014b) which sill already provides an commendable example.

Recommendation

Those federal states that have residential wolves should provide funding for preventive measures for sheep, goats and fenced game inside of the funding area. For other kinds of livestock, flexible funding is necessary, following the example of Lower-Saxony. For cases where a wolf has already attacked a herd should get financial support in order to prevent another attack. This is highly likely to be relevant in a wolf area. Nevertheless, such cases can also occur where wolves are only transmigrating. Hence, all federal states with wolf abundance should exceptionally investment in protection measures for cattle and horses.

5.2 Requirements for funding schemes

Summary table and evaluation criteria

Table 5 provides a summary of the requirements for funding schemes derived from the discussion in the previous chapters. The requirements outlined do not only request ideal future practices, but are also derived from current practices already implemented. Hence, the practices mentioned with regard to the different stages of wolf occurrence could have been achieved by now. Behind these criteria a scoring system is provided. Hence, the federal states should ideally fulfil the practices marked with a dot (•). A detailed listing of the federal states' compliance is outlined in the previous 13 chapters. A summary of the given points per aspect is provided in table 6 in the following chapter.

Table 5: Summary of the requirements for funding schemes

<table>
<tr><th></th><th>federal states with wolf population with reproduction</th><th>federal states with single residential wolves</th><th>federal states with transmigrating wolves</th><th>federal states with no wolves</th></tr>
<tr><td>1. Evidence for compensation</td><td colspan="4">• canid species; wolf cannot be excluded as the culprit species</td></tr>
<tr><td>2. Direct and indirect costs compensated</td><td colspan="4">• compensating total replacement value or 100% of the income loss for direct and indirect damages
• direct costs: killed livestock or injured animals requiring immediate homicide (optional: killed livestock due to stress as a consequential damage); indirect costs: veterinary costs, the costs for the disposal of the carcasses (optional: amount of work)
• ideally compensating the restoration of preventive measures (property damage) as indirect costs</td></tr>
<tr><td rowspan="2">3. De Minimis Notice</td><td colspan="2">• EU notification to exceed De Minimis Notice</td><td colspan="2">De Minimis Notice is sufficient</td></tr>
<tr><td colspan="3">• implementing a fund, carried by NGOs, covering 20% of remaining (indirect) costs or compensate cases exceeding 15.000 EUR</td><td>De Minimis Notice is sufficient</td></tr>
</table>

<table>
<tr><th></th><th>federal states with wolf population with reproduction</th><th>federal states with single residential wolves</th><th>federal states with transmigrating wolves</th><th>federal states with no wolves</th></tr>
<tr><td>4. Animals compensated</td><td colspan="4">• compensation for livestock held for agricultural, commercial and domestic reasons (incl. hobby livestock owners) (for sheep, goats, fenced game, cattle, horses)
• compensation for hunting dogs and LGDs (optional: sheepdogs, donkeys, lamas and alpacas)</td></tr>
<tr><td rowspan="3">5. Precondition to apply preventive measures</td><td>• compulsory in wolf areas</td><td>• compulsory in wolf areas after a transition period of one year</td><td colspan="2">• announcement of future precondition (after a transition period)</td></tr>
<tr><td colspan="2">• exceptions to cases where prevention is not feasible for reasons of applicability, lack of knowledge and/or funding</td><td colspan="2">no prevention compulsory</td></tr>
<tr><td colspan="3">• compulsory for cases when an attack on livestock has happened before</td><td>no prevention compulsory</td></tr>
<tr><td>6. Minimum standards</td><td colspan="2">wolf-proof preventive measures for sheep and goats:
• non-electric fence: at least 120 cm high, measures against digging
• electric sheep nets: at least 110 cm high, at least 4000–5000 V
• permanent e-wire fence: 5 wires, max. 20cm above the ground, at least 4000–5000 V
• defining wolf-proof minimum standards for cattle and horses</td><td colspan="2">• defining minimum standards for wolf-proof preventive measures for emergency cases</td></tr>
<tr><td rowspan="2">7. Funding for preventive measures</td><td colspan="2">• funding available for minimum standards</td><td colspan="2">no prevention compulsory</td></tr>
<tr><td colspan="4">• flexible funding for cases outside of wolf areas; alternatively providing mobile fences</td></tr>
<tr><td>8. Funding area</td><td colspan="2">• large funding areas or whole federal state as funding area
• funding area designated along administrative borders</td><td>• preparing funding areas</td><td>no funding compulsory</td></tr>
</table>

<table>
<tr><th></th><th>federal states with wolf population with reproduction</th><th>federal states with single residential wolves</th><th>federal states with transmigrating wolves</th><th>federal states with no wolves</th></tr>
<tr><td rowspan="2">9. Funding of wolf-proof fences</td><td colspan="2">• funding for all three kinds of wolf-proof fences
• 3x compliance with wolf-proof preventive measures for sheep and goats set by Reinhardt et al. (2012) (see 6. Minimum standards)</td><td colspan="2">no funding compulsory</td></tr>
<tr><td colspan="4">• setting identical standards for funding and compensation</td></tr>
<tr><td>10. Funding of LGDs</td><td colspan="2">• funding of LGDs
• binding funding to the precondition of correct upbringing and training of LGDs
• funding of training of LGDs (ideally the living costs, too)</td><td colspan="2" rowspan="3">no funding compulsory</td></tr>
<tr><td>11. Funding amount</td><td colspan="2">• subsidising 80% of costs
• lower limit < 200 EUR</td></tr>
<tr><td rowspan="2">12. Beneficiary funding is available for</td><td colspan="2">• funding available for hobby livestock owners and those in main and secondary occupation</td></tr>
<tr><td colspan="3">• outlining the beneficiary group specifically</td><td>no funding compulsory</td></tr>
<tr><td rowspan="2">13. Animals funding is available for</td><td colspan="2">• categorical funding for sheep, goats and fenced game</td><td colspan="2">no funding compulsory</td></tr>
<tr><td colspan="3">• exceptional investment in protection measures for cattle and/or horses</td><td>no funding compulsory</td></tr>
</table>

DISCUSSION: FINANCING POSSIBILITIES TO IMPLEMENT REQUIREMENTS

When discussing the actual implementation of these requirements, the question arises if they can actually be implemented from a financial point of view. Despite some aspects mentioned above, financial aspects are purposely disregarded here. The purpose of this thesis is to present a design of funding schemes that would serve as an incentive for livestock herders to apply preventive measures and to follow the principal of cost-sharing when it comes to losses of livestock caused by wolves. Consequently, the financial reasons why federal state governments chose not to comply with certain criteria requested here should not broadly be looked at. Nevertheless, it would be interesting to learn from the reasoning behind the implementation in order to enhance the current situation of compliance. Nevertheless, the financial reasons are inevitably linked to the implementation of the funding schemes. In fact, it is specifically outlined in most regulations that any payments are dependent on the budget of the federal states. There is no legal claim for any of these subsidies. So the question should be discussed, which financing possibilities are provided in order to cover the full costs when implementing the range of criteria requested in in table 5.

The costs for funding schemes already pose a challenge to the budget of the federal states, since compensation costs can be high (Agarwala *et al.* 2010; Nyhus *et al.* 2005; Treves *et al.* 2009). Furthermore, the costs vary greatly and they are quite unpredictable. Schleswig-Holstein, for example, paid compensation of 36,000€ in 2013. In 2015 the one case alone, which was mentioned above, raised the amount up to 32,000€ (Landesportal Schleswig Holstein 2016a). The amount of money spent for preventive measures is hardly predictable as well. Brandenburg published data revealing these costs for eight consecutive years. While 2008-2010 only two to four applications were funded with an amount of 6,378€-9,257€, these costs increased considerably in the following years to 55,647€ for 13 cases in 2011 and 145,899€ in 2012. Even through there was a rise in the costs, in 2010 only 12 cases were funded. Costs were lower in the following two years but rose again in 2015 with the introduction of funding for LGDs. Last year the funding costs comprised 136,586€ (LfU Brandenburg 2016b). In Lower-Saxony, costs for compensation were about 17,500€ and prevention measures were funded by 317,500€ until September 2015 (Wochenblatt für Landwirtschaft & Landleben 2015; Land & Forst 2015). These numbers alone draw a picture of comparatively low depredation rates and a high willingness to apply prevention measures.

With regards to these varying sums, spent for compensation and prevention, it remains questionable if budgets provided by the federal states are sufficient to cover the costs. Furthermore, the implementation of the requirements would probably even raise the budget necessary. It is also highly dependent on the actual stage of wolf occurrence in the respective state and the ability of the state to adapt to unpredictable changes. Bavaria, for example, with only a few residential wolves, financially supports preventive measures for pilot projects with a budget of 50.000€ (LfU 2010). With regard to

the experiences in Brandenburg in 2011, this amount of money would not even suffice for 13 cases. Lower-Saxony, on the contrary, is among the federal states with most wolves, but only facing the challenge since 2012 with the establishment of the first pack (Landesjägerschaft Niedersachsen e.V. 2016). For 2016 and 2017 the budget will be made up of 800,000€, including 510,000€ for compensation and funding of prevention. Nevertheless, most other states do not publish the budget for the item funding; it is rather integrated in the budget for wolf management as a whole. Schleswig-Holstein for example provided a budget of 100.000€ for the whole wolf management (Freundeskreis freilebender Wölfe e.V. 2015a). As a federal state with only one residential wolf pack this amount can be seen as considerably high. Nevertheless, Schleswig-Holstein is planning to improve the wolf management with a budget double as high (MELUR 2015b).

At the first sight the budget available for wolf management seems to be sufficient to cover the costs outlined above. Nevertheless, most budgets contain other items of wolf management, like monitoring. The work load of the administration alone is estimated to be high and costly. Hence, the budget included for funding is up to the estimation of the government and also dependent on the costs for wolf management as a whole. There are however, divergent funding possibilities that have only partly been outlined already.

One of which would be the cooperation with NGOs within the implementation of a fund. Such a fund is regarded as fast and non-bureaucratic (MLR 2013). The main advantage is that money can be provided independently from governmental subsidies and the related restrictions. However, main responsibility for financial support as well as its coordination should lie in the hands of the federal states. Since it is possible to receive criticism about too much funding from "public tax money", like expressed in an inquiry addressed to the federal state government in Lower Saxony (Wochenblatt für Landwirtschaft & Landleben 2015; Land & Forst 2015), a financing option unbundled from the governmental budget should be aimed for.

According to Linnell *et al.* (2008) financial means should best be provided on a national or supranational level. As a consequence not every German Land is financially burdened (Reinhardt and Kluth 2007). With regard to the inequalities among the federal states, cost-sharing on a national level could potentially provide a remedy. For Germany, Reinhardt and Kluth (2007) proved that the number of wolves in an area correlates with the number of attacks on livestock. Consequently, those federal states with more wolves are also obliged to pay more for compensation. Additionally, larger wolf areas mean larger funding areas, which potentially cause more applications for funding and higher costs. Furthermore, the abundance of wolves is currently unevenly distributed between eastern and western states that are known to be unevenly liquid. Alternatively, national responsibility would help to overcome inequalities between the federal states. Reinhardt and Kluth (2007) therefore suggest a national fund where money can be paid in by all federal states dependent on their size in order to share the economic burden posed by wolves equally.

While the responsibility of such a fund lies on a national level with federal contribution, it is also recommended to apply for financial support from the EU, especially for supporting the installation of preventive measures (Reinhardt and Kluth 2007; EC 2015a). In other European countries the application of prevention measures is usually covered by projects such as LIFE COEX (Reinhardt *et al.* 2012). Comparable projects are not known in Germany on a large scale yet (Salvatori 2013; Toland *et al.* 2013). However, the EC has intensively promoted financing such projects and pilot studies in the frame of LIFE or rural development programmes (RDP) (EC 2015b; Salvatori 2013).

One of the financing mechanisms of the RDP is the ELER (StMELF 2014; EC 2014a) In the funding period 2014-2020 100 billion Euro are provided, of which 9,446 million Euro are designated for Germany (EC 2014c; EC 2014a). One of the projects financed by ELER is the subsidising of preventive measures, which have been implemented in Brandenburg and Saxony since 2007 (LfU Brandenburg 2016b; Freistaat Sachsen 2014; MLUL 2014; Freistaat Sachsen 2007). In Brandenburg this kind of funding made it possible to subsidise preventive measures with an amount of 235,040 Euro. The federal state only contributed 78,347 Euro, which only makes up a quarter of the total costs (MLUL 2014). These federal states use two different regulations for compensation and funding for preventive measures; ELER is only used in order to finance preventive measures for livestock protection. Some of its benefits are that the 15,000€-limit does not apply and funding is unrelated to the limit of the financial budgets of the federal state. However, Lower Saxony clearly emphasizes that funding of prevention measures by EU funds is not planned because of high minimum limits and inflexible deadlines for applications. Furthermore, a transition period between the funding periods requires alternative funding schemes (MU 2014a). Saxony is also planning to stop ELER-funding for this purpose, yet it has not been officially announced.

Even if no ideal funding solution can be provided and every system has downsides, it should be highlighted that it is not target-aimed, when decisions on the funding amount are solely based on the size of the available budget of the federal states. Generally, it should be strived for a flexible and independent funding. An important reasoning is that most regulations inhibit any legal claim. Nevertheless, this right for compensation payments, is strongly demanded by the farmers' association of Brandenburg (WeltN24 GmbH 2015). Even if such a claim might not be entirely possible, the number of denials potentially decreases with a sufficiently large funding budget.

5.3 EVALUATION OF COMPLIANCE

SUMMARY TABLE OF COMPLIANCE

Table 6 gives an overview about the evaluation of the federal states. Their compliance with the above stated requirements for funding schemes has been scored according to the evaluation criteria outlined in table 5. The results are relative to the actual stage of wolf occurrence in the federal states. Since the compliance with the single criteria has already been outlined in the previous chapters, the following discussion should rather explain the results and refer to the respective circumstances in the federal states with regard to adaptive management.

Table 6: Points given for federal states' compliance with requirements

		population with reproduction (33 points)					single residential (33 points)		
		Saxony	Lower-Saxony	Brandenburg	Mecklenburg-Western Pomerania	Saxony-Anhalt	Thuringia	Schleswig-Holstein	Bavaria
1.	Evidence for compensation	1	0	0	1	0	1	1	1
2.	Direct and indirect costs compensated	2	1	1	2	2	2	2	2
3.	De Minimis Notice	2	0	1	1	0	0	1	1
4.	Animals compensated	2	1	1	2	2	2	2	0
5.	Precondition to apply preventive measures	1	3	3	1	1	1	1	1
6.	Minimum standards	0	1	0	0	1	1	0	0
7.	Funding for preventive measures	2	2	1	0	1	0	1	1
8.	Funding area	2	1	2	1	2	1	1	0
9.	Funding of wolf-proof fences	2	3	2	1	0	2	3	1
10.	Funding of LGDs	1	2	3	3	0	3	1	0
11.	Funding amount	2	2	1	0	2	1	2	0
12.	Animals funding is available for	2	1	1	2	1	2	1	0
13.	Beneficiary funding is available for	2	2	2	0	1	1	0	1
Sum		21	19	18	14	13	17	16	8
Relative		0,64	0,58	0,55	0,42	0,39	0,52	0,48	0,24

		transmigrating (14 points)				no occurrence (10 points)
		Rhineland-Palatinate	North Rhine-Westphalia	Baden-Wuerttemberg	Hesse	Saarland
1.	Evidence for compensation	1	0	0	0	1
2.	Direct and indirect costs compensated	3	2	0	0	2
3.	De Minimis Notice	0	0	1	0	0
4.	Animals compensated	1	0	0	0	1
5.	Precondition to apply preventive measures	1	1	1	0	0
6.	Minimum standards	1	0	0	0	1
7.	Funding for preventive measures	1	1	0	1	0
8.	Funding area	1	0	0	0	0
9.	Funding of wolf-proof fences	1	0	0	0	1
10.	Funding of LGDs	0	0	0	0	0
11.	Funding amount	0	0	0	0	0
12.	Animals funding is available for	0	0	0	0	0
13.	Beneficiary funding is available for	0	0	0	0	0
Sum		10	4	2	1	6
Relative		0,71	0,29	0,14	0,07	0,60

DISCUSSION: COMPLIANCE WITH REGARD TO ADAPTIVE MANAGEMENT

OVERALL COMPLIANCE

The given requirements have been developed according to good practices already available and therefore present a state, which could have been implemented by now. Nevertheless, except of Saxony, no other federal state with residential wolves was able to achieve more than 60% of compliance with the defined criteria. Lower Saxony and Brandenburg could achieve more than 50% of compliance. Furthermore, the two federal states with single reproducing wolves Thuringia and Schleswig-Holstein complied with 52% and 48% of the defined criteria, which gives hope to step up with Saxony when wolves begin to reproduce in the future. Still, the overall implementation of funding schemes is improvable. Since all of these criteria have been defined based on scientific knowledge and research available, theoretically every state could already comply with these. Furthermore, most of which are already practiced and have achieved positive results in some of the states. It is therefore advisable to simply adapt successful measures. With a steady change and growth of wolf populations the preparation of successful measures is especially important.

Rhineland-Palatinate was able to do so and therefore achieves 70% of compliance as a federal state with transmigrating wolves. Similarly, Saarland could comply with 60% of the requirements even if wolves have not yet occurred. They were able to comply with requirements defined with regard to future change and therefore aimed for a proactive management. This need for proactive management becomes especially apparent with the examples of Hesse and Bavaria. Both have lost significant points since they were not yet able to adapt their management practices to the current occurrence of wolves. Even if Bavaria has already prepared a management plan dealing with single residential wolves, their funding scheme for preventive measures is still in its infancy. Information is scarce about the proceedings that currently differ largely from all other federal states that have to manage residential wolf populations. Additionally, Hesse is the only state that has not implemented any funding schemes in favour for livestock herders. Hence, only one point could have been achieved for the defined requirements showing that Hesse is not sufficiently set up and prepared.

Compliance with the requirements differed largely. Even rather simple regulations were not entirely implemented, such as the criterion of evidence. Three out of eight federal states chose different approaches. For “Direct and indirect costs compensated” only Rhineland-Palatinate was able to achieve full points. With regard to the long experience of Saxony, which issued a notification of the De Minimis Notice, it is surprising that not all federal states have followed this example already. Another interesting aspect is the definition of standards for prevention measures that differ largely between the federal states and mostly do not comply with scientific recommendations. The differentiation between minimum standards to be eligible for compensation and the standards set to

receive funding is not logical and only unified by Lower-Saxony. Furthermore, there should not be that many differences when it comes to the livestock herders that are eligible for funding. A potentially "perceived unfairness" might cause frustration towards the funding schemes in general.

Furthermore, only some federal states cooperate with NGOs that can potentially step in when it comes to financing restrictions or communication of the implemented regulation. Nevertheless, responsibility lies with the federal state government. Therefore, all aspects analysed were within the scope of federal responsibility. The results presented are significantly dependent on the transparency of the implemented regulations. Since the methodological approach is based on the analysis of existing publications of the federal states, some of the results vary from the actual practices. If information is missing it is then attributable to a missing transparency of the states. This aspect alone already gives insights in the communication strategies towards livestock herders and the public forming one important part of wolf management.

Federal states with residential wolves

Saxony is the federal state that achieved most points, with a compliance of 64%. Saxony deals with reproducing wolves since 2000 already (NABU 2015c) and implemented these economic schemes quite early. Therefore, the result is no surprise. Statistics show that compensation has been paid since 2002 already and prevention measures get funded since 2005 (Wolfsregion Lausitz 2015). With a growing wolf population, Saxony improved its funding regulations continuously by amending the management plan five years after its implementation in 2014 (SMUL 2009; SMUL 2014). Furthermore, innovative ways of funding were found as an improvement such as ELER-financing in 2007 (Freistaat Sachsen 2007), exceeding the De Minimis Notice limit in 2010 or making the whole state area the funding area in 2015 (Wolfsregion Lausitz 2015). Nevertheless, Saxony still has some weaknesses in its funding scheme with regard to the requirements given here.

Compared to Lower-Saxony, that achieved 19 out of 33 points with a compliance of 58%, some improvements could be adapted from this federal states, which only deals with reproducing wolves since 2012 (Landesjägerschaft Niedersachsen e.V. 2016). In four aspects, Lower Saxony achieved more points speaking for a proactive and innovative wolf management in Lower-Saxony. This federal state, for example grants exceptions for applying prevention measures for cases where prevention is not feasible for reasons of applicability, lack of knowledge and/or funding. Furthermore, the application of prevention measures is mandatory to receive compensation when an attack on livestock has happened on the flock before. Moreover, Lower Saxony explicitly requires good training and upbringing of LGDs, measures against digging to receive compensation and sets the same standards for funding and compensation. Nevertheless, the funding regulation of Lower Saxony is much more

transparent and some aspects might just not be communicated in Saxony. Hence, the actual treatment of exceptional cases can only be looked at by a case by case comparison.

Lower-Saxony, however, is only now investing considerable resources in wolf management (Wochenblatt für Landwirtschaft & Landleben 2015; Land & Forst 2015). It has been establishing a special wolf office being under the jurisdiction of NLWKN in 2015. With regard to wolves occurring since 2007 this establishment comes relatively late (NLWKN 2015). Furthermore, the funding was only implemented in 2015 (MU 2015b). A management plan has not yet been published amending the rudimentary arrangements of the so-called principles (MU 2010). The federal state now needs to pay the price for the time delay. For the first time in German history a wolf needed to get shot on the 27th April 2016 because it came too close to humans and their dogs. IFAW, NABU und WWF now request to look deeper into the reasons of that behaviour in order to prevent a repetition of this case (NABU 2016). Nevertheless, with regard to livestock protection, little is known about loopholes and sensitive cases like these.

Brandenburg comes third with 18 points, complying with 55% of the requirements. This federal state serves as a positive example regarding the exceptions for the precondition, just like Lower-Saxony. Furthermore, Brandenburg also designated the whole federal state as a funding area (Kontaktbüro Wolfsregion Lausitz n.d.). Even if Brandenburg only provides funding for LGDs since 2015, the system behind the allocation and training of the dogs is the best in Germany (Investitionsbank des Landes Brandenburg 2015). Brandenburg prepared the first management plan for wolves in Germany in 1994 already (Promberger and Hofer 1994). Even ten years before the first wolf territory occurred, the plan was discussed intensively with a great extent of public involvement (Reinhardt *et al.* 2013). Even though the plan was never implemented, the attempt can be applauded. Other than Saxony, Brandenburg was also able to implement the regulations even before the reproduction of wolves in 2009 (LfU Brandenburg 2015; LfU Brandenburg 2016b). Statistics show that ELER funding for prevention measures were already available in 2008, while compensation was already paid in 2007 (LfU Brandenburg 2016b; LfU Brandenburg 2016a). Nevertheless, only after these payments were provided the funding guideline for compensation came into force in 2011, stating that prevention was set as a precondition to receive compensation payments (MLUL 2011). The current regulations still show some weaknesses, which refer to the compliance with wolf-proof prevention set as minimum standards and the necessity not to require clear evidence for the wolf to be the culprit species in case of a damage to livestock.

Thuringia, Schleswig-Holstein and Bavaria are the only federal states with only single residential wolves. Thuringia complies with 52% of the requirements and achieved 17 points. Schleswig-Holstein comes close with 16 points (48%). They achieved more points than Mecklenburg-Western Pomerania and Saxony-Anhalt, as federal states with reproducing wolves. Since Thuringia did not issue a notification to exceed the De Minimis Notice and the funding for prevention measures is not according

to the requirements outlined in chapter 7, the federal state lost considerable points. Nevertheless, the conditions for funding of LGDs can be evaluated as very good. Thuringia has even already amended its management plan (TMUEN 2012; TMUEN 2015b). The management plan and the funding guideline was even published before the actual designation of a wolf area in 2014 (TMUEN 2015b; TMUEN 2015a). With some adjustments in the following funding guideline in January 2017, Thuringia will be well prepared for the reproduction of wolves, which will likely happen soon enough.

Schleswig-Holstein, on the contrary, has not yet published a proper wolf management plan, yet. The official document is currently only a position paper which was planned to be adjusted in 2015 (MELUR 2008; MELUR 2015b). Until now, only the funding guideline from 2015 gives further insights in the practices of the funding schemes (MELUR 2015a). Nevertheless, transmigrating wolves have occurred in Schleswig-Holstein since 2007 already (Wolfsinformationszentrum Schleswig-Holstein 2016a; NABU 2015c), making a sound wolf management inevitable. Therefore the funding regulation and the position paper was already implemented before the actual designation of a wolf area in 2015 (MELUR 2012; Wolfsinformationszentrum Schleswig-Holstein 2016b). One major weakness of the funding scheme is that minimum standards are not published and therefore binding requirements for receiving compensation are not known. The same applies to the targeted beneficiaries for funding.

Bavaria was only able to comply with 24% of the requirements. This is due to the fact, that wolves have only recently been monitored to be residential (NABU 2016b). Due to this recent change of the stage of wolf occurrence, there evolves a significant difference in the rating now. When Bavaria was only listed as a federal state having transmigrating wolves, the states was able to achieve 70% (10 points). This positive wolf management was due to the implementation of two funds for compensation and prevention which have been implemented as a progressive management measure. Since 2009, wolves have constantly been monitored in Bavaria. Therefore compensation is available since 2007 already (StMUV 2007). Funding for pilot projects of preventive measures is available since 2010 (LfU 2010). With its notification in 2012 (LfU 2014a) Bavaria has even improved ins funding schemes. Nevertheless, the changing wolf occurrence makes it necessary to improve these measures, especially when it comes to the designation of a wolf area and the broad funding for prevention measures apart from single pilot projects. After Klose (2012) has requested to amend its initial management plan (StMUV 2007), Bavaria has acted promptly by publishing a management plan “stage 2” in 2014 (LfU 2014a). Nevertheless its implementation is now urgently needed (NABU 2016b). Acknowledging the need for adaptive management, this management plan even states the necessity for amendment following future insights from implemented measures and their evaluation (LfU 2014a). Looking at the compliance and the scarce information available in this plan, an adaption is now urgently needed, especially since the plan in now already outdated.

Mecklenburg-Western Pomerania and Saxony-Anhalt are the tail lights of the federal states with reproducing wolves. They are in accordance with 14 (42%) and 13 (39%) aspects of the requirements.

Both federal states reveal four main weaknesses each. Even if the achieved points are very close to each other, the actual regulations differ quite much. For Mecklenburg-Western Pomerania these weaknesses mainly lie in the funding regulation for preventive measures. The amount of funding, for example, and the beneficiary funding available for, do not comply with the respective requirements. Nevertheless, its system of funding for LGDs is remarkable. The federal state has paid compensation since the designation of a wolf area in 2007, which was even before wolves actually reproduced in 2014 (NABU 2015c; Stier 2014b). Still the management plan and the regulation were published considerably late (LU 2010; LU 2013). Mecklenburg-Western Pomerania even underlines that the management plan should be seen as a preliminary version and add the possibility that conditions may change requiring adapted management (LU 2010). After five years of wolf management in place, an amendment of the practices should now be aimed for.

Saxony-Anhalt, on the contrary did not achieve any points considering the prevention measures funding should be available for and the notification to exceed the limit of the De Minimis Notice as well as the criteria "evidence". What is considerably striking is that Saxony-Anhalt still has not published a proper management plan. Instead, only a guidance document is available, which does not comprise sufficient information (MLU 2008). Even if this guideline was compiled as soon as a wolf was monitored (NABU 2015c), the time passed since then is too long considering the number of wolf packs. However, Saxony-Anhalt has implemented both regulations in 2014 (ALFF 2014; MLU 2014) and is now working on a management plan (MLU 2015).

Federal states with transmigrating wolves and no wolf occurrence

For federal states with transmigrating wolves a total of 14 points was achievable. Rhineland-Palatinate is by far the federal state with the highest compliance, with 10 point (71%). Relatively compared to the federal states with reproducing wolves, this state does best. In Rhineland-Palatinate there have only been a few wolves monitored since 2012. The federal state has only recently published its management plan in 2015 revealing insights in the compensation scheme and the planned funding scheme for when wolves settle permanently (MULEWF 2015). Even if a funding guideline is not published, the wolf management already reveals good practice. The compensation of direct and indirect costs could be evaluated as sufficient. Furthermore, the evidence and the animals compensated lead to a full score. The federal state could achieve many points in the field of prevention since funding is well prepared. Nevertheless, it remains questionable if these principals will be kept as soon as more wolves become residential, like the case of Bavaria has shown.

Saarland is the only federal state where no wolves are present. Since most of the management plan published in 2015 is identical with Rhineland-Palatinate, the wolf management is well prepared for an actual colonisation by wolves (MUV 2015). Nevertheless, it is also questionable, if this good practice

will be maintained. With 6 points out of 10, Saarland complies with 60% of the requirements. Since the standards defined for wolf- proof measures were orientated to Brandenburg and standards for compensation and planned funding of prevention was identical, important aspects could be fulfilled. Nevertheless, the management plan does not mention any flexible funding for cases outside of wolf areas, the provision of mobile fences, or the necessity to apply prevention measures compulsory for cases when an attack on livestock has happened before.

The last three places are occupied by North Rhine-Westphalia, Baden-Wurttemberg and Hesse. Since the latter did not implement any funding scheme, only one point could be gathered, for the mentioning of provided mobile fences. This is one important aspect since it underlines the necessity for prevention measures. Baden-Wurttemberg could achieve two points with the implementation of a fund to compensate losses and the mentioning of the precondition to apply preventive measures. Baden-Wurttemberg, however, already implemented a management plan for wolves focusing on single residential wolves, which has been praised by NABU (Klose 2014). North Rhine-Westphalia has just recently published its management plan “stage 2” in 2016 (LANUV 2016). Unfortunately, the first management plan was not available online (LANUV 2015). Consequently, improvements were not possible to identify. Good results could be achieved considering the compensation of indirect costs and the mentioning of the necessity for prevention measures. Furthermore, mobile fences are provided. Nevertheless, these states need to make some significant improvements in order to be prepared for more wolves recolonising these states. With regard to a rapidly growing wolf population in Lower Saxony, Hesse and North Rhine-Westphalia are especially obliged to trail their neighbouring state.

6. Conclusion

The analysis of the funding guidelines of the federal states revealed that there are different regulations implemented how to reduce and prevent extra economic burdens for livestock owners. The respective funding of compensatory damages and preventive measures varies greatly. These differences mainly refer to the funding sums, their beneficiaries and the measures or items subsidies are available for. Some of these regulations could serve as commendable examples which were evaluated based on scientific articles and expert knowledge. These good practices were outlined as requirements necessary to consider when designing funding schemes as a means of wolf conservation. The requirement which can be considered as most important is to set the application of preventive measures as a precondition to receive compensation for damages caused by wolf predation. This is due to the fact that cases of predation need to be reduced in order to achieve coexistence between wolves and livestock herders, which can only be achieved when incentives are given for applying protection measures for livestock. This important aspect of wolf management revealed that these two funding schemes are unescapably bound to each other.

Nevertheless, not all federal states are required to combine these funding schemes. The compiled requirements are not plainly transferable to every federal state. Their implementation is rather dependent on the wolf population, more specifically if they are occurring in reproducing packs, as residential individuals or if they are only transmigrating. The regulations need to be adapted respectively. The compliance of the federal states with the requirements was scored accordingly. Different gradations were integrated in the requirements that all federal states were supposed to comply with.

The results showed that the overall compliance with these criteria was insufficient given that most of which have already been existent in some states. It shows that all states need to improve their funding schemes within an adaptive management framework. Continuously adapting these regulations to incorporate new data and adapt to the changing occurrence of wolves is inevitable. Many federal states indeed implemented these regulations as a proactive approach even before wolves settled. Hence, they were prepared for the next stage of wolf occurrence. Wildlife management follows the notion of ‘management by objectives’ which is a proactive, future oriented approach rather than a reactive approach (Thomas and Middleton 2003). Consequently, many states complied with the necessity to adapt to changing conditions.

Schleswig-Holstein and Thuringia, for example, developed regulations and management plans even before a wolf area has been designated. By now, they have the potential to step up with the exemplary implementation of the funding schemes of Saxony as soon as wolves begin to reproduce. Rhineland-Palatinate and Saarland also comply with many required regulations which prepares them sufficiently

for a future wolf colonisation as long as measures get adapted to future conditions. Lastly, it shall be highlighted that Lower Saxony did well providing an innovative approach as a federal state which only recently needed to face a rapid colonisation of wolves.

This thesis identifies weak points for each federal state and recommendations of how to implement economic schemes best in order to reduce and prevent extra economic burdens for livestock owners. Nevertheless, it should also be highlighted that there are restrictions for the implementation of the requirements outlined here. Management practices need to be adapted to local situations and are required to be responsive to local level influences and needs. Due to various legal, technical and organisational circumstances, management details must be tailored to the respective situation of the land. Not all circumstances could be analysed within the frame of this thesis. Therefore, a one-to-one implementation will not be applicable for every state.

However, there must be a coherent approach with one overriding goal. While the requirements outlined here follow the motive of reimbursing economic inequalities due to the comeback of wolves, federal states should clearly define what purpose these regulations serve for. One of the motives behind implementing these economic schemes is the expectation to improve acceptance towards wolves. However, an actual improvement could not yet be proven. Generally, only few scientific efforts have been made to evaluate the efficacy of funding schemes (Nyhus *et al.* 2005; Treves *et al.* 2009). Nevertheless, this evaluation is urgently needed in order to validate efforts to define the best way to implement and manage these schemes. The same applies to the attempt of this thesis. Whether or not the presented requirements succeed with regard to the goal of reducing and preventing extra economic burdens for livestock owners can only be judged by further research.

Furthermore, the results presented here are significantly shaped by the methodological approach. Since the comparative analysis is based on reports and information published by the federal states, it would be expedient to further validate the results by interviews with livestock herders and decision-makers. Since these results are based on the assumption that they are in the interest of livestock herders, qualitative interviews could get insights in their attitudes towards the current implementation of the funding schemes and the requirements presented here. Furthermore, interviewing responsible authorities would give further insights into financial aspects of different regulations and reasons for missing compliance. The latter was purposely disregarded here, in order not to allow biased disclosure about the best management practises.

Nevertheless, with regard to a rapidly growing wolf population in Germany, the results presented here can shape future wolf management which still seems to be in its infancy. There is still the chance to achieve consistency among the federal states considering the goals and the shaping of the funding schemes with the establishment of a national centre for wolf documentation and advice. As the compiled differences of the regulations show it is crucial to integrate tasks considering livestock

protection into the duties of the national centre. Even if wolf management is under the jurisdiction of the federal states, national guidance could support decision-makers. Transboundary management alone currently does not achieve a common policy. Guidance on a national level is therefore needed in order to avoid redundant work, unfairness towards livestock herders in different states and step up with the requirements of a species that is highly mobile. A coordinated framework is needed for setting principles and goals while giving space for locally adapted solutions.

REFERENCES

Agarwala, M., *et al.*, 2010. Paying for wolves in Solapur, India and Wisconsin, USA: Comparing compensation rules and practice to understand the goals and politics of wolf conservation. *Biological Conservation*, 143 (12), 2945–2955. Available from: http://ac.els-cdn.com/S000632071000217X/1-s2.0-S000632071000217X-main.pdf?_tid=0b5fdf38-4447-11e6-8174-00000aab0f6b&acdnat=1467898440_c9f4e7b1bc783e153acd945db1a60af4 [Accessed 7 July 2016].

ALFF, 2014. *Ausgleichszahlungen für Schäden an Nutztieren durch den Wolf* [online]. Amt für Landwirtschaft und Flurneuordnung. Available from: http://www.alff.sachsen-anhalt.de/fileadmin/Bibliothek/Politik_und_Verwaltung/LVWA/LVwA/Dokumente/landwirtschaftumwelt/alffanhalt/Landwirtschaft/Amtsblatt-LvwA_20140515.pdf [Accessed 7 July 2016].

ALFF, 2015. *Merkblatt 2015 und 2016. Förderung von Maßnahmen des Herdenschutzes von Schafen, Ziegen und Gehegewild vor dem Wolf (Richtlinie Herdenschutz)* [online]. Amt für Landwirtschaft, Flurneuordnung und Forsten Anhalt. Available from: http://www.alff.sachsen-anhalt.de/fileadmin/Bibliothek/Politik_und_Verwaltung/LVWA/LVwA/Dokumente/landwirtschaftumwelt/alffanhalt/Landwirtschaft/2015-Merkblatt_Herdenschutz.doc.

Andersone, Ž., and Ozolinš, J., 2004. Public perception of large carnivores in Latvia. *Ursus*, 15 (2), 181–187. Available from: http://www.bioone.org/doi/pdf/10.2192/1537-6176%282004%29015%3C0181%3APPOLCI%3E2.0.CO%3B2 [Accessed 14 December 2015].

Arbeitsgemeinschaft Herdenschutzhunde e.V., n.d. *Leitfaden Herdenschutzhunde. Die Eingewöhnung eines trainierten, adulten Herdenschutzhundes in eine für ihn fremde Tierherde* [online]. Available from: http://www.ag-herdenschutzhunde.de/app/download/9534030198/Leitfaden+Herdenschutzhunde.pdf?t=1457912234 [Accessed 7 July 2016].

Bathen, M., *et al.*, 2010. *NABU-POSITION – Wölfe in Deutschland. Leitlinien zum Schutz von Canis lupus* [online]. NABU - Naturschutzbund Deutschland. Available from: https://www.nabu.de/imperia/md/content/nabude/wolf/140310-nabu-wolfsposition.pdf [Accessed 20 June 2015].

Bayrisches landwirtschaftliches Wochenblatt, 2015. *Fachgespräch zu Wolf- und Herdenschutz. Unterschiedliche Standpunkte zur Etablierung des Wolfes in Deutschland* [online]. Available from: http://www.agrarheute.com/wochenblatt/news/fachgespraech-wolf-herdenschutz [Accessed 31 March 2016].

BfN, 2011. *Wanderwege der Wölfe* [online]. Bundesamt für Naturschutz. Available from: http://www.bfn.de/0401_pm.html?&cHash=4758c42541&tx_ttnews[backPid]=1&tx_ttnews[tt_news]=4030 [Accessed 4 June 2016].

BfN, 2016. *Neues Wolfs-Beratungszentrum des Bundes soll Landesbehörden unterstützen* [online]. Bundesamt für Naturschutz (BfN). Available from: https://www.bfn.de/0401_pm.html?&no_cache=1&tx_ttnews%5Btt_news%5D=5720&cHash=c2f99fbd82d614e6ed6ba76d8ebab153 [Accessed 16 June 2016].

Bisi, J., *et al.*, 2007. Human dimensions of wolf (Canis lupus) conflicts in Finland. *European Journal of Wildlife Research,* 53 (4), 304–314. Available from: https://www.researchgate.net/profile/Sami_Kurki/publication/226266289_Human_dimensions_of_wolf_%28Canis_lupus%29_conflicts_in_Finland/links/00b7d5346fd93ca02b000000.pdf [Accessed 14 December 2015].

BMEL, 2014. *Merkblatt zur Verordnung (EU) Nr. 1408/2013 der Kommission vom 18. Dezember 2013* [online]. Bundesministerium für Ernährung und Landwirtschaft. Available from: http://www.bmel.de/SharedDocs/Downloads/Landwirtschaft/Foerderung/MerkblattDe-Minimis.pdf?__blob=publicationFile [Accessed 1 June 2016].

BMUB, 2015. *Bericht des Bundesministeriums für Umwelt, Naturschutz, Bau und Reaktorsicherheit zur Lebensweise, zum Status und zum Management des Wolfes (Canis lupus) in Deutschland* [online]. Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit, ed. Available from: https://www.bundestag.de/blob/393542/5e21bfea995e1f0f0f19271d442f365d/bericht-bmub-data.pdf [Accessed 2 January 2016].

Boitani, L., 1995. Ecological and cultural diversities in the evolution of wolf-human relationships. *Ecology and conservation of wolves in a changing world: 3-12. Carbyn, L. N., Fritts, S. H., and Seip, D. R.(Eds.). Edmonton: Canadian Circumpolar Institute. Available from:* http://www.kora.ch/malme/05_library/5_1_publications/B/Boitani_1995_Ecological_and_cultural_diversities_of_wolf_human_relationships.pdf [Accessed 14 December 2015].

Boitani, L., 2000. *Action Plan for the conservation of the wolves (Canis lupus) in Europe* [online]. Available from: http://www1.nina.no/lcie_new/pdf/634991270776292110_COE%20NE%20113%20Action%20plans%20for%20wolves%202000.pdf [Accessed 7 July 2016].

Boitani, L., *et al.*, 2015. *Key actions for Large Carnivore populations in Europe. Report to DG Environment, European Commission, Bruxelles. Contract no. 07.0307/2013/654446/SER/B3* [online]. Institute of Applied Ecology (Rome, Italy). Available from:

http://ec.europa.eu/environment/nature/conservation/species/carnivores/pdf/key_actions_large_carnivores_2015.pdf [Accessed 5 March 2016].

Boitani, L., Ciucci, P., and Raganella-Pelliccioni, E., 2010. Ex-post compensation payments for wolf predation on livestock in Italy: a tool for conservation? *Wildlife Research*, 37 (8), 722. Available from: http://www.kora.ch/malme/05_library/5_1_publications/B/Boitani_et_al_2010_Compensation_payments_for_wolf_predation_on_livestock_in_Italy.pdf [Accessed 7 July 2016].

Bueltemann, C., 2014. *NABU: Die Rückkehr des Wolfs vorbereiten* [online]. Nordhessen-Rundschau. Available from: http://nordhessen-rundschau.de/wissenschaft-natur/nabu-die-rueckkehr-des-wolfs-vorbereiten/ [Accessed 17 March 2016].

Bulte, E., and Rondeau, D., 2005. Research and management viewpoint: why compensating wildlife damages may be bad for conservation. *Journal of Wildlife Management (*69(1)), 14-19. Available from: http://www.bioone.org/doi/full/10.2193/0022-541X%282005%29069%3C0014%3AWCWDMB%3E2.0.CO%3B2 [Accessed 5 July 2016].

BUND, n.d. *Wölfe managen statt jagen* [online]. Bund für Umwelt und Naturschutz Deutschland, ed. Available from: http://www.bund-brandenburg.de/themen_projekte/natur_und_artenschutz/wolf/wolfsmanagement/ [Accessed 31 March 2016].

Bundesregierung, n.d. *Kernpunkte der Föderalismusreform. Naturschutz* [online]. Available from: http://www.bundesregierung.de/Content/DE/StatischeSeiten/Breg/Reformprojekte/foederalismusreform-2006-08-09-kernpunkte-der-foederalismusreform-2.html [Accessed 15 December 2015].

BundesUmweltPortal, 2016. *Wolfzentrum: Einheitliche Linie ist wichtig* [online]. Available from: http://www.bundesumweltportal.de/berlin/6-berlin/wolfzentrum-einheitliche-linie-ist-wichtig.html [Accessed 22 June 2016].

Chapron, G., *et al.*, 2014. Recovery of large carnivores in Europe's modern human-dominated landscapes. *Science (New York, N.Y.)*, 346 (6216), 1517–1519. Available from: http://www.sciencemag.org/content/346/6216/1517 [Accessed 9 April 2015].

Council of the European Union, 1992. The European Council Directive 92/43/EEC of 21. May 1992 on the conservation of natural habitats and of wild fauna and flora. *Amtsblatt der Europäischen Gemeinschaft (*L 103), 1–6.

Deutscher Jagdverband e. V., 2014. *Rückkehrer Wolf. Willkommen ohne Wenn und Aber? Abstracts der Beiträge zur Fachtagung des Deutschen Jagdverbandes e. V.* [online]. Deutscher Jagdverband e. V., ed. Available from: http://www.ljv-

rlp.de/duew_nw/download/news/Wolfstagung%20des%20DJV%20Statements%202014_03.pdf [Accessed 25 January 2016].

Dryzek, J., 1982. Policy analysis as hermeneutic activity. *Policy Sciences (*14), 309–329. Available from: http://link.springer.com/article/10.1007/BF00137394#page-1 [Accessed 7 July 2016].

Dunn, W.N., 2012. *Public policy analysis. An introduction*. 5th ed. Boston: Pearson.

EC, 2012. *Conservation status of large carnivores* [online]. European Commission DG Environment. Available from: http://ec.europa.eu/environment/nature/conservation/species/carnivores/conservation_status.htm [Accessed 15 June 2016].

EC, 2014a. *2014 – 2020 EAFRD funding* [online]. European Commission. Available from: http://ec.europa.eu/agriculture/rural-development-2014-2020/country-files/common/funding-per-ms_en.pdf [Accessed 8 June 2016].

EC, 2014b. *Der Entwurf neuer Vorschriften für staatliche Beihilfen in der Land- und Forstwirtschaft und der Entwicklung des ländlichen Raums ist nun zur Information verfügbar – Rückmeldungen willkommen* [online]. European Commission. Available from: http://europa.eu/rapid/press-release_IP-14-185_de.htm [Accessed 2 May 2016].

EC, 2014c. *Entwicklung des ländlichen Raums 2014–2020. Landwirtschaft und ländliche Entwicklung* [online]. European Commission. Available from: http://ec.europa.eu/agriculture/rural-development-2014-2020/index_de.htm [Accessed 8 June 2016].

EC, 2014d. *Exploring traditional husbandry methods to reduce wolf predation on free-ranging cattle in Portugal and Spain. Final report* [online]. European Commission DG Environment. Available from: http://www1.nina.no/lcie_new/pdf/635622559476739189_PA_Iberia1_FinalReport.pdf [Accessed 4 July 2016].

EC, 2014e. *Rahmenregelung der Europäischen Union für staatliche Beihilfen im Agrar- und Forstsektor und in ländlichen Gebieten 2014-2020* [online]. European Commission. Available from: http://www.bmel.de/SharedDocs/Downloads/Landwirtschaft/Foerderung/RahmenregelungAgrarbeihilfen2014-2020.pdf;jsessionid=32B216E7BC70AE388477A77034679CAA.2_cid385?__blob=publicationFile [Accessed 2 May 2016].

EC, 2015a. *Promoting dialogue with stakeholders* [online]. European Commission DG Environment. Available from: http://ec.europa.eu/environment/nature/conservation/species/carnivores/promoting_dialogue.htm [Accessed 1st April 2015].

EC, 2015b. *Promoting population level management of large carnivores* [online]. European Commission DG Environment. Available from: http://ec.europa.eu/environment/nature/conservation/species/carnivores/promoting_management.htm [Accessed 16 December 2015].

EC, 2016a. *EU Large Carnivore Platform: Third Regional Workshop. Berlin, Germany 18-20 April 2016* [online]. European Commission DG Environment. Available from: http://ec.europa.eu/environment/nature/conservation/species/carnivores/pdf/Workshop-report_Berlin-adelphi_FINAL.pdf [Accessed 2 June 2016].

EC, 2016b. *Plenary Meeting of the EU Platform on Coexistence between People and Large Carnivores. EU Large Carnivore Platform Annual Meeting: Rural Development funds support coexistence* [online]. European Commission DG Environment. Available from: http://ec.europa.eu/environment/nature/conservation/species/carnivores/pdf/LC%20Platform_Plenary%20Meeting%202016_Press%20Release_final.pdf [Accessed 15 June 2016].

Ehrlich, M., 2015. *Speziell ausgebildete Hunde sollen Schafe vor Wolf schützen* [online]. Mediengruppe Thüringen Verlag GmbH, ed. Available from: http://www.tlz.de/web/zgt/leben/detail/-/specific/Speziell-ausgebildete-Hunde-sollen-Schafe-vor-Wolf-schuetzen-2009343277 [Accessed 23 May 2016].

Espuno, N., *et al.*, 2004. Heterogenous response to preventive sheep husbandry during wolf recolonization of the French Alps. *Wildlife Society Bulletin (*32(4)), 1195–1208. Available from: http://www.carnivoreconservation.org/files/thesis/espuno_2004_phd.pdf#page=170 [Accessed 26 December 2015].

EU, 2013. *VO (EG) 1408/2013 über die Anwendung der Artikel 107 und 108 des Vertrags über die Arbeitsweise der Europäischen Union auf De-minimis-Beihilfen im Agrarsektor* [online]. European Union. Available from: https://www.voeb.de/download/beihilferecht-6-verordnung.pdf [Accessed 1 June 2016].

Evensen Gangås, K., 2014. Attitudes towards large carnivores and acceptance of illegal hunting – the importance of social attitudes and scales in large carnivore management. Available from: http://www.slu.se/Documents/externwebben/nj-fak/ekologi/forskning/skandulv%20dokument/Gang%C3%A5s%202014%20Attitudes%20towards%20large%20carnivores%20and%20acceptance%20of%20illegal%20hunting%20%E2%80%93%20the%20importance%20of%20social%20attitudes%20and%20scales%20in%20large%20carnivore%20management.pdf [Accessed 8 December 2015].

Fass, F., 2015. *Statement zur "Goldenstedter Wölfin"* [online]. Wolfcenter Dörverden. Available from: http://www.wolfcenter.de/Aktuell.html?1&news=1795 [Accessed 2 June 2016].

forsa Politik- und Sozialforschung GmbH, 2015. *Wölfe in Deutschland* [online]. NABU - Naturschutzbund Deutschland, ed. Available from: https://www.nabu.de/imperia/md/content/nabude/wolf/150923-nabu-bericht-woelfe-in-deutschland.pdf [Accessed 15 December 2015].

Freistaat Sachsen, 2007. *Richtlinie Natürliches Erbe (NE/2007)* [online]. Sächsisches Staatsministerium für Umwelt und Landwirtschaft. Available from: https://www.smul.sachsen.de/foerderung/93.htm [Accessed 8 June 2016].

Freistaat Sachsen, 2014. *Förderrichtlinie Natürliches Erbe – RL NE/2014. ELER-finanzierte Vorhaben* [online]. Available from: http://www.revosax.sachsen.de/vorschrift/14198-Foerderrichtlinie_Natuerliches_Erbe#t1 [Accessed 16 March 2016].

Freistaat Sachsen, 2015. *Hilfen für Schäfer künftig in ganz Sachsen* [online]. Sächsische Staatskanzlei; Sächsisches Staatsministerium für Umwelt und Landwirtschaft. Available from: http://www.medienservice.sachsen.de/medien/news/196705 [Accessed 17 March 2016].

Freundeskreis freilebender Wölfe e.V. Vorbeugender Schutz von Nutztieren vor Wölfen, n.d. Available from: http://www.wolfsbetreuer.de/mediapool/99/996877/data/Flyer_Herdenschutz.pdf [Accessed 22 March 2016].

Freundeskreis freilebender Wölfe e.V., 2015a. *Das Wolfsmanagement ist noch nicht ausgereift* [online]. Available from: http://www.lausitz-wolf.de/index.php?id=1439 [Accessed 28 May 2016].

Freundeskreis freilebender Wölfe e.V., 2015b. *Thüringen vor der Ausweisung des ersten Wolfsgebiets* [online]. Available from: http://www.lausitz-wolf.de/index.php?id=1320 [Accessed 16 March 2016].

Freundeskreis freilebender Wölfe e.V., 2016a. *Projekt Herdenschutzhunde bei Rindern* [online]. Available from: http://www.lausitz-wolf.de/index.php?id=1505 [Accessed 23 May 2016].

Freundeskreis freilebender Wölfe e.V., 2016b. *Welpen übergeben - Projekt "Herdenschutzhunde bei Rindern"* [online]. Available from: http://www.lausitz-wolf.de/index.php?id=1527 [Accessed 23 May 2016].

Hahnel, F., n.d. *Herdenschutzhunde in Deutschland. Schäfermeister Frank Hahnel im Interwiev mit der ABCD Rundi Redaktion zum Thema "Herden-schutzhunde in Deutschland"*. [online]. ABCD e.V., ed. Available from: http://www.ag-herdenschutzhunde.de/app/download/10225410498/HSH.pdf?t=1457912234 [Accessed 2013].

Hajer, M., 2003. Policy Without Polity? Policy Analysis and the Institutional Void. *Policy Sciences (*36), 175–195. Available from:

https://www.researchgate.net/profile/Maarten_Hajer/publication/226690034_Policy_without_polity_Policy_analysis_and_the_institutional_void/links/53dbe5f40cf2cfac9928fc3d.pdf [Accessed 21 June 2016].

Hausding, M., 2015. *Land fördert Kauf von Hunden zum Schutz* [online]. Märkische onlineZeitung. Available from: http://www.moz.de/artikel-ansicht/dg/0/1/1376860 [Accessed 17 March 2016].

Hermann, N., and Menzel, S., 2013. Predicting the intention to support the return of wolves. A quantitative study with teenagers. *Journal of Environmental Psychology*, 36, 153–161. Available from: http://ac.els-cdn.com/S0272494413000595/1-s2.0-S0272494413000595-main.pdf?_tid=950ec8e8-32c8-11e5-81bf-00000aacb361&acdnat=1437827458_1bbd16e2324ababf6b4be5b5199053d0 [Accessed 16 December 2015].

Hilde, W.K., and John, D.G., 2004. Reduced Wolf Attacks on Sheep in Østfold, Norway using Electric Fencing. *Carnivore Damage Prevention News No 7 / July 2004 by Large Carnivore Initiative for Europe (LCIE). Available from:* http://www1.nina.no/lcie_new/pdf/634991552770719755_CDPNews7.pdf [Accessed 7 July 2016].

HMUKLV, 2015. *Wolfsmanagement für Hessen* [online]. Hessisches Ministerium für Umwelt, Klimaschutz, Landwirtschaft und Verbraucherschutz. Available from: https://umweltministerium.hessen.de/sites/default/files/media/hmuelv/wolfsmanagementfuerhessen.pdf [Accessed 2 April 2016].

IFAW, 2015. *30 Tonnen Hundefutter zum Schutz der Wölfe* [online]. International Fund for Animal Welfare. Available from: http://www.ifaw.org/deutschland/aktuelles/30-tonnen-hundefutter-zum-schutz-der-w%C3%B6lfe [Accessed 23 May 2016].

Investitionsbank des Landes Brandenburg, 2015. Merkblatt für Vorhaben des Artenschutzes in Brandenburg. Available from: https://www.ilb.de/media/dokumente/dokumente_fuer_programme/dokumente_mit_programmzuordnung/wirtschaft/zuschuesse/natuerliches_erbe_und_umweltbewusstsein/ILB_merkblatt_fuer_Vorhaben_des_Artenschutzes.pdf [Accessed 16 March 2016].

Istituto di Ecologia Applicata, 2008. *LIFE COEX - Improving Coexistence of Large Carnivores and Agriculture in Southern Europe. Final technical report of activities* [online]. Available from: http://www.life-coex.net/Final-Technical-Report/Final%20technical%20report%20LIFE%20COEX.pdf [Accessed 26 December 2015].

IUCN, 2008. *Strategic Planning for Species Conservation: A Handbook. The Species Conservation Planning Task Force Species Survival Commission* [online]. International Union for

Conservation of Nature and Natural Resources. Available from: http://cmsdata.iucn.org/downloads/scshandbook_2_12_08_compressed.pdf [Accessed 23 January 2016].

Jędrzejewski, W., *et al.*, 2008. Habitat suitability model for Polish wolves based on long-term national census. *Animal Conservation*, 11 (5), 377–390. Available from: http://onlinelibrary.wiley.com/doi/10.1111/j.1469-1795.2008.00193.x/epdf [Accessed 25 July 2015].

Kaczensky, P., 2006. *Medienpräsenz- und Akzeptanzstudie Wölfe in Deutschland* [online]. Staatliches Museum für Naturkunde in Görlitz, ed. Available from: http://www.kora.ch/malme/05_library/5_1_publications/K/Kaczensky_2006_Akzeptanzstudie_Woelfe_in_Deutschland.pdf.

Kaczensky, P., *et al.*, 2009. *Monitoring von Großraubtieren in Deutschland. BfN Skripten 251* [online]. Bundesamt für Naturschutz (BfN), ed. Available from: https://www.bfn.de/fileadmin/MDB/documents/service/Skript251.pdf [Accessed 16 December 2015].

Kaczensky, P., *et al.*, 2012a. *Status, management and distribution of large carnivores – bear, lynx, wolf & wolverine – in Europe. Part 2* [online]. European Commission DG Environment, ed. Available from: http://ec.europa.eu/environment/nature/conservation/species/carnivores/pdf/task_1_part2_species_country_reports.pdf [Accessed 20 June 2015].

Kaczensky, P., *et al.*, 2012b. *Status, management and distribution of large carnivores – bear, lynx, wolf & wolverine – in Europe. Part 1* [online]. European Commission DG Environment, ed. Available from: http://ec.europa.eu/environment/nature/conservation/species/carnivores/pdf/task_1_part1_statusoflcineurope.pdf [Accessed 20 June 2015].

Kaeser, A., and Zimmermann, W., 2012. Analyse der Wolfpolitik verschiedener Länder. Wolfmanagement in der Schweiz, Montana (USA) und Sachsen (DE). Available from: http://e-collection.library.ethz.ch/eserv/eth:6284/eth-6284-01.pdf [Accessed 12 June 2015].

Kaltenborn, B.P., *et al.*, 1999. Attitudes toward large carnivores among sheep farmers, wildlife managers, and research biologists in Norway. *Human Dimensions of Wildlife*, 4 (3), 57–73. Available from: https://www.researchgate.net/publication/235456805_Attitudes_toward_large_carnivores_among_sheep_farmers_wildlife_managers_and_research_biologists_in_Norway [Accessed 14 December 2015].

Kleiven, J., Bjerke, T., and Kaltenborn, B.P., 2004. Factors influencing the social acceptability of large carnivore behaviours. *Biodiversity & Conservation*, Volume 13 (9), 1647–1658. Available from: http://link.springer.com/article/10.1023/B:BIOC.0000029328.81255.38 [Accessed 14 December 2015].

Klemm, C.d., 1996. *Compensation for damage caused by wild animals*. Strasbourg, Croton-on-Hudson, NY: Council of Europe Pub.; Manhattan Pub. Co. [distributor].

Klose, M., 2014. *Bewertung des Wolfsmanagements in den Bundesländern* [online]. Naturschutzbund Deutschland, ed. Available from: https://www.nabu.de/imperia/md/content/nabude/wolf/140430-nabu-hintergrund-bewertung-wolfsmanagement.pdf [Accessed 16 December 2015].

Kluth, G., and Reinhardt, I., 2010. Mit Wölfen leben. Informationen für Jäger, Förster und Tierhalter in Sachsen und Brandenburg. Available from: http://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/mit_woelfen_leben.pdf [Accessed 23 March 2016].

Kontaktbüro Wolfsregion Lausitz, n.d. *Wolfsregion - Förderung in Brandenburg* [online]. Landkreis Görlitz, Landratsamt. Available from: http://www.wolfsregion-lausitz.de/index.php/7-berwolf/katwolfnutztiere/80-foerderung-brandenburg [Accessed 16 March 2016].

Kontaktbüro Wolfsregion Lausitz, 2016. *Schadensstatistik Sachsen* [online]. Landkreis Görlitz, Landratsamt. Available from: http://www.wolfsregion-lausitz.de/index.php/schadensstatistik [Accessed 27 April 2016].

Land & Forst, 2015. *Kosten für Wolfsmanagement* [online]. Deutscher Landwirtschaftsverlag GmbH. Available from: http://www.agrarheute.com/landundforst/news/kosten-fuer-wolfsmanagement [Accessed 28 May 2016].

Land Schleswig-Holstein, 2015. *Wolfsnachweise im Kreis Herzogtum Lauenburg: Land fördert künftig Herdenschutz in der Region* [online]. Available from: http://www.schleswig-holstein.de/DE/Landesregierung/V/Presse/PI/2015/0315/MELUR_150313_Herdenschutz_Lauenburg.html [Accessed 23 March 2016].

Landesjägerschaft Niedersachsen e.V., 2016. *Wolfsnachweise in Niedersachsen* [online]. Available from: http://www.wildtiermanagement.com/wildtiere/haarwild/wolf/wolfsnachweise_in_niedersachsen/ [Accessed 2 April 2016].

Landesportal Schleswig Holstein, 2016a. *Ministerium für Energiewende, Landwirtschaft, Umwelt und ländliche Räume - Jagd und Artenschutzbericht* [online]. Der Ministerpräsident des Landes Schleswig-Holstein. Available from: https://www.schleswig-holstein.de/DE/Landesregierung/V/_startseite/Artikel/160106_Jagd_Artenschutzbericht_2015.html [Accessed 26 May 2016].

Landesportal Schleswig Holstein, 2016b. *Tod eines Schafes im Kreis Segeberg: Wolf kann als Verursacher nicht ausgeschlossen werden* [online]. Available from: http://www.schleswig-holstein.de/DE/Landesregierung/LLUR/Presse/Pressemeldungen/2016/0316/LLUR_160315_Wolf_Latendorf.html [Accessed 28 March 2016].

Landesschafzuchtverband Mecklenburg-Vorpommern e.V., 2012. *Arbeitsgemeinschaft Herdenschutzhunde. Bericht der Gründungsveranstaltung in Brandenburg* [online]. Available from: http://www.schafzucht-mv.de/index.php?id=205 [Accessed 23 May 2016].

Landtag von Baden-Württemberg, 2014. *Willkommen Wolf – Baden-Württemberg als Wolfserwartungsland. Stellungnahme des Ministeriums für Ländlichen Raum und Verbraucherschutz* [online]. Available from: http://www.landtag-bw.de/files/live/sites/LTBW/files/dokumente/WP15/Drucksachen/4000/15_4767_D.pdf [Accessed 28 March 2016].

LANUV, 2015. *Naturschutz, Schafzucht, Landwirtschaft, Jagd und Land NRW erstellen gemeinsam Leitfaden zum Umgang mit WölfenNaturschutz, Schafzucht, Landwirtschaft, Jagd und Land NRW erstellen gemeinsam Leitfaden zum Umgang mit Wölfen* [online]. Landesamt für Natur, Umwelt und Verbraucherschutz Nordrhein-Westfalen. Available from: http://www.lanuv.nrw.de/landesamt/veroeffentlichungen/pressemitteilungen/details/?tx_ttnews%5Btt_news%5D=127&cHash=7a9ebb8baf91647caf6a47ed1104588c [Accessed 2 April 2016].

LANUV, 2016. Wolfsmanagementplan für NRW. Available from: https://www.wald-und-holz.nrw.de/fileadmin/Naturschutz/Dokumente/Wolfsmanagementplan.pdf [Accessed 22 April 2016].

LCIE, n.d. *Large Carnivores know no boundaries. The European populations of large carnivores at a glance* [online]. Large Carnivore Initiative for Europe, ed. Available from: http://ec.europa.eu/environment/nature/info/pubs/docs/brochures/large_carnivores_know_no_boundaries.pdf [Accessed 16 December 2015].

LCIE, 2013. *A manifesto for large carnivore conservation in Europe (ver. 20.06.2013)* [online]. Large Carnivore Initiative for Europe, ed. Available from: http://www.rewildingeurope.com/wp-content/uploads/2014/06/Manifesto.pdf [Accessed 16 December 2015].

LfU, 2010. *Präventionsfonds Bayern* [online]. Bayerisches Landesamt für Umwelt. Available from: http://www.lfu.bayern.de/natur/wildtiermanagement_grosse_beutegreifer/praevention/fonds/index.htm [Accessed 23 March 2016].

LfU, 2013. *Ausgleichsregelung Große Beutegreifer. Ausgleichsregelung zum finanziellen Ausgleich von durch Wolf, Luchs oder Bär verursachtem Schaden durch den "Ausgleichsfonds Große Beutegreifer"* [online]. Bayerisches Landesamt für Umwelt. Available from:

https://www.lfu.bayern.de/natur/wildtiermanagement_grosse_beutegreifer/ausgleichsfonds/doc/ausgleichsregelung.pdf [Accessed 28 March 2016].

LfU, 2014a. *Managementplan Wolf. Wölfe in Bayern – Stufe 2, Stand: April 2014 (einzelne standorttreue Tiere)* [online]. Bayerisches Landesamt für Umwelt, ed. Available from: http://www.bestellen.bayern.de/application/stmug_app000014?SID=1775431181&ACTIONxSESSxSHOWPIC(BILDxKEY:lfu_nat_00211,BILDxCLASS:Artikel,BILDxTYPE:PDF) [Accessed 28 January 2016].

LfU, 2014b. *Wolf: Gebietskulisse für Präventionsmaßnahmen* [online]. Bayerisches Landesamt für Umwelt. Available from: http://www.lfu.bayern.de/natur/wildtiermanagement_grosse_beutegreifer/ausgleichsfonds/voraussetzung/doc/praeventionskulisse_wolf.pdf [Accessed 24 March 2016].

LfU, 2015. *Empfehlungen zu Herdenschutzmaßnahmen gegen Übergriffe durch Wölfe und andere große Beutegreifer* [online]. Bayerisches Landesamt für Umwelt. Available from: https://www.lfu.bayern.de/natur/wildtiermanagement_grosse_beutegreifer/wolf/doc/herdenschutzmassnahmen.pdf [Accessed 22 March 2016].

LfU Brandenburg, 2015. *Wolfswelpen im Land Brandenburg* [online]. Landesamt für Umwelt Brandenburg. Available from: http://www.lugv.brandenburg.de/cms/detail.php/bb1.c.353029.de [Accessed 2 April 2016].

LfU Brandenburg, 2016a. *Nutztierschäden Land Brandenburg* [online]. Landesamt für Umwelt Brandenburg. Available from: http://www.lugv.brandenburg.de/cms/detail.php/bb1.c.407130.de [Accessed 2 April 2016].

LfU Brandenburg, 2016b. *Statistik der Präventionsförderung Wolf im Land Brandenburg* [online]. Landesamt für Umwelt Brandenburg. Available from: http://www.lugv.brandenburg.de/cms/detail.php/bb1.c.401256.de [Accessed 2 April 2016].

Linnell, J., Salvatori, V., and Boitani, L., 2008. *Guidelines for Population Level Management Plans for Large Carnivores* [online]. European Commission DG Environment, ed. Available from: http://ec.europa.eu/environment/nature/conservation/species/carnivores/pdf/guidelines_for_population_level_management.pdf [Accessed 16 December 2015].

Linnell, J.D., *et al.*, 2013. *From conflict to coexistence? Results from a stakeholder workshop on large carnivores in Brussels, 25, January, 2013.* [online]. European Commission DG Environment, ed. Available from: http://ec.europa.eu/environment/nature/conservation/species/carnivores/pdf/task_5_workshop_report.pdf [Accessed 16 December 2015].

Linnell, J.D.C., 2013. *From conflict to coexistence? Insights from multi-disciplinary research into the relationships between people, large carnivores and institutions.* [online]. European

Commission DG Environment, ed. Available from: http://ec.europa.eu/environment/nature/conservation/species/carnivores/pdf/task_4_conflict_coexistence.pdf [Accessed 16 December 2015].

Linnell, J.D.C., and Lescureux, N., 2015. Livestock guarding dogs. Cultural heritage icons with a new relevance for mitigating conservation conflicts. Available from: http://ec.europa.eu/environment/nature/conservation/species/carnivores/pdf/livestock%20guarding%20dogs_web.pdf [Accessed 15 June 2016].

LU, 2010. *Managementplan für den Wolf in Mecklenburg-Vorpommern* [online]. Ministerium für Landwirtschaft, Umwelt und Verbraucherschutz Mecklenburg-Vorpommern, ed. Available from: http://www.wolf-mv.de/data/Managementplan_Wolf_MV.pdf [Accessed 30 August 2015].

LU, 2013. *Richtlinie für die Gewährung von Zuwendungen zur Vermeidung oder Minderung von wirtschaftlichen Belastungen durch die Art Wolf in Mecklenburg-Vorpommern (Förderrichtlinie Wolf – FöRiWolf M-V)* [online]. Ministerium für Landwirtschaft, Umwelt und Verbraucherschutz Mecklenburg-Vorpommern. Available from: http://www.lung.mv-regierung.de/dateien/foeri_wolf_text.pdf [Accessed 19 March 2016].

LUGV, 2012. *Managementplan für den Wolf in Brandenburg 2013 - 2017* [online]. Ministerium für Umwelt, Gesundheit und Verbraucherschutz Brandenburg, ed. Available from: http://www.lugv.brandenburg.de/cms/media.php/lbm1.a.3310.de/wmp_2013_2017.pdf [Accessed 16 December 2015].

LUNG, 2015. *Wolfsgebiet in Mecklemburg-Vorpommern* [online]. Landesamt für Umwelt, Naturschutz und Geologie Mecklenburg-Vorpommern. Available from: http://www.lung.mv-regierung.de/dateien/foeri_wolf_karte.pdf [Accessed 24 March 2016].

MDR Sachsen-Anhalt, 2016. *Nach Wolfsattacken – Sachsen-Anhalt will Schäfer stärker unterstützen* [online]. Mitteldeutscher Rundfunk, ed. Available from: http://www.mdr.de/sachsen-anhalt/wolfsattacken-schaefer-100_zc-3cab68a5_zs-e4873e5f.html [Accessed 26 May 2016].

MELUR, 2008. *Positionspapier zur Wiederbesiedelung Schleswig-Holsteins durch den Wolf* [online]. Ministerium für Energiewende, Landwirtschaft, Umwelt und ländliche Räume des Landes Schleswig-Holstein. Available from: http://www.wolfsbetreuer.de/mediapool/99/996877/data/PositionspapierWolfV2010Endfassung.pdf [Accessed 29 March 2016].

MELUR, 2012. Amtsblatt für Schleswig-Holstein. Wolfsrichtlinie. Available from: https://www.schleswig-holstein.de/DE/Fachinhalte/N/naturschutz/Downloads/Rili_Woelfe.pdf?__blob=publicationFile&v=2 [Accessed 10 June 2016].

MELUR, 2015a. *Amtsblatt für Schleswig-Holstein. Wolfsrichtlinie* [online]. Ministerium für Energiewende, Landwirtschaft, Umwelt und ländliche Räume des Landes Schleswig-Holstein. Available from: http://www.wolfsbetreuer.de/mediapool/99/996877/data/Wolfsrichtlinie2015Amtsblatt.pdf [Accessed 28 March 2016].

MELUR, 2015b. *Bericht des MELUR zur Arbeit des Runden Tisches Wolfsmanagement in Schleswig-Holstein" im Rahmen der Sitzung des Umwelt- und Agrarausschusses am 7. Oktober 2015* [online]. Ministerium für Energiewende, Landwirtschaft, Umwelt und ländliche Räume des Landes Schleswig-Holstein. Available from: https://www.landtag.ltsh.de/infothek/wahl18/umdrucke/4900/umdruck-18-4923.pdf [Accessed 19 March 2016].

Mertens, A., Promberger, C., and Gheorge, P., 2002. Testing and Implementing the Use of Electric Fences for Night Corrals in Romania. No 5 / May 2002. *Carnivore Damage Prevention News by Large Carnivore Initiative for Europe (LCIE). Available from:* http://www1.nina.no/lcie_new/pdf/634991550810099187_CDPNews5.pdf [Accessed 1 December 2015].

MLR, 2013. *Die Rückkehr des Wolfs nach Baden-Württemberg. Handlungsleitfaden für das Auftauchen einzelner Wölfe* [online]. Ministerium für Ländlichen Raum, Ernährung und Verbraucherschutz Baden-Württemberg, ed. Available from: https://mlr.baden-wuerttemberg.de/fileadmin/redaktion/m-mlr/intern/dateien/publikationen/Rueckkehr_des_Wolfes.pdf [Accessed 21 August 2015].

MLU, 2008. *Leitlinie Wolf - Grundsätze zum Umgang mit Wölfen. Handlungsempfehlungen und Managementmaßnahmen für Sachsen-Anhalt* [online]. Ministerium für Landwirtschaft und Umwelt des Landes Sachsen-Anhalt, ed. Available from: http://www.gzsdw.de/files/leitlinie_wolf_sachsen_anhalt.pdf [Accessed 7 July 2016].

MLU, 2014. *Richtlinien über die Gewährung von Zuwendungen zur Förderung von Maßnahmen des Herdenschutzes von Schafen, Ziegen und Gehegewild vor dem Wolf. Land Sachsen-Anhalt* [online]. Ministerium für Landwirtschaft und Umwelt des Landes Sachsen-Anhalt, ed. Available from: http://www.alff.sachsen-anhalt.de/fileadmin/Bibliothek/Politik_und_Verwaltung/LVWA/LVwA/Dokumente/landwirtschaftumwelt/alffanhalt/Landwirtschaft/MBl-2014_584.pdf [Accessed 17 March 2016].

MLU, 2015. *Wölfe in Sachsen-Anhalt* [online]. Ministerium für Landwirtschaft und Umwelt. Available from: http://www.mlu.sachsen-anhalt.de/themen/natur-landschaft/woelfe-in-sachsen-anhalt/ [Accessed 5 April 2016].

MLUL, 2011. *Richtlinie zum Ausgleich von durch Wölfe verursachte Schäden* [online]. Ministerium für Umwelt, Gesundheit und Verbraucherschutz des Landes Brandenbrurg. Available from: http://www.mlul.brandenburg.de/cms/media.php/lbm1.a.3310.de/rl_wolfsschaeden.pdf [Accessed 2 May 2016].

MLUL, 2014. *Projekt des Monats Juni. Vereinbarkeit von Wölfen und Nutztieren* [online]. Ministerium für Ländliche Entwicklung, Umwelt und Landwirtschaft des Landes Brandenburg. Available from: http://www.eler.brandenburg.de/sixcms/detail.php/654506 [Accessed 8 June 2016].

MLUL, 2015. *Fördermaßnahme. Ausgleich von durch Wölfe verursachten Schäden* [online]. Ministerium für Ländliche Entwicklung, Umwelt und Landwirtschaft des Landes Brandenburg. Available from: http://www.mlul.brandenburg.de/cms/detail.php/bb1.c.309527.de [Accessed 31 March 2016].

MU, 2010. *Der Wolf in Niedersachsen. Grundsätze und Maßnahmen im Umgang mit dem Wolf* [online]. Niedersächsisches Ministerium für Umwelt, Energie und Klimaschutz, ed. Available from: file:///C:/Users/Nina/Downloads/2012_11_14_Wolfskonzept.pdf [Accessed 16 December 2015].

MU, 2014a. *Antwort auf die mündliche Anfrage: Wann stellt die Landesregierung den Schutz des Wolfes in Niedersachsen durch eine angemessene Ausgleichsregelung für geschädigte Nutztierhalter sicher? | Nds. Ministerium für Umwelt, Energie und Klimaschutz* [online]. Niedersächsisches Ministerium für Umwelt, Energie und Klimaschutz. Available from: http://www.umwelt.niedersachsen.de/aktuelles/pressemitteilungen/antwort-auf-die-muendliche-anfrage-wann-stellt-die-landesregierung-den-schutz-des-wolfes-in-niedersachsen-durch-eine-angemessene-ausgleichsregelung-fuer-geschaedigte-nutztierhalter-sicher-128084.html [Accessed 24 March 2016].

MU, 2014b. *Richtlinie Wolf. Welche Betragshöchstgrenzen gem. EU-Beihilfevorschriften liegen vor?* [online]. Niedersächsisches Ministerium für Umwelt, Energie und Klimaschutz. Available from: http://www.umwelt.niedersachsen.de/startseite/themen/natur_landschaft/foerdermoeglichkeiten/richtlinie_wolf/richtlinie-wolf-129504.html [Accessed 17 March 2016].

MU, 2015a. *Förderkulisse Herdenschutz* [online]. Niedersächsisches Ministerium für Umwelt, Energie und Klimaschutz. Available from: http://www.umwelt.niedersachsen.de/live/institution/mediadb/mand_10/psfile/zoombild/11/foerderkul567176d8b9c90.jpg [Accessed 24 March 2016].

MU, 2015b. *Richtlinie über die Gewährung von Billigkeitsleistungen und Zuwendungen zur Minderung oder Vermeidung von durch den Wolf verursachten wirtschaftlichen Belastungen*

in Niedersachsen (Richtlinie Wolf) [online]. Niedersächsisches Ministerium für Umwelt, Energie und Klimaschutz. Available from: http://www.nds-voris.de/jportal/?quelle=jlink&query=VVND-281000-MU-20141106-SF&psml=bsvorisprod.psml&max=true [Accessed 18 March 2016].

MU, 2016. *Antwort auf die mündliche Anfrage: Nutztierrisse durch Hunde in Niedersachsen* [online]. Niedersächsisches Ministerium für Umwelt, Energie und Klimaschutz. Available from: http://www.umwelt.niedersachsen.de/aktuelles/pressemitteilungen/antwort-auf-die-muendliche-anfrage-nutztierrisse-durch-hunde-in-niedersachsen-141567.html [Accessed 8 June 2016].

MUGV, 2010. *Broschüre "Wölfe in Brandenburg"* [online]. Available from: http://www.mlul.brandenburg.de/media_fast/4055/woelfe.pdf [Accessed 31 March 2016].

MULEWF, 2015. *Managementplan für den Umgang mit Wölfen in Rheinland-Pfalz* [online]. Ministerium für Umwelt, Landwirtschaft, Ernährung, Weinbau und Forsten Rheinland-Pfalz. Available from: http://mulewf.rlp.de/uploads/media/Wolfmanagmentplan.pdf [Accessed 17 March 2016].

MUV, 2015. *Managementplan für den Umgang mit Wölfen im Saarland* [online]. Ministerium für Umwelt und Verbraucherschutz Saarland. Available from: http://www.saarland.de/dokumente/thema_tierschutz/WOLF_Managementplan_Fassg._Mai_2015.pdf [Accessed 17 March 2016].

NABU, 2015a. *NABU: Leitfaden Pferd und Wolf vorgelegt* [online]. Naturschutzbund Deutschland. Available from: https://www.nabu.de/presse/pressemitteilungen/http/index.php?popup=true&show=15512&db=presseservice [Accessed 2 January 2016].

NABU, 2015b. *Pferde wehren Wolf ab* [online]. Naturschutzbund Deutschland. Available from: https://www.nabu.de/news/2015/11/19741.html [Accessed 2 January 2016].

NABU, 2015c. *Wölfe in den Bundesländern* [online]. Naturschutzbund Deutschland. Available from: https://www.nabu.de/tiere-und-pflanzen/saeugetiere/wolf/deutschland/19424.html [Accessed 2 April 2016].

NABU, 2016a. *Alternativer Herdenschutz bei Konik-Pferden. Beweidungsprojekt reagiert auf Wolfsübergriffe auf Fohlen* [online]. Naturschutzbund Deutschland. Available from: https://www.nabu.de/tiere-und-pflanzen/saeugetiere/wolf/ [Accessed 28 April 2016].

NABU, 2016b. *Bayern ist Wolfsland* [online]. Naturschutzbund Deutschland. Available from: https://www.nabu.de/news/2016/06/20840.html [Accessed 15 June 2016].

NABU, 2016c. *Bundesweites Wolfs-Beratungszentrum* [online]. Naturschutzbund Deutschland. Available from: https://www.nabu.de/news/2016/02/20264.html [Accessed 16 June 2016].

NABU, 2016d. *Wölfe in Deutschland. Vorkommen in Deutschland* [online]. Naturschutzbund Deutschland. Available from: https://www.nabu.de/tiere-und-pflanzen/saeugetiere/wolf/deutschland/index.html [Accessed 14 June 2016].

NABU Bundesverband, 2015. *Pferd und Wolf. Wege zur Koexistenz* [online]. Naturschutzbund Deutschland. Available from: https://www.nabu.de/imperia/md/content/nabude/wolf/150929-leitfaden-pferd-und-wolf.pdf [Accessed 31 March 2016].

NABU Schleswig-Holstein, 2010. *Wolfsgarantiefonds Schleswig-Holstein* [online]. Naturschutzbund Deutschland. Available from: https://schleswig-holstein.nabu.de/tiere-und-pflanzen/saeugetiere/wolf/17718.html [Accessed 28 May 2016].

Naughton-Treves, L., GROSSBERG, R., and Treves, A., 2003. Paying for Tolerance. Rural Citizens' Attitudes toward Wolf Depredation and Compensation. *Conservation Biology*, 17 (6), 1500–1511.

Nilsen, E.B., *et al.*, 2007. Wolf reintroduction to Scotland. Public attitudes and consequences for red deer management. *Proceedings of the Royal Society B: Biological Sciences*, 274 (1612), 995–1003. Available from: http://rspb.royalsocietypublishing.org/content/274/1612/995 [Accessed 14 December 2015].

Nitze, M., 2012. *Untersuchungen am Schalenwild im Wolfsgebiet der Oberlausitz und Schlussfolgerungen zu dessen Hege und jagdlicher Bewirtschaftung. Forschungsbericht Zeitraum 2007- 2010* [online]. AG Wildtierforschung, Forstzoologie - TUD. Available from: http://www.wildtiermanagement.com/fileadmin/dateien/wildtiermanagement.de/pdfs/bericht_schalenwildforschung_im_wolfsgebiet_2007-2010.pdf [Accessed 8 December 2015].

NLWKN, 2015. *Das Wolfsbüro des NLWKN* [online]. Niedersächsischer Landesbetrieb für Wasserwirtschaft, Küsten- und Naturschutz. Available from: http://www.nlwkn.niedersachsen.de/startseite/naturschutz/tier_und_pflanzenartenschutz/wolfsbuero/das-wolfsbuero-des-nlwkn-134954.html [Accessed 10 June 2016].

Nyhus, P.J., *et al.*, 2005. Bearing the costs of human–wildlife conflict: the challenges of compensation schemes. *In:* R. Woodroffe, S. Thirgood, and A. Rabinowitz, eds. *People and Wildlife.* Cambridge: Cambridge University Press, 107–121.

Promberger, C., and Hofer, D., 1994. Managementplan für Wölfe in Brandenburg.

Reinhardt, I., *et al.*, 2012. Livestock protection methods applicable for Germany - a Country newly recolonized by wolves. *Italian Journal of Mammalogy. Available from:* http://www.italian-journal-of-mammalogy.it/article/view/4555 [Accessed 16 December 2015].

Reinhardt, I., *et al.*, 2013. *A review of wolf management in Poland and Germany with recommendations for future transboundary collaboration* [online]. Bundesamt für Naturschutz (BfN), ed. Available from: https://www.bfn.de/fileadmin/MDB/documents/themen/artenschutz/pdf/Skript356.pdf [Accessed 16 December 2015].

Reinhardt, I., and Kluth, G., 2007. *Leben mit Wölfen. Leitfaden für den Umgang mit einer konfliktträchtigen Tierart in Deutschland* [online]. Bundesamt für Naturschutz (BfN), ed. Available from: https://www.bfn.de/fileadmin/MDB/documents/service/skript201.pdf [Accessed 16 December 2015].

Ribeiro, S., and Petrucci-Fonseca, F., 2007. The Use of Livestock Guarding Dogs in Portugal: Results from a Longterm Experience. Available from: http://lobo.fc.ul.pt/caodegado/Palestras/LargeCarnivoresAgriculture_Mar2007.pdf.

Rinderzuchtverband Mecklemburg-Vorpommern e.G., 2015. *Stellungnahme der Rinderhaltung zum Wolfsmanagement in Mecklemburg-Vorpommern* [online]. Available from: http://rinderallianz.de/fileadmin/user_upload/Stellungnahme_Rinderhaltung_zum_Wolfsmanagement_in_MV_20150601.pdf [Accessed 31 March 2016].

Røskaft, E., *et al.*, 2007. Human attitudes towards large carnivores in Norway. *Wildlife Biology,* 13 (2), 172–185. Available from: http://www.bioone.org/doi/pdf/10.2981/0909-6396%282007%2913%5B172%3AHATLCI%5D2.0.CO%3B2 [Accessed 14 December 2015].

Salvatori, V., 2013. *The contribution of EC co-funded LIFE projects* [online]. European Commission DG Environment, ed. Available from: http://ec.europa.eu/environment/nature/conservation/species/carnivores/pdf/task_2_life_and_lc.pdf [Accessed 5 January 2016].

Salvatori, V., and Linnell, J., 2005. *Report on the conservation status and threats for wolf (Canis lupus) in Europe* [online]. Council of Europe, ed. Available from: http://www.wwf.se/source.php/1120062/rapport%20om%20vargar%20nov05.pdf [Accessed 16 December 2015].

Schwerdtner, K., and Gruber, B., 2007. A conceptual framework for damage compensation schemes. *Biological Conservation,* 134 (3), 354–360.

SMUL, 2009. Managementplan für den Wolf in Sachsen. Available from: http://www.medienservice.sachsen.de/medien/assets/download/88893 [Accessed 5 April 2016].

SMUL, 2014. *Managementplan für den Wolf in Sachsen. 3. Fassung – Stand Februar 2014* [online]. Sächsisches Staatsministerium für Umwelt und Landwirtschaft, ed. Available from:

http://www.oberelbe.de/jagdverband/pdf/Managementplan_Wolf_2014.pdf [Accessed 7 July 2016].

SMUL, 2015. *Förderung des präventiven Herdenschutzes zur Vermeidung von Nutztierschäden durch die Tierart Wolf* [online]. Staatsministerium für Umwelt und Landwirtschaft. Available from: https://publikationen.sachsen.de/bdb/artikel/11635/documents/33759 [Accessed 25 March 2016].

Stier, N., 2014a. *Kompensation bei Übergriffen auf Nutz- und Haustiere* [online]. Landesamt für Umwelt, Naturschutz und Geologie Mecklenburg-Vorpommern. Available from: http://www.wolf-mv.de/pages/haustierschaeden.html [Accessed 17 March 2016].

Stier, N., 2014b. *Wölfe in Mecklemburg-Vorpomern. Verbreitung* [online]. Landesamt für Umwelt, Naturschutz und Geologie Mecklenburg-Vorpommern. Available from: http://www.wolf-mv.de/pages/verbreitung.html [Accessed 3 April 2016].

StMELF, 2014. *ELER. Europäischer Landwirtschaftsfonds für die Entwicklung des ländlichen Raums* [online]. Bayerisches Staatsministerium für Ernährung, Landwirtschaft und Forsten. Available from: http://www.stmelf.bayern.de/agrarpolitik/foerderung/000994/ [Accessed 8 June 2016].

StMUV, 2007. Managementplan Wolf Stufe 1. Available from: http://www.luchsprojekt.de/downloads/MP_Wolf_Bayern.pdf [Accessed 2 April 2016].

Swenson, J., and Andrén, H. A tale of two countries: large carnivore depredation and compensation schemes in Sweden and Norway. *In: . People and Wildlife*.

Thiel, A., Schleyer, C., and Plieninger, T., 2012. Wolves are Mobile, While Fruit Trees are not! How Characteristics of Resources and Supranational Regulatory Frameworks Shape the Provision of Biodiversity and Ecosystem Services in Germany. *Environmental Policy and Governance*, 22 (3), 189–204. Available from: http://onlinelibrary.wiley.com/doi/10.1002/eet.1578/epdf [Accessed 7 July 2016].

Thomas, L., and Middleton, J., 2003. *Guidelines for Management Planning of Protected Areas. Best Practice Protected Area Guidelines Series No. 10* [online]. IUCN – The World Conservation Union. World Commission on Protected Areas (WCPA), ed. Available from: https://portals.iucn.org/library/efiles/documents/PAG-010.pdf [Accessed 4 December 2015].

TMUEN, 2012. *Managementplan für den Wolf in Thüringen* [online]. Thüringer Ministerium für Umwelt, Energie und Naturschutz, ed. Available from: http://apps.thueringen.de/de/publikationen/pic/pubdownload1609.pdf [Accessed 7 July 2016].

TMUEN, 2015a. *Richtlinie für die Gewährung von Zuwendungen zur Vermeidung oder Minderung wirtschaftlicher Belastungen durch den Wolf (Förderrichtlinie Wolf)* [online]. Thüringer Ministerium für Umwelt, Energie und Naturschutz. Available from:

http://www.thueringen.de/mam/th8/tmlfun/naturschutz/wolf/entwurf_forderrichtlinie_wolf.pdf [Accessed 28 March 2016].

TMUEN, 2015b. *Thüringen_MP_Dez 2015* [online]. Thüringer Ministerium für Umwelt, Energie und Naturschutz. Available from: http://apps.thueringen.de/de/publikationen/pic/pubdownload1609.pdf [Accessed 7 July 2016].

TMUEN, 2016. *Der Wolf kehrt zurück – Thüringen ist vorbereitet* [online]. Thüringer Ministerium für Umwelt, Energie und Naturschutz. Available from: http://www.thueringen.de/th8/tmuen/naturschutz/wolf/ [Accessed 16 March 2016].

Toland, J., *et al.*, 2013. LIFE and human coexistence with large carnivores. Available from: http://ec.europa.eu/environment/nature/conservation/species/carnivores/pdf/life_and_human_coexistence_with_large_carnivores.pdf [Accessed 23 July 2015].

top agrar online, 2014. *Brandenburg: Mehr Schutz vorm Wolf* [online]. Available from: http://www.topagrar.com/news/Rind-Rindernews-Brandenburg-Mehr-Schutz-vorm-Wolf-1593780.html [Accessed 31 March 2016].

Treves, A., *et al.*, 2009. The price of tolerance: wolf damage payments after recovery. *Biodiversity and Conservation*, 18 (14), 4003–4021. Available from: http://faculty.nelson.wisc.edu/treves/pubs/2009_treves_a_jurewicz_r_naughton-treves_l_wilcove_d.pdf [Accessed 7 July 2016].

Verdade, L.M., and Campos, C.B., 2004. How much is a puma worth? Economic compensation as an alternative for the conflict between wildlife conservation and livestock production in Brazil. *Biota Neotropica*, 4 (2), 1–4.

Verein für Neue Medien Kiel e.V., 2015. *Status Quo: Der Wolf in Schleswig-Holstein* [online]. Available from: http://landesblog.de/blog/2015/10/20/status-quo-der-wolf-schleswig-holstein/ [Accessed 23 March 2016].

Wechselberger, M., Rigg, R., and Beťková, S., 2005. *An investigation of public opinion about the three species of large carnivores in Slovakia: brown bear (Ursus arctos), wolf (Canis lupus) and lynx (Lynx lynx)* [online]. SWS - Slovak Wildlife Society, ed. Available from: http://www1.nina.no/lcie_new/pdf/635012234324499955_Wechselberger_carnivores_slovak_hd.pdf [Accessed 14 December 2015].

WeltN24 GmbH, 2015. *Land will Zuschüsse für Hunde zahlen* [online]. Available from: http://www.welt.de/regionales/berlin/article137611672/Land-will-Zuschuesse-fuer-Hunde-zahlen.html [Accessed 29 March 2016].

Wildtiermanagement Niedersachsen, 2016. *Nutztierrisse* [online]. Available from: http://www.wildtiermanagement.com/wildtiere/haarwild/wolf/nutztierrisse_karte/ [Accessed 28 April 2016].

Wochenblatt für Landwirtschaft & Landleben, 2015. *Was kostet der Wolf?* [online]. Available from: http://www.wochenblatt.com/landwirtschaft/nachrichten/was-kostet-der-wolf-10353.html.

Wolfsinformationszentrum Schleswig-Holstein, n.y. *Wolf und Nutztiere* [online]. Wildpark Eekholt, ed. Available from: http://www.wolfsbetreuer.de/wolf-und-nutztiere.html [Accessed 9 May 2016].

Wolfsinformationszentrum Schleswig-Holstein, 2016a. *Herzlich willkommen beim Wolfsinformationszentrum Schleswig-Holstein* [online]. Available from: http://www.wolfsbetreuer.de/ [Accessed 19 March 2016].

Wolfsinformationszentrum Schleswig-Holstein, 2016b. *Wolfsgebiet: Kreis Herzogtum-Lauenburg* [online]. Available from: http://www.wolfsbetreuer.de/schleswig-holstein-1.html [Accessed 24 March 2016].

Wolfsregion Lausitz, 2015. *Förderung Herdenschutz* [online]. Available from: http://www.wolfsregion-lausitz.de/index.php/foerdergebiet [Accessed 5 April 2016].

Wotschikowsky, U., 2015. *Naive, freche, gefährliche Wölfe?* [online]. Available from: http://woelfeindeutschland.de/naive-freche-gefaehrliche-woelfe/ [Accessed 18 March 2016].

WWF Deutschland, 2014. *Information: Schutz von Nutztieren vor dem Wolf Sachsen-Anhalt* [online]. Available from: https://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/WWF-Information-Schutz-von-Nutztieren-vor-dem-Wolf-Sachsen-Anhalt.pdf [Accessed 25 March 2016].

Zabel, A., and Holm-Müller, K., 2008. Conservation performance payments for carnivore conservation in Sweden. *Conservation biology : the journal of the Society for Conservation Biology*, 22 (2), 247–251. Available from: https://www.amherst.edu/system/files/media/0176/Zabel%2520and%2520Holm-muller%25202008.pdf [Accessed 7 July 2016].