

CDP **news**

Carnivore Damage Prevention



Issue 17

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**SUCCESS
OF INSTITUTIONAL
INTERVENTIONS
TO MITIGATE
CONFLICTS**
Costa Rica

**INSURANCE-BASED
COMPENSATION**
Italy and Spain

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STUDIES AND
PARTICIPATORY
MEETINGS**
Portugal, Spain

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Chief Editor
Silvia Ribeiro
Grupo Lobo, Portugal
MedWolf Project
globo@fc.ul.pt

Associate Editors
John Linnell
NINA, Norway
john.linnell@nina.no

Jean-Marc Landry
IPRA, Switzerland
canis.ovis@gmail.com

Daniel Mettler
AGRIDEA, Switzerland
daniel.mettler@agridea.ch

Robin Rigg
Slovak Wildlife Society, Slovakia
info@slovakwildlife.org

Design
Armando Lopes

Photo credits
José Conde (front cover and others)
Mauro Rotisciani (back cover)

E-mail:
lifemedwolf@fc.ul.pt

Available at:
www.medwolf.eu

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Dear Readers,

As LIFE MEDWOLF draws to a close, we are proud to present the last issue of CDPNews produced within this project. After several previous issues focused mainly on technical means to prevent damage to livestock, we now turn our attention to socio-economic aspects.

The risk of predation can be addressed through the application of various specific and integrated approaches, but their viability and effectiveness are dependent on the willingness of livestock owners and shepherds to accept changes in management and, ultimately, accept the presence of predators. No matter how innovative or efficient a tool may be for preventing livestock losses, it is of no value if end-users (livestock owners) are unwilling to use it or do not apply it correctly. Conflicts resulting from the presence of predators in areas where they negatively impact human activities are thus complex and need to be considered fully, including from social and economic points of view.

In this issue, we explore these aspects through a collection of articles presenting experiences from different parts of the world where efforts have been made to study social perceptions, attitude analyses, open dialogue processes and evaluation of levels of satisfaction of end-users. Communication and support appear to be basic instruments for building trust, which is the prerequisite for any successful and long-term progress. Trust might depend on the availability of knowledgeable experts providing technical support, but most importantly it is linked to the perception of livestock owners that their problems are receiving proper consideration.

Farming provides many important services for society, so every effort should be made to ensure continuity. We present examples of support – either financial or in the form of knowledge and technical advice – from Switzerland and Lithuania, while examples of full consideration and experimentally structured interventions among different stakeholders are provided from Italy, Spain and Portugal. The ultimate criterion of success that appears to be most relevant – the satisfaction of livestock owners – has been evaluated in Costa Rica, where pumas and jaguars pose a threat to unguarded livestock. Dialogue with stakeholders about adapting to the presence of predators is integral to the European Platform on Coexistence Between People and Large Carnivores, where a detailed analysis of financial measures available within the Rural Development Funds was made. Here, too, further progress will be reliant on trust and acceptance of the need to change current systems of managing livestock.

Coexistence between predators and humans is a dynamic, never-ending story. We might be able to reduce conflicts between the presence of large carnivores and human activities in the future, but only if the issue is tackled from different points of view and with multidisciplinary approaches. The examples in this issue illustrate the importance of social contexts and we hope that future activities will continue to focus on this often-neglected aspect.

CDPNews seeks to extend and empower the international community working to improve and exchange solutions to managing ongoing and emerging conflicts. Although LIFE MEDWOLF has ended, the challenge has not. Our work will go on within the new LIFE EuroLargeCarnivores project. Keep your eyes open for the next issue!

Valeria Salvatori & Francisco Petrucci-Fonseca

THE “SAFE SHEEP” INITIATIVE IN LITHUANIA: OVERVIEW AND FIRST RESULTS

Vaidas Balys*, Lina Paškevičiūtė

Association for Nature Conservation “Baltijos vilkas”, Dvaro 2-22, Buivydiškių k., Vilniaus r. sav., Lithuania www.vilkai.lt

1. Wolves and sheep husbandry in Lithuania

The wolf (*Canis lupus*) was never eradicated from Lithuania, even when its range in Europe was drastically reduced by human persecution. However, this does not mean they were welcome and cherished guests. Wolves in Lithuania were also subject to unlimited hunting, removal of pups from dens, bounties and other means of persecution, and the lowest point was reached in 1965–1970 when only 34–56 animals were left (Prūsaitė, 1988).

The new millennium has brought changes: in 2004

Lithuania joined the European Union (EU), bounties for wolves were abolished in 2002 and the wolf hunting season was limited with quotas designed to let the population recover. During the following 10 years the population successfully expanded its distribution and increased in numbers. The latest official census in winter 2015 estimated wolf population size to be at least 292 individuals (MoE, 2015). Combined spatial data of tracks, depredation and hunting from 2015 indicate that wolves occur in almost the whole country (Fig. 1).

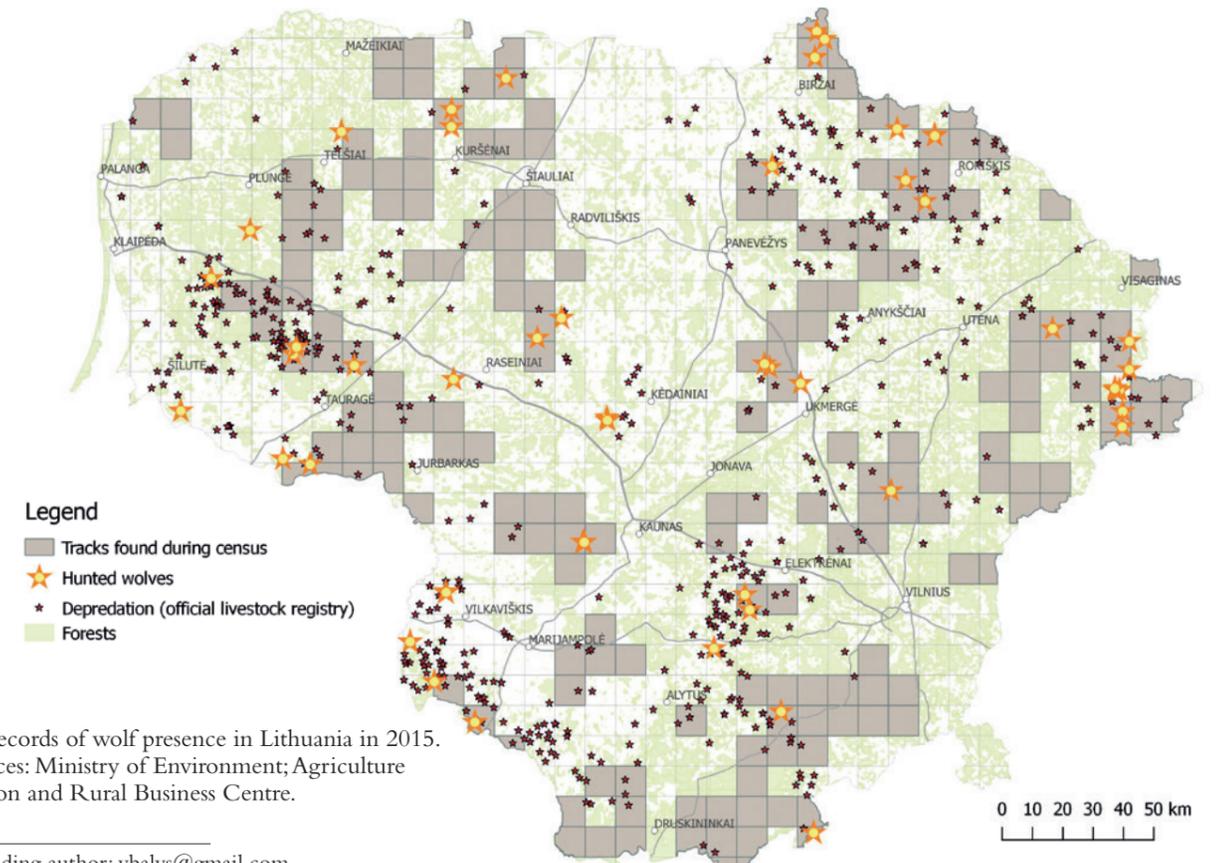


Fig. 1. Records of wolf presence in Lithuania in 2015. Data sources: Ministry of Environment; Agriculture Information and Rural Business Centre.

* Corresponding author: vbalys@gmail.com

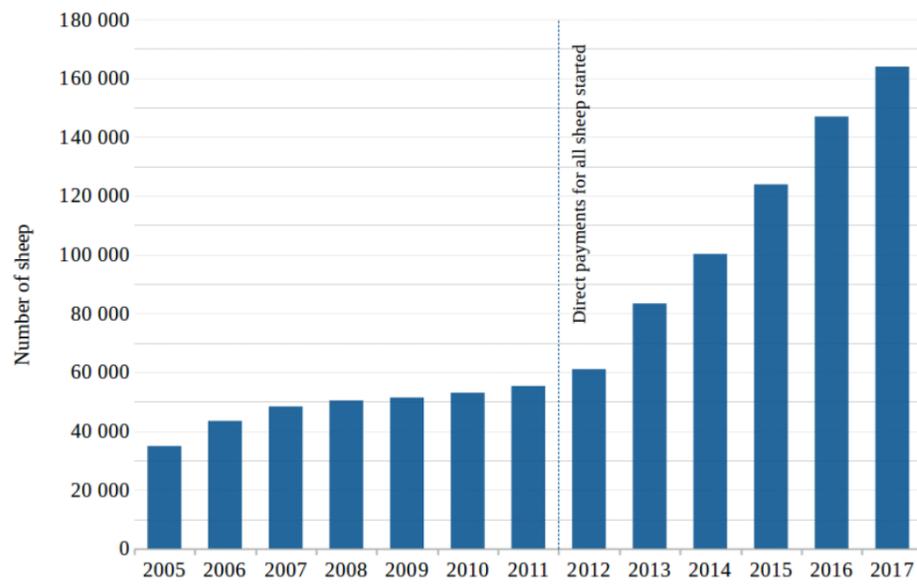


Fig. 2. Sheep numbers in Lithuania in 2005–2017. Numbers are from the 1st of January of each year. Data source: Agriculture Information and Rural Business Centre.

Wild ungulates and beavers form the basis of wolf diet in Lithuania (Špinkytė-Bačkaitienė and Pėtelis, 2012). Official game statistics for 2017 estimated there to be 140,000 roe deer (*Capreolus capreolus*), 40,000 red deer (*Cervus elaphus*), 15,000 moose (*Alces alces*), 19,000 wild boar (*Sus scrofa*) and 40,000 European beaver (*Castor fiber*) (MoE, 2017). Populations are stable or increasing with the exception of wild boar, which for the last three years has been affected by African swine fever and consequently increased hunting pressure.

Immediately before the Second World War there were hundreds of thousands of sheep in Lithuania. With the war came 50 years of Soviet occupation which saw a decline in sheep farming. As a result, in the early 21st century there were only around 10,000 sheep. However, direct payments from EU regional development funds fuelled a new growth in sheep numbers. Especially after 2011, sheep numbers increased by as much as 15–20% per year, and by the end of 2014 there were more than 120,000 (Fig. 2).

Currently, there are c. 10,000 sheep farmers, the majority of whom (80%) raise less than 20 animals (SEAIRBC, 2017). Flocks are grazed in enclosed pastures during the vegetation season, lasting from March/April to October/November. Sheep are left unattended but are regularly visited to check or relocate them. Enclosures are designed to limit sheep movement, not to protect them from predators. The most common type of enclosure is a low electric fence of one to three wires.

Wolves and sheep are distributed throughout the country with no natural barriers separating their ranges. Together with a mosaic of forests, meadows

and agricultural lands, this puts the majority of sheep within reach of wolves.

Beef cattle and goats have also increased in numbers and fall prey to wolves. Nevertheless, sheep are the main prey (75% of kills), and the depredation causes around 30% of sheep mortalities, as opposed to only around 5% of mortalities for cattle. Therefore, while wolf and livestock conflict in Lithuania is not limited to sheep, this species was chosen as the main target and a symbol of the initiative.

2. “Safe Sheep” initiative

Wolf recovery and the huge expansion of livestock – especially sheep – farming led to increased depredation and growing conflicts between predators and farmers (Figs. 3, 4). The national agriculture strategy to prioritize sheep and beef cattle farming and encourage them with direct payments meant that with each year even more potential wolf prey would graze Lithuanian pastures. It became clear that livestock breeders did not know how to protect their animals.

Moreover, protection was not recognized as needed or useful, while intensive wolf hunting was promoted as the only solution. Regular heated discussions about hunting quotas and depredation was a clear indication that the situation was not going to improve, as no governmental institution was willing to take responsibility for helping farmers with damage prevention or other non-lethal methods.

All this meant that Lithuania was on track towards ever increasing depredation and more severe conflicts between rural communities and wolves. In the long

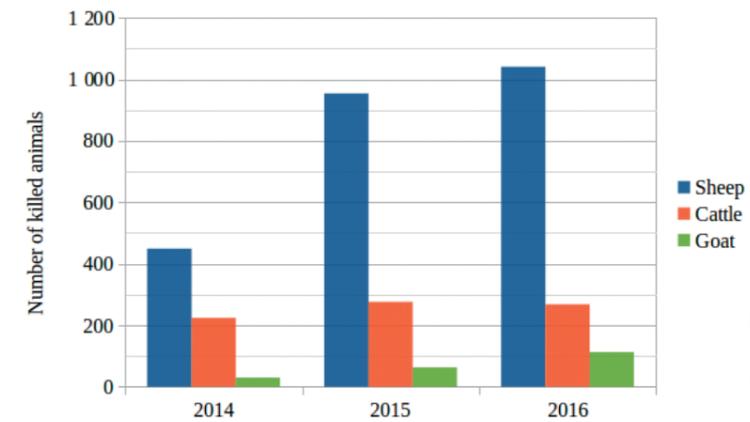


Fig. 3. Wolf depredation on livestock in 2014–2016. Data source: Agriculture Information and Rural Business Centre.

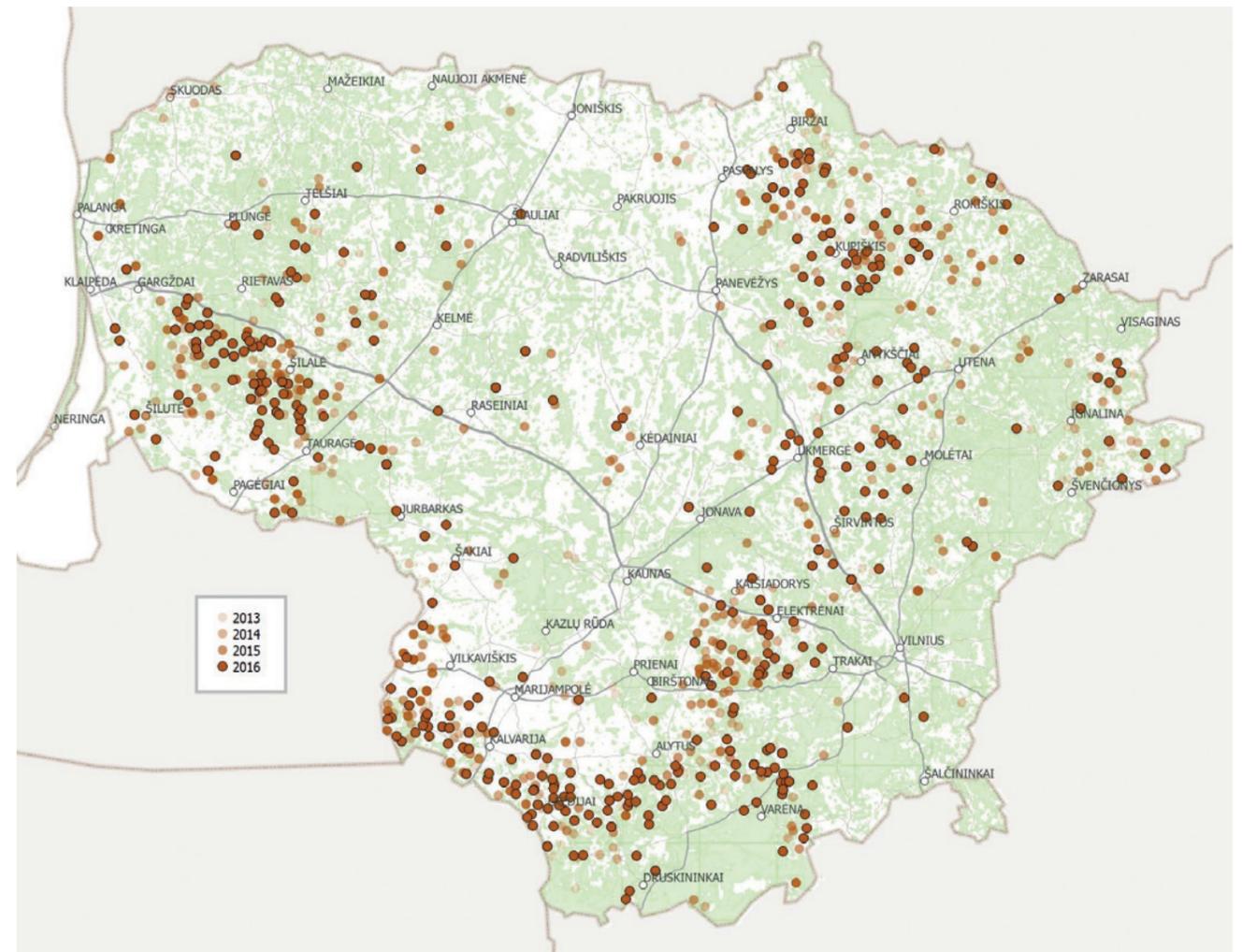


Fig. 4. Reported cases of wolf depredation on livestock in 2013–2016. Data source: Agriculture Information and Rural Business Centre.

run this was likely to be detrimental to both wolves and farmers. In the wake of these realizations, the “Safe Sheep” initiative was started in January 2015 by environmental non-governmental organization “Baltijos vilkas” with the aim of promoting extensive use of non-lethal protective measures in Lithuania. Three main goals were formulated: i) to provide information about the means of protection; ii) to promote the es-

tablishment of locations where farmers could acquire protection equipment; and iii) to prompt government institutions to support the acquisition and installation of protective means.

We wanted to be flexible at the start, to be able to adapt and respond to the changing situation by modifying activities as needed. Therefore, we decided not to apply for any funding, which would have added addi-

tional bureaucracy and restrictions. Up until now the initiative has been based entirely on voluntary work. While this has had certain advantages, public funding or other options will be considered in the near future to ensure sustainability and expansion of the initiative.

3. Activities and their results

3.1. Website

The cornerstone of the "Safe Sheep" initiative is its website: <http://www.saugiavis.lt> (Fig. 5). This serves as a platform to collect and provide up to date and relevant information to farmers about protecting livestock from wolves: installation of various fences and enclosures, use of livestock guarding dogs (LGDs), temporary solutions such as fladry, changes to husbandry practices such as confining small flocks in sheds at night, among others.

Initial information for the website came from our NGO's previous experience with promoting protective measures, discussions with farmers and various other existing information sources, mostly in Europe (e.g. Nowak and Mysłajek, 2006; Reinhardt et al., 2012). The idea was not to try to provide the most accurate and definitive data from the very first moment but to progressively update it, gathering knowledge and experience, especially specific to Lithuania.

On the website, farmers can easily find descriptions of protective measures, information about what to do in case of depredation, about financial aid for damage prevention measures, wolf depredation maps, among other type of information.

The website was designed to be simple, intuitive and mobile-friendly, having in mind three observations: i) farmers are pragmatic users that need information, not fancy designs; ii) many farmers are middle aged or elderly; and iii) smartphones are increasingly used to access online content.

There is no meaningful way to assess the impact of the information provided in the website after such a short period of time. However, it is possible to assess the usage of the website itself, which may be indicative of its effectiveness. Google Analytics usage numbers for the last two years are not very impressive, bearing in mind that there are 10,000 sheep breeders, 4,000 goat breeders, and 45,000 cattle breeders in the country and not all the visits are from the target group: around 510 sessions a month; average session length of 1 minute 50 seconds; around 10,000 unique users, 80% of them from Lithuania. To achieve higher usage of the website, research into its usage patterns and shortcomings is needed. The effectiveness of communication and dissemination must also be improved.



Fig. 5. Home page of the "Safe Sheep" website (English translation). The Lithuanian version has additional material, not available in English.

3.2. Seminars and meetings with farmers

We expected direct communication with farmers to be a good way to promote protective measures and reduce conflicts by listening to farmers' problems and providing relevant information. We have tried three models of communication: i) seminars with local

farmers (two seminars, very low attendance of on average five farmers); ii) seminars with local farmers and participation of administrative officials (four seminars, on average 50 participants); and iii) personal meetings with single farmers (eight meetings). Seminars of both types were organized in hot spots – locations



Fig. 6. Seminar with farmers and administrative officials.



Fig. 7. Seminar with farmers in a more informal setting, without administrative officials.

with high depredation rates – with open invitations disseminated online and via the local administration.

In our experience, seminars with participation of administrative officials proved to be the most hostile and frustrating. When officials were present, farmers tended to shout all their problems at them. On the other hand, officials did not want to be unpopular, so they turned to various forms of populism and blame shifting. Usually there were no constructive outcomes except for hope that someone may have heard something new. The presence of a skilled, unbiased moderator might improve the situation.

Meetings with individual farmers, for example who had just lost livestock to depredation, have been the most effective form of communication and information exchange. In some cases, farmers contacted us, in others we were able to contact them after reports in the media. This format reduced the risk of outright hostility and the personal nature of the conversation allowed discussion of specific situations. Unfortunately, this format is limited in extent as only a small fraction of farmers can be reached in this way.

Outcomes of seminars with local farmers without administrative officials present lay somewhere between the previous two formats. However, one unexpected issue became apparent: currently there are so many projects with seminars for farmers that there are clear signs of over-saturation and a drop in attendance.

3.3. Work with governmental institutions

A compensation system for wolf depredation was introduced in 2013. Compensation is paid by municipality from special environmental funds. In each depredation case, a veterinarian must first confirm the case, the affected animals (only officially registered ones) and the predator species. The sum to be paid

is calculated according to a nationwide official damage assessment protocol, based on the market value of meat of animal. All livestock species are eligible for compensation, but dogs are not. In theory, payment of compensation is conditional on the use of suitable protection measures but, in practice, almost anything resembling protection is deemed suitable. While this system is far from perfect, it partially reduced the financial strain on farmers, with a positive side-effect of improved quality of depredation statistics. However, there are still at least two major tasks for official institutions: i) dissemination of information about depredation and protection; and ii) financial aid for implementing preventive measures.

Over the last five years the Ministry of Environment considerably changed its approach to communication regarding wolves and depredation. Now, they always remind farmers that they should protect their livestock. Since we presented "Safe Sheep" to ministry specialists, they refer to the initiative and its website as a source of information in their messages. However, these communicative messages reach only a fraction of livestock breeders and probably are not perceived as coming from a reliable and relevant source due to prevalent distrust and opposition to all kinds of "environmentalists", including official ones.

The first attempts to introduce "Safe Sheep" to the Ministry of Agriculture started in May 2015 and looked promising. Officials seemed happy to fill the information gap in their communication with livestock breeders. They also started referring to the initiative website in their messages. Unfortunately, by the end of July of the same year the official attitude abruptly changed to aggressively hostile towards wolves and wildlife in general. Most likely, this happened due to recognition that the main target



Fig. 9. A young livestock guarding dog being raised to protect sheep on a farm in Lithuania.

groups – rural communities in general, and farmers in particular – were getting increasingly angry about depredation by wolves, while conflict was being aggravated by regional media. Thus, today the Ministry of Agriculture does not provide any information for livestock farmers about wolves, depredation or livestock protection. Changing this situation remains one of the most important goals for the initiative.

Information about preventive means is crucial, but in the end farmers have to acquire and install the equipment. Effective means do not come cheap, thus financial aid is very important. According to legal regulations, the environmental funds of municipalities may be used to finance acquisition of protective measures. Each municipality has to decide how it wants to use its funds and, so far, the majority of them have chosen only to pay compensation. In the communication of "Safe Sheep" we constantly encourage municipalities to direct part of their funds towards protection and inform farmers that they should request such aid.

The Ministry of Agriculture is responsible for distributing financial support from the European Agricultural Fund for Rural Development. Each year around two million Euros are paid to sheep breeders and 13 million Euros to cattle breeders as direct payments (for comparison, depredation damage is estimated to be around 150,000 Euros per year). Several measures in the rural development programme could provide financial support for protection (Marsden et al., 2017), but up until 2015 protective means were

not considered eligible for support in Lithuania. Only after intensive work by the "Safe Sheep" team and experts from the Ministry of Environment protective means were listed as eligible for support under measure 4.1 Support for investment in agricultural holdings. Requirements for applicants are still rather restrictive (e.g. farm production value per year must exceed 8,000 Euros) and the possibility to get support for protection is not articulated or communicated enough, therefore in practice this support does not work well if at all.

3.4. Improving access and promoting good practice

From the start, we were confronted by an unexpected problem: there was almost nowhere in Lithuania to buy equipment such as electric fences suitable for protection against wolves, while the closest breeders of LGDs were located in Poland. We contacted several sellers and distributors of equipment for livestock breeders. Some of them did not know about protection against wolves, others knew but had nothing in stock. The main reason was that there was no demand from farmers for such equipment. After two years of collaboration with businesses, the situation improved: some have electric fences and meshes together with generators, batteries, voltage indicators, in supply and they can also provide information about installation and farmers are increasingly inquiring about these solutions. As demand for LGDs is also slowly increasing, there is at least one farmer that we know of who has just started breeding Tatra sheepdogs in the expectation of selling them to other livestock breeders (Figs. 8, 9).

Providing examples of good practice is a powerful tool to encourage other farmers to follow. Therefore, we have tried not only to consult or visit farmers but also to share some of their success stories. There are a handful of such stories on our website (in Lithuanian), and we hope to add more in the future.

There is a "demonstration" farm in one of the regions of Lithuania that is within the range of high depredation intensity. A farmer who had lost some of her then unprotected calves to wolves asked us for help. We found a willing distributor who agreed to participate in a three-way experiment: they provided equipment, we provided knowledge, physical help with installation and publicity, and the farmer also provided publicity in case of success. A 4-wire electric fence (with wires from 20 cm to 130 cm)



Fig. 8. A good example of protection. A livestock guarding dog and electric mesh protect sheep on a Lithuanian farm.

Fig. 10. A newly installed electric fence.

was installed around a 0.6 ha pasture (Fig. 10). Signal lamps and a voltmeter were used to ensure that the fence was operational. Additionally, cattle were tethered in the enclosure to prevent them from panicking and breaking out. So far, this solution has proven to be reliable protection, while neighbouring farms continued to be attacked by wolves.

3.5. Communication

The key factor for success of such an initiative is an effective communication strategy. Unfortunately, this was one of the weakest points, mainly because it requires professional planning and extensive resources that were simply not available.

Our principal target group is farmers, therefore the most important communication channels include regional and local media, official information outlets of agriculture and local administration institutions, businesses providing farmers with equipment and the farmers' community itself. Businesses and certain groups of farmers are rather supportive of damage prevention ideas. For example, the Association of Sheep Breeders endorsed "Safe Sheep", protective measures are discussed in farmers' online forums and businesses are slowly starting to provide the means of protection against wolves. However, the main channels of communication are not supportive or even oppose the ideas promoted by "Safe Sheep". In particular, regional and local media are dominated by sensationalized and hostile attitudes towards wolves. The main relevant official institution, the Ministry of Agriculture, showed only limited and temporary support.

Last year one technique was tested to address the problem of one-sided reports in the regional media. First, we prepared a concise summary with key facts and ideas about depredation and protection; this summary is accessible on the Lithuanian version of our website. Then, during the summer season, we monitored portals for publications about depredation cases. In each case, we (i) wrote a short situation-specific comment with reference to "Safe Sheep"; and (ii) contacted the authors or editors of publications and sent them our prepared information asking them to refer to it in the future to represent both sides. Some responded positively but results will be visible only when the main season of depredations starts in the late summer.



4. Conclusions

More than two years of the "Safe Sheep" initiative have passed and the first results can be considered. We think that so far the initiative has been a moderate success.

Up to now "Safe Sheep" has been fully voluntary work driven by enthusiasm. This has its strengths as proven by the results achieved so far, but there are also obvious weaknesses. Therefore, a decision about the format of the initiative will have to be taken soon which will influence the shape and pace of "Safe Sheep" in the future.

It is clear that a shift towards new ways of dealing with conflicts is much more than a technical or financial matter. First and foremost, it is a question of a change of mindset, and such a change will not happen overnight. Therefore, we see our initiative not as a short project but as a platform to support and drive long years of work towards achieving our vision of making livestock safe even when wolves live nearby.

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EU PLATFORM ON COEXISTENCE BETWEEN PEOPLE AND LARGE CARNIVORES:

EXAMINING THE POTENTIAL TO SUPPORT COEXISTENCE THROUGH THE RURAL DEVELOPMENT PROGRAMMES

Katrina Marsden¹, Tasos Hovardas², Spyros Psaroudas², Yorgos Mertzanis²

¹ adelphi consult GmbH, Alt-Moabit 91, 10559 Berlin

² Callisto 123 Mitropoleos st., 54621 Thessaloniki, Greece

Platform Website:

ec.europa.eu/environment/nature/conservation/species/carnivores/coexistence_platform.htm

1. Introduction

Europe's large carnivores are challenging species in conservation terms. The brown bear (*Ursus arctos*), wolf (*Canis lupus*), Eurasian lynx (*Lynx lynx*), and wolverine (*Gulo gulo*) have large ranges which cross borders and their needs can potentially conflict with human activities such as farming and hunting. While favourable legislation, in particular the Habitats Directive (ECC, 1992) of the European Union (EU), has protected these species and supported their recovery, different populations are in very different states of health. At the same time, political, socioeconomic and societal chang-

es challenge existing management approaches.

This has been recognised both by the European Commission and stakeholder representative groups who, following several Commission-organised workshops, agreed to come together to form the EU Platform on Coexistence between People and Large Carnivores. In June 2014, eight organisations signed an agreement stating that they would work together “to promote ways and means to minimise, and wherever possible find solutions to, conflicts between human interests and the presence of large carnivores”. The organisations involved are: the European Landowners' Organization (ELO); joint representatives of

Finnish and Swedish reindeer herders; the European Federation of Associations for Hunting & Conservation (FACE); the International Council for Game and Wildlife Conservation (CIC); the International Union for Conservation of Nature (IUCN); the Worldwide Fund for Nature (WWF), European Policy Office; and EUROPARC Federation (COPA-COGECA was also initially involved but left the Platform in 2015). The European Commission helped to establish the Platform and acts as a co-chair although it is not a member. It supports the Platform members in their work by funding a Platform Secretariat (currently managed by adelphi consult GmbH and Callisto).

In their first meetings, the Platform agreed a work plan. This focused on transfer of good practice for coexistence across the EU, through organising regionally and topically focused workshops and by collecting and sharing good practice examples. Many coexistence actions have been well tested by EU LIFE projects (Salvatori, 2013; Silva et al., 2013) and nationally or regionally funded schemes (Fig. 1). They are therefore ripe for broader roll-out.

For this reason, in the second year of their work, the Platform members decided that they wished to focus particularly on the potential to support good practice through the Rural Development Programmes, the second Pillar of the Common Agricultural Policy which is financed on an EU level through the European Ag-

ricultural Fund for Rural Development (EAFRD), and co-financed by Member States (EU, 2013). The EAFRD aims to promote sustainable development in rural areas by supporting a range of measures which can be targeted on the national or regional level. The particular advantages of this funding stream is that it is available across the EU, is significantly larger than LIFE+ Nature and Biodiversity and it is possible for individuals or groups to access it.

The Platform Secretariat therefore carried out a study (Marsden et al., 2016) which examined the good practice identified in the case studies (step 1); over-viewed the measures currently included in the Rural Development programmes targeted at large carnivores (step 2) and; evaluated the future potential to fund good practice identified in step 1 through the Rural Development programmes (step 3).



Fig. 1. Fencing measures and livestock guarding dogs introduced through the LIFE MEDWOLF Project. Photos: Luisa Vielmi/MEDWOLF.

¹ The EU Platform agreement includes these four species. The Iberian lynx (*Lynx pardinus*) and the golden jackal (*Canis aureus*) are also present in Europe but are not included in the Platform's work at present.

² Platform Agreement: http://ec.europa.eu/environment/nature/conservation/species/carnivores/pdf/EN_Agreement.pdf

2. Identifying good practice suitable for EAFRD funding

Case studies were initially collected by means of an online questionnaire sent to Platform members and large carnivore experts. In the second and third year of the Platform's work, members simply sent web links and short descriptions to the Secretariat. Case studies that focused on concrete, transferable good practice examples were selected. This meant that some submitted examples were excluded from the final sample

either because they did not focus on good practice (they highlighted problems rather than solutions) or they described a wide range of activities implemented over the course of a project or a scientific study. If the project or study included several specific good practice elements, these were included as individual cases.

This process resulted in the collection of 35 case studies from 14 European countries targeting all four carnivore species. The cases identified were grouped into five categories according to the type of intervention (Table 1).

Table 1. Examples of best practices for coexistence between people and large carnivores listed by categories (for a list of the case studies see Annex 1 of Marsden et al., 2016).

Category	Descriptions	Species	Member States	Number of cases
Advice/Awareness raising	Sourcing of information from individual contact points (websites, experts, volunteers) for the general public, responsible authorities or stakeholders	Bear, wolf, lynx	Austria, Germany, Lithuania, Finland	8
	Awareness raising for tourists to avoid conflict with bears	Bear	Bulgaria, Poland	2
	Avoiding infrastructure development in areas important for wolf breeding	Wolf	Portugal	1
Innovative financing	Volunteer programmes supporting livestock keepers in protecting their flocks from wolves	Wolf	France, Italy	3
	Eco-labelling schemes to increase value of farm produce coming from areas where livestock coexist with large carnivores	Bear, wolf	Austria, Croatia, France, Italy, Slovenia	3
	Eco-tourism development based on the presence of large carnivores	Wolf	Italy	1
	Payment for results scheme (number of successful young wolverine)	Wolverine	Sweden	1
Practical support	Practical measures to improve coexistence such as provision of fencing or livestock guarding dogs	Bear, wolf, lynx	Bulgaria, Greece, Italy, Slovenia	5
	Establishment of emergency teams to respond to call-outs	Bear	Greece	1
Monitoring	Good practice in involving stakeholders in monitoring of large carnivores and sharing the results with stakeholders	Bear, wolf, lynx, wolverine	Slovenia, Croatia, Italy, Finland, Sweden, Norway	4
	Good practice in cross border monitoring	Bear, wolf	Finland, Norway, Russia	1
Understanding viewpoints	Studies understanding stakeholder attitudes to different large carnivore species	Bear, wolf	Greece, Italy, Slovenia	2
	Intensive efforts to encourage stakeholders to work together	Bear, wolf, lynx	Germany, Switzerland, Spain	3

3. Assessment of the potential of EAFRD funding to support good practice

An initial situation analysis was carried out at the start of 2016, which involved reviewing relevant literature, meeting officials from the Directorate General Environment and Agriculture and asking the Platform members to question their own members. Based on this, a questionnaire was produced and sent either directly to managing authorities or to experts in the Member States who then approached the managing authorities to gather the relevant information. All Member States with populations of large carnivores were initially contacted (Belgium, Luxemburg and island states were not included). The questionnaire covered the 2000–2006, the 2007–2013 and the 2014–2020 EAFRD programming periods. Respondents were asked for information on sub-measures targeted at coexistence and their financing but also for background information on the programme, the involvement of stakeholders in the process and their views on the success of the measures (for past programmes). Following initial information gathering, the results of the questionnaire were analysed statistically.

4. Results

Altogether 15 respondents from 12 Member States provided information on 13 regional or national Rural Development Programmes in the 2007–2013 programming period and another 29 Rural Development Programmes in the 2014–2020 programming period. Only Slovenia included a large carnivore coexistence measure in the 2000–2006 period (as part of their agri-environment scheme) so this funding period was not analysed further. The countries included in the analysis were Bulgaria, Croatia, Finland, France, Greece, Germany, Italy, Portugal, Slovenia, Spain, Sweden, and Lithuania. It is believed that all relevant Rural Development programmes were covered with the exception of Spain where only Rioja was covered in the full analysis. Information on Asturias and Aragon was added late. Castilla y Leon also intended to include measures on damage prevention but concrete information could not be gathered in time. It should be noted that Member States can make changes and updates to their programmes on an annual basis and that certain Member States had not yet fully agreed on all activities to be included under a particular measure.

4.1. Measures chosen

There are 20 measures and 60 sub-measures in the EAFRD regulation (EU, 2013). Measures give a broad description of an action which can be funded. Sub-measures provide more detail including which costs can be covered. A variety of sub-measures were used in the different Member States and regions to support coexistence. A summary is shown in Table 2.

The main actions funded were damage prevention methods: establishment of electric fences (five instances of specific mention in the former programming period and another 12 instances in the current programming period in Finland, Croatia, Greece, all the Italian programmes, Lithuania, Spain-Aragon, Spain - Asturias, Sweden) and distribution of livestock guarding dogs (three and seven instances, respectively in Croatia, Italia - Emilia Romagna, Italy - Marche, Italy - Piemonte, Portugal, Spain-Asturias, Spain - Rioja). Other approaches involved alert systems and video surveillance (Croatia, Toscana-Italy), adaptation of grazing patterns, when livestock had been exposed to the risk of wolf depredation (Alsace and Auvergne in France) and additional agri-environment area payments in areas where the presence of wolf or bear might prevent delivery of environmentally beneficial grazing practice, normally with a top-up for keeping livestock guarding dogs (Bulgaria, Finland, Spain-Rioja) (Fig. 2). In 2014–2020 the LEADER programme was used for awareness raising and advice provision in Finland (for a full description of all actions see Annex 2 of Marsden et al., 2016).

Different measures were used to fund very similar actions for example, measures 4.1, 4.4 and 7.6 (support for investment in agricultural holdings, support for non-productive investment, village renewal) were all used to deliver damage prevention measures such as fencing and livestock guarding dogs. Regional programmes in a Member State tended to use the same sub-measure (e.g. in France measure 7.6) but this is not always the case (e.g. in Germany different sub-measures are used in the regional programmes). Usually where Member States had included a sub-measure in their 2007–13 programme, they continued using the equivalent sub-measure in the 2014–20 programme.

The reasons for the choices of the different Member States in selecting certain sub-measures to support particular actions clearly needs to be explored further. From the requirements included in the EU Regulation, however it is possible to identify administrative reasons why particular sub-measures have been used. For example measure 4.1 (support for in-

Table 2. Description of measures implemented within the EAFRD in each country, according to programming period. Measure and sub-measure codes are those used in the EU regulation and the Member States' programmes. They are listed and described in Annex 1, Part 5 of the implementing regulation (EU, 2014).

Sub-measure description	2007-2013		2014-2020	
	Sub-measure code	Country/Region where the sub-measure was used	Sub-measure code	Country/Region where the sub-measure is used
Support for investment in agricultural holdings	121	Italy (Marche, Toscana)	4.1	Croatia, Finland, Italy (Marche), Spain (Aragon), Sweden
Support for non-productive investments linked to the achievement of agri-environment-climate objectives	216	Germany (Saxony), Greece, Italy (Abruzzo), Sweden	4.4	Germany (Saxony, Mecklenburg-Vorpommern), Greece, Italy (Abruzzo, Emilia Romagna, Friuli Venezia Giulia, Lazio, Marche, Piemonte, Toscana), Spain (Asturias)
Support for non-productive investments linked to the achievement of forest environment objectives	227	Spain (Rioja)	8.5	Not included
Agri-environment-climate	214	Bulgaria, Greece, Slovenia	10.1	Bulgaria, Portugal, Slovenia, Spain (Rioja)
Village renewal	323	Germany – Brandenburg	7.6	Germany – Brandenburg, France (Alsace, Auvergne, Champagne-Ardenne, Franche-Comte, Languedoc Rousillon, Midi – Pyrenees, Alpes Côte D'Azur, Rhones Alpes)
LEADER	412	Germany – Saarland (highlighted as having potential)	19	Germany – Saarland (highlighted as having potential), Finland (used in a project)



Fig. 2. Example of measures supported through the Bulgarian Regional Development Programme – flocks attended by livestock guarding dogs and a shepherd. Photos: Elena Tsingarska and Sider Sedefchev.

vestment in agricultural holdings) has the advantage of being flexible. Fencing paid through for this measure may also bring a farmer other benefits such as reducing the time needed to gather stock together. Support under measure 4.4 (support for non-productive investment) must demonstrate that it delivers en-

vironmental aims and does not provide farmers with economic benefits. The advantage of 4.4 for farmers, is that (contrary to 4.1) it is fully funded and they do not need to invest anything themselves. Table 3 describes the strengths and potential barriers for each of the main measures used.

Table 3. Strengths and potential barriers of the main measures within the European Agricultural Fund for Rural Development used for coexistence.

Code	Measure	Strengths	Potential barriers
121 / 4.1	Support for investment in agricultural holdings	Farmers do not need to prove that the measures are linked to agri-environment-climate objectives under the regulation. Measures may therefore also provide additional economic benefits.	Not fully financed (the beneficiary must also contribute). Open only to farmers/groups of farmers. Only covers costs of infrastructure.
216 / 4.4	Support for non-productive investments linked to the achievement of agri-environment (-climate) objectives	100% financed. Open to all land managers.	Need to prove the link to agri-environment-climate objectives and that the measure is "non-productive". Land manager cannot benefit financially from the measure. Only covers costs of infrastructure.
214 / 10.1	Agri-environment (-climate)	Potentially available to all land managers. Longer-term payment (normally 5-7 years) which can cover additional costs and income foregone on an annual level, not just initial costs.	Annual payment which does not cover the initial investment in infrastructure. The link with providing area-based environmental benefits should be clear - therefore needs to include land management requirements.
323 / 7.6	Village renewal	Open to wide range of rural actors. Can cover a wider range of measures related to coexistence including information and awareness raising, waste management, local infrastructure management.	Actions must be in accordance with plans for the development of municipalities and villages in rural areas.

4.2. Targeting measures and stakeholder involvement in design

All four large carnivore species covered by the Platform's work are targeted in the Rural Development programmes³. The wolf was the most commonly targeted species but the fairly generic measures can often be used to prevent damage by more than one species.

The main beneficiaries are stockbreeders/herders and farmers followed by bee keepers, rural residents and environmental non-governmental organisations (NGOs). This reflects the focus of the chosen meas-

ures which are largely on protecting livestock. Implementation of measures is targeted mainly at individuals (i.e. individual stockbreeders, not their associations). The number of NGO beneficiaries appears to have increased in the second programming period.

National authorities/ministries and regional/local authorities were (unsurprisingly) most frequently involved in the design of measures, followed by environmental NGOs. Participation in the Programme Monitoring Committee (PMC)⁴ is more evenly distributed among stakeholders with greater

³ Brown bear, wolf, Eurasian lynx and wolverine.

⁴ The PMC is made up of managing authorities and stakeholder representatives. Its aim is to monitor the implementation of the programme. Members of the PMC agree the measures and sub-measures to be included in the programme initially, monitor their uptake and make suggestions for amendments.



Photo: Silvia Ribeiro.

direct involvement of farming unions and farming cooperatives. Overall, stakeholder involvement appears to have increased in the new programming period in comparison to the 2007–2013 programme.



Photo: Luisa Vielmi.

5. Discussion and future potential

To identify how good practice could be better supported through the EAFRD, a comparison between the categories of good practice identified through the case studies and the support available through the EAFRD was carried out.

Coexistence with large carnivores is a complex topic, including a wide range of activities from awareness raising to fence building (as demonstrated by the case studies). Theoretically, therefore, most of the measures could be put to some use related to coexistence. An effort has been made here to concentrate on those measures most relevant to the good practices identified.

Following the example of Allen et al. (2012), measures were identified as: being key to delivering co-

existence (K); with potential to deliver coexistence (P); or as having cross-cutting potential (C) to deliver for coexistence amongst other objectives (Table 4). For a fuller description see Annex 3 of Marsden et al. (2016).

6. Recommendations and role of the Platform

The analysis of EAFRD measures shows that they are already used in various ways in many Member States to support coexistence. However, some Member States with significant large carnivore populations do not make use of the EAFRD (notably Slovakia, Romania and Poland). While in some countries, national support may be available, in others, no funds are dedicated to this purpose and there may be the

Table 4. Potential use of EAFRD measures to support best practice actions for coexistence (compare with Table 1 for a description of the best practice categories): K=Key measure; P=Measure with potential; C=Cross-cutting measure.

Code	Measure	Categories of best practices for coexistence				
		Advice/Awareness	Innovative financing	Practical support	Monitoring	Understanding viewpoints
1	Knowledge transfer/Information	C	C	C	C	C
2	Advisory Services	C	C	C	C	C
4.1	Investment in physical assets			K		
4.4	Non-productive investment			K		
6.2	Business start-up aid		P			
6.4	Non-agricultural activity development		P			
7.1	Basic services/village renewal		P			
7.5	Tourism infrastructure		P			
7.6	Studies/investments natural heritage	K	K	K	K	K
8.5	Forest ecosystem investment			K		
10.1	Agri-environment-climate		K	K		
12.1	Compensation Natura 2000 areas			K		
14	Animal welfare payments			P		
15.1	Forest-environment-climate			K		
16	Cooperation	P	P			P
19	LEADER	C	C	C	C	C
20	Technical support	C	C	C	C	C

potential to exploit the EAFRD further. There is clear potential to use the EAFRD more innovatively, for example to support awareness raising and advice, target different stakeholders, establish pilot projects or new business opportunities.

This overview does not provide information on uptake of measures (evidence gathering occurred shortly after the start of the new programmes). However, from the information gathered from the 2007-2014 period, it appears that in many cases uptake is poor. The respondents to the questionnaire suggest that this may be due to lack of awareness and poor promotion of the measures. In certain areas there may be resistance to using measures (acceptance of support being seen as de facto acceptance of the presence of large carnivores). Finally in some locations, Rural Development funds are still seen as largely an agricultural support measure and little support is distributed to other rural actors.

The Platform members clearly have a role in promoting the potential of the Rural Development Programmes to fund coexistence with their members and encouraging them to use the measures that are available. To assist them in awareness raising, the Platform Secretariat produced a leaflet translated into several languages. This is freely available to print from the Platform website to take to events attended by appropriate stakeholders⁵.

In 2017, the Platform members have commissioned the Secretariat to look in more detail at the good practice examples identified.

The most promising examples of joint-working on coexistence have been selected and are being analysed to identify the key success factors for stakeholders working together. The findings are presented in a report available on the Platform website (Hovadas et al., 2017). In 2018, the Platform Secretariat will examine in more detail the gaps in the financing of prevention measures through the EAFRD or national funding.

To keep track of this and other initiatives carried out by the Platform, visit the Platform website.



Photo: Jasna Jeremic.



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⁵ <http://ec.europa.eu/environment/nature/conservation/species/carnivores/communication.htm>

FEDERAL FUNDING FOR LIVESTOCK PROTECTION MEASURES IN SWITZERLAND

Felix Hahn^{1*}, Daniel Mettler², Andreas Schiess², Daniela Hilfiker²

¹ AGRIDEA, Avenue des Jordils, CH- 1006 Lausanne, Switzerland

² AGRIDEA, Eschikon 28, CH- 8315 Lindau, Switzerland

1. Introduction

As large carnivores expand their ranges throughout Europe and recolonize regions from which they had been extirpated, conflicts with farmers are bound to increase. This is especially so in regions where livestock management is no longer adapted to their presence, making livestock very vulnerable to carnivore attacks. In Switzerland, after more than a century of absence, the renewed presence of Eurasian lynx (*Lynx lynx*), brown bears (*Ursus arctos*) and, especially, wolves (*Canis lupus*) has increased the need to implement effective damage prevention measures (Breitenmoser, 1998; FOEN, 2013). According to official estimates provided by the Swiss Federal Office for the Environment (FOEN), in the past 12 years an average of 250 sheep have been killed each year by large carnivores. These are protected by national legislation, and the state compensates the damages they cause and funds the use of damage prevention measures to make them economically viable. Furthermore, the regulation of lynx and wolf populations, foreseen in the legislation if damage reaches a certain threshold, is only possible if the use of adequate damage prevention measures was in place prior to the attacks.

The Swiss Federal Office for the Environment (FOEN) maintains a national livestock protection

programme based at AGRIDEA. In addition to the coordination and further development of livestock protection measures, this programme provides consultation services to farmers and government agencies, the breeding and training of livestock guarding dogs (LGDs) under the responsibility of the association “Livestock Guardian Dogs Switzerland” (a union of breeders and owners of LGDs; for further details see: Pfister and Nienhuis, 2017), as well as financial aid to farmers who implement herd protection measures. The Federal Office for Agriculture (FOAG) supports farmers with incentives for good grazing management. The system of federal contributions to farmers is briefly explained here, but the details of the whole herd protection programme are contained in a Directive by the Federal Government (FOEN, 2016).

2. Damage prevention measures funded

2.1. Livestock guarding dogs

FOEN supports the keeping of LGDs (especially Maremma Sheepdog and Great Pyrenees breeds) deployed under the national herd protection programme, with an annual contribution of 1,200 CHF (\approx 1,030 EUR) (Fig. 1). This sum covers the average expenses an owner incurs for his dog, such as food, veterinary, purchase and other costs. Dogs that have



Fig. 1. The Maremma Sheepdog (above) and the Great Pyrenees (below) breeds are supported by the Swiss Federal Office for the Environment under the national herd protection programme. Photo: AGRIDEA.

* Corresponding author: felix.hahn@agridea.ch

completed basic training are currently sold in Switzerland for 1,200 CHF. However, the everyday work required to manage dogs, which is especially significant in the case of inexperienced new owners or in areas with a high tourist density, is not compensated.

2.2. Summer grazing in mountain pastures

Transhumance (taking livestock to mountain pastures for the summer) is encouraged by financial incentives from the Federal Office for Agriculture (FOAG) in order to support sustainable management of the Alps (prevent overuse of pastures etc.), basically irrespective of any herd protection measures. The only exception is contributions for taking sheep up to mountain pastures by means of the so-called rotational grazing system (fenced pasture enclosures rotating every 2 weeks). Here, the use of LGD is rewarded with a 20% higher FOAG contribution (the equivalent of approximately 13 CHF (\approx 11 EUR) per adult sheep per summer season).

Contrary to FOAG, FOEN supports the use of LGDs in summering areas independent of the grazing system. FOEN compensates farmers with a lump sum for the costs of keeping and monitoring LGDs in summer grazing areas. The yearly funding levels

for the use of a team of at least two dogs per flock differ according to the grazing system: 2,000 CHF (\approx 1,710 EUR) per livestock unit with permanent shepherding as well as for alpine cattle, goats or milk sheep; 500 CHF (\approx 430 EUR) per livestock unit with rotational or permanent pastures. Furthermore, FOEN also compensates 80% of the costs of material to fence hiking trails where LGDs are used, up to a maximum of 2,500 CHF (\approx 2,140 EUR) for a period of five years (Fig. 2). This measure is designed to minimise any potential conflicts between LGDs and hikers, bikers, etc.

2.3. Electric reinforcement of pasture fences

A further measure aimed at herd protection is the electrical reinforcement of pasture fences, and reinforced fences around stables to keep large predators out (Fig. 3). Measures classified as reinforcement are: 1) an external and low-lying stranded wire (at about 15–20 cm above the ground) and an upper additional wire (at about 105–120 cm, electrified, with non-electrified plastic ribbon as a visual barrier, Fig. 4) to increase the height of the net wire fence; 2) the electrified reinforcement of grazing nets (increased height with one or two additional strands at 110–120 cm)



Fig. 2. To prevent conflicts between LGDs and hikers or bikers, FOEN funds the acquisition of material to fence hiking trails. Photo: AGRIDEA.



Fig. 3. Reinforcement of traditional fences around stables, adding one low and one upper electrified wire, is funded by the FOEN to increase herd protection. Photo: AGRIDEA.



Fig. 4. White and blue plastic ribbons on top of electrified fences act as a visual barrier to discourage predators from crossing the fences. Photo: AGRIDEA.



Fig. 5. The reinforcement of electrified grazing nets, by increasing the normal height with one or two additional strands, is also funded by the FOEN. Photo: AGRIDEA.

(Fig. 5). This measure is used in particular in lowland areas, more rarely in mountain pastures. Fencing is recommended in general for relatively small pastures (max. 3–4 ha) where a rotational grazing system is practised.

The farmer is compensated by FOEN for the electrification of fencing systems or up-grading conventional electrified fencing systems to the extent of 80% of the material costs, up to a maximum of 0.70 CHF (\approx 0.60 EUR) per running metre of fence. For the combination of “electrical reinforcement of pasture fences for protection from large predators” plus “difficult maintenance of pasture fences for protection from large predators” (see below) there is a ceiling limit of 5,000 CHF (\approx 4,280 EUR) for a period of five years.

2.4. Night penning in alpine summer grazing areas

Night-time containment of sheep or goats in pens can be an effective measure for herd protection in

alpine grazing areas (Fig. 6). Mostly electrified nets (105 cm high) are used. For big flocks, several “fence-packages” for several night pens can be compensated. FOEN reimburses farmers 80% of the material costs (excluding the energizer) for construction of night pens. Every alpine farm can obtain a maximum contribution of 2,500 CHF for a period of five years.

2.5. Maintenance of fences in difficult terrain

The maintenance and (daily) checking of electric fences for herd protection is extremely problematic in Alpine terrain due to steep, rocky and sometimes dry conditions. Therefore, it is supported. FOEN compensates farmers for expenses related to the difficult maintenance and control of electric fences for herd protection in mountain areas with 0.30 CHF (\approx 0.26 EUR) per running metre of fence per year. Each farm is eligible for the contribution combination “electrical reinforcement of pasture fences as protection from large predators” plus “difficult maintenance of pasture



Fig. 6. Night-time pens can be an effective measure to protect livestock in alpine grazing areas, and the FOEN funds the upgrade of traditional net-wire fences to electrified nets. Photo: AGRIDEA.

fences for protection from large predators”. There is a ceiling limit per farm of 5,000 CHF for a period of five years.

2.6. Protection of beehive and apiaries

FOEN supports beekeepers in the installation of electric fencing around beehives and apiaries in areas with potential occurrence of brown bears in the cantons of Graubünden and Ticino (Fig. 7). The beekeeper is subsidised with a lump sum of 700 CHF (\approx 600 EUR) per site for expenses related to the fencing of a beehive or apiary. This includes the cost of the fencing material and electrification. The estimated life-time of equipment is generally estimated at 7 years. So the beekeeper can ask for another payment after 7 years.

2.7. Other prevention measures

If cantons wish to support farmers in taking protection measures other than dogs or fences, they may apply to FOEN for funds (up to a maximum of 80%

of the effective material costs), but must be able to demonstrate the usefulness of the measures chosen in their local context. Deterrent measures for herd protection such as the use of flashing lights, as well as llamas or donkeys as guard animals, are not directly subsidised by the Federal Government. Donkeys and llamas are used especially for small predators such as foxes or stray dogs. For these unprotected species, prevention measures are not subsidised. Flashing lights and other deterrents are not subsidised because their effect is only considered efficient for a short “emergency” period.

2.8. Emergency kits

The unpredictable appearance of dispersing large predators can lead to the need for emergency herd protection, which takes the form of immediate fencing of livestock at risk (for example, emergency night pens in summering areas). For such emergency situations, FOEN provides cantons with a corresponding number of emergency kits for herd protection.

FOEN covers the cost of such emergency kits up to the amount of 4,000 CHF per kit (\approx 3,420 EUR). The service life of the equipment is generally estimated at five years. Since 2015 foxlights (Fig. 8) are also financed by this measure since they should be used only for short periods and in emergency cases.

3. Damage compensation

When it is confirmed by an experienced wildlife ranger or by DNA analysis (performed in a certified laboratory) that livestock have been killed by large predators, the Federal Government Confederation and the cantons usually compensate the farmers concerned, irrespective of whether they have taken herd protection measures or not (the compensation amount is currently based on the market and breed reference value of the Swiss breeding associations). This regulation is currently being reconsidered in various cantons to ensure that livestock are compensated only when preventive measures have been taken. On the one hand, this would entail a considerable administrative effort regarding the official clarification of each herd protection measure linked to the damage. On the other hand, this would also increase the incentive for livestock owners to take protective measures. This problem is linked to the fact that the risk of damage by predation is still quite low in some regions. Because

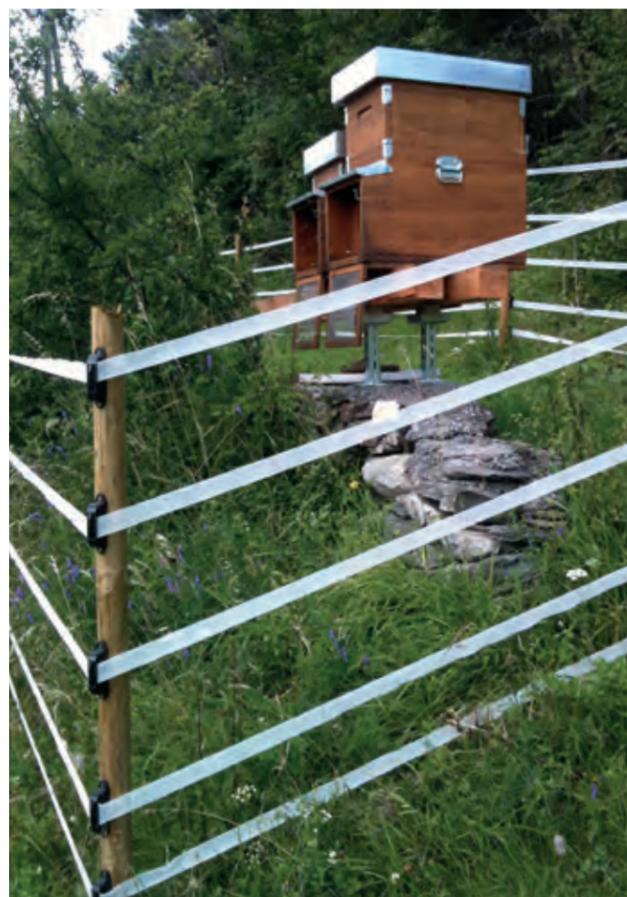


Fig. 7. Beekeepers are also subsidized by the FOEN to install electric fences around beehives to prevent damages from brown bears. Photo: AGRIDEA.



Fig. 8. Foxlights are subsidized to prevent damages during short periods, as part of the emergency kits provided by FOEN to cantons. Photo: AGRIDEA.

se of this risk evaluation the farmers may accept some damages which are financially compensated instead of taking preventive measures.

4. Final considerations

It is important that livestock owners are not left alone with their problems caused by large predators, and also that they receive financial support. Subsidies provided by the FOEN since 2003 for supporting the use of LGDs total 2,843,800 CHF (\approx 2,430,000 EUR). Subsidies for improving and implementing the use of fences, as well as foxlights, total 510,332 CHF (\approx 436,000 EUR) (Fig. 9).

However, experience has shown that the implementation of herd protection measures is usually less influenced by the level of funding than by other fac-

tors, in particular the level of motivation of the farmer to engage in what for him is a tiresome subject: herd protection, which is often equated with the acceptance of large predators (see Mettler and Hilfiker, 2017). In addition, comprehensive advice and support by proven experts from the agricultural environment are key for the long-term successful implementation of herd protection measures. The amount contributed is, of course, particularly important where farmers and alpine shepherds are short of resources (working time and money). In such cases one-off financial support from NGOs, or project funds for the expensive, but necessary, adaptation of the grazing system or to renovate shepherding shelters, as well as work assignments (for example, the installation of protective fences by volunteers or persons doing community service) can be of great help.

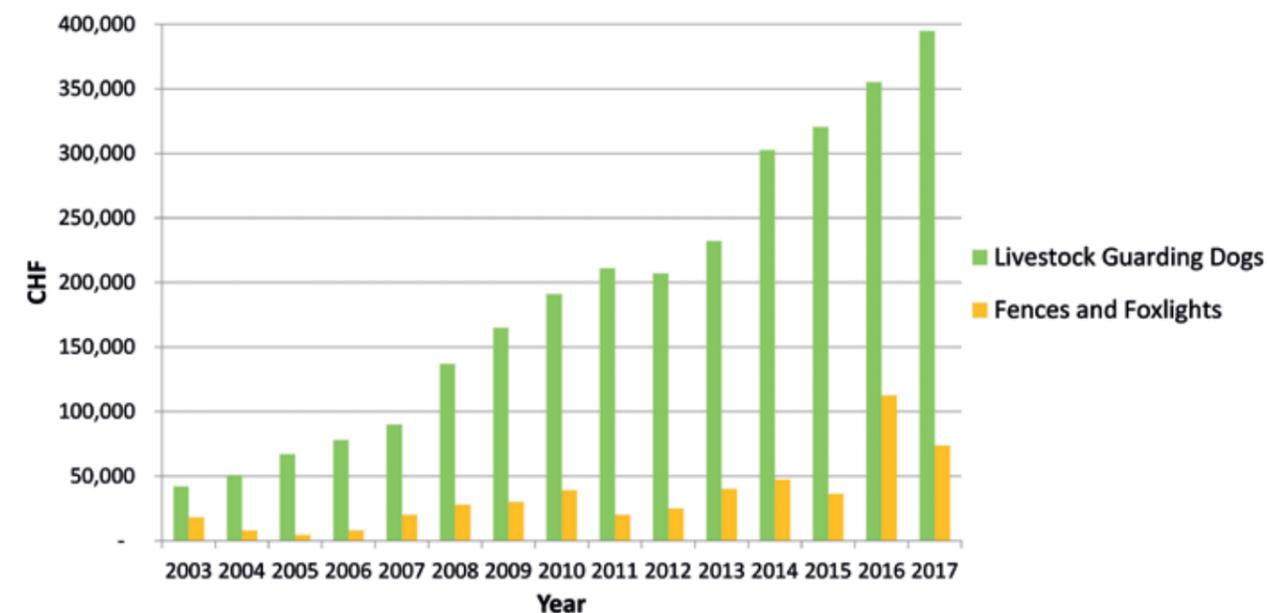


Fig. 9. Annual subsidies paid by the FOEN for LGDs and for fences and foxlights.

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“I NO LONGER FEEL ALONE”:

INTRODUCING A DECISION MODELLING APPROACH TO ADDRESSING WOLF CONFLICTS IN ITALY

Juliette Claire Young^{1*}, Stephen Mark Redpath², Paolo Ciucci³, Agnese Marino^{4,5,6}, Simone Ricci⁴, Valeria Salvatori⁴

¹ NERC Centre for Ecology and Hydrology, Bush Estate, Edinburgh EH26 0QB, UK

² IBES, Zoology Building, University of Aberdeen, Tillydrone Av., Aberdeen AB24 2TZ, UK

³ Department of Biology and Biotechnologies, University of Rome La Sapienza, Roma 00185, Italy

⁴ Istituto di Ecologia Applicata, Via B. Eustachio 10, 00161 Roma, Italy

⁵ Institute of Zoology, Regent's Park, London NW1 4RY, UK

⁶ University College London, London WC1E 6BT, UK

1. Background to a multi-dimensional conflict

The persecution of wolves in Italy reduced their numbers to fewer than 100 individuals in the 1970s (Zimen and Boitani, 1975). A combination of national and European legislation protecting wolves, urbanisation and abandonment of rural areas, and the increase of wild prey led to an increase in the wolf population in the 1980s and recolonization of areas from which it had disappeared or remained at very low densities, such as the Grosseto Province of Tuscany (Boitani and Ciucci, 1993). Grosseto has a strong economic focus on agricultural production and a tradition of free-ranging livestock breeding and rearing (Pacciani, 2003). The high quality of local products has resulted in many of its dairy products gaining the Protected Denomination of Origin (PDO) designation.

Whilst the main prey of wolves in the area are roe deer (*Capreolus capreolus*) and wild boar (*Sus scrofa*), livestock represents a secondary item in their

diet (Bargagli, 2006). The impact of wolves on sheep may be compounded in the Province by the fact that, following the initial extermination of wolves, many local livestock owners lost the knowledge and implementation of traditional husbandry practices that had alleviated the impacts of wolves on livestock in the past (Fritts et al., 2003; Gazzola et al., 2008; Naughton-Treves et al., 2003). Whilst ex-post direct compensation is provided regionally, a recent study suggests that such a scheme, applied through different management solutions, has not been successful in mitigating the levels of discontent among livestock raisers suffering losses (Marino et al., 2016), and claims for damage compensation continue to be forwarded to the Regional administration while the conflict among different sectors of the society is often represented in the local press. For some, the expansion in the numbers and range of wolves can be perceived as a conservation success. However, not everyone shares this perception. As a consequence, the impact of wolves on economic activities in the area has led



Sheep milk production and transformation has a high economic importance in Grosseto. Photos: Luisa Vielmi.

to an intense conflict, resulting in retaliatory killing of wolves and social tension around wolf management (Marino et al., 2016).

As part of the LIFE MEDWOLF Project (www.medwolf.eu), and following a process of trust-building with all relevant local stakeholders, an approach was taken to promote social debate around wolf management in the Grosseto Province, encouraging key stakeholders to discuss the main issues around wolf conservation openly, before jointly identifying management approaches that could be implemented by local decision-makers.



The Italian wolf is endangered and protected in Italy. Photo: Mauro Rotisciani.

2. Methodological approach

The approach used was Multi-Criteria Decision Analysis (MCDA), a step-wise decision support tool whose aim is to evaluate management options based on multiple objectives (for a complete overview of the MCDA process, see Davies et al., 2013). The expectation of participatory MCDA processes is that they bring groups with competing interests and world-views together with the objective of sharing understanding and openly discussing difficult and complex issues – such as conservation conflicts.

The LIFE MEDWOLF team approached the MCDA through a series of three workshops (following the methodology set out in Redpath et al., 2004). In brief, the methodology comprises seven steps: 1) establish context and identify participants; 2) define criteria; 3) rank and weight criteria; 4) define management options; 5) score management options against criteria; 6) multi-criteria evaluation; and 7) deliberate options based on results.

In the first workshop, held during one day in May 2017 in Grosseto, a total of 15 experts and managers involved in local wolf management helped to define the main ecological, economic and social criteria relevant to wolf management in the Grosseto Province, with the support of a professional facilitator (step 2 of the methodology above). The criteria were related to the following factors:

*Corresponding author: j.young@ceh.ac.uk

- i) Economic – e.g. work opportunities/livestock owners' income, work opportunities/commercial trade of livestock products – not tied with tourism, work opportunities/income from tourism sector;
- ii) Social – e.g. local traditions, relationships between stakeholder groups;
- iii) Knowledge about wolves;
- iv) Importance of biodiversity (existence value);
- v) Wolves as a danger to humans and properties;
- vi) Landscape – e.g. landscape composition, aesthetics;
- vii) Ecological – e.g. trophic ecology, interactions with wild prey, genetic identity, density of wolves, other predators;
- viii) Animal welfare;
- ix) Political/administrative – e.g. efficacy of legislation, acceptability of policies.

The second two-day workshop, held in May 2017 in Grosseto and moderated by the same professional facilitator, convened 15 individuals from various sectors (livestock owners, environmentalists, animal rights activists, recreationalists, hunters) with strong and potential conflicting views on wolf management to rank and weight the criteria identified in the first workshop and to jointly define management options (steps 2–4 of the methodology). Participants were selected in an opportunistic manner and in a totally experimental approach, to test the applicability of the

methodology in Grosseto. In order to keep the group at a manageable size and to ensure productive discussions, a set of three participants per sector were invited and selected through informal channels: people known to have strong opinions but willing to discuss and listen to others.

3. A process for debate

The literature on conflict refers to the potential for conflicts to increase democratic legitimacy and public trust in politics and decision-making, thereby framing conflict management as the creation of a process where people can share their opinions on conservation and better understand different values, attitudes



Photos: Luisa Vielmi.



and goals and the potential to seek shared solutions to conflicts (Young et al., 2012; 2016). In addition, much of the debate in the conflict literature has pointed to the need to engage with stakeholders in the conflict, based on critiques of traditional top-down approaches to conflicts, including those around large carnivores (Redpath et al., 2017; Mishra et al., 2017). The MCDA process implemented in Grosseto aimed to bring together actors in the conflicts with very different and often conflicting views on wolves and their conservation, and encourage initial dialogue and debate from grass-roots up as part of a longer process of conflict management.

At the beginning of the workshop, all participants were asked to set out their expectations. Although one hunter was sceptical about progressing simply by bringing together environmentalists, hunters and livestock owners, all the hunters acknowledged the need to find a common solution, potentially leading to co-existence between wolves and people. One hunter also voiced the need for increased knowledge on the situation – not only to better guide the role of hunters in the conflict: “Can the environment be managed, and what can hunters do?” but also to raise awareness more broadly about the conflict – an issue also raised by the environmentalist.

During the opening session of the workshop, when participants voiced their expectations, there was already a high level of openness exhibited by participants. The environmentalist, for example, acknowledged that the workshop would be a “personal challenge, because sitting with hunters is the opposite of what my association represents”. Similarly, one of the livestock owners admitted that he needed “to exchange ideas with the other stakeholders because livestock owners feel they have been abandoned [...] We feel we are alone in dealing with the problem”.

Perhaps because of this openness, the dialogue and debate during the workshop was dynamic and inclusive, albeit at times heated. A number of issues sparked lively debate, in particular the management of wolf-dog hybrids, the potential loss of PDO accreditation due to wolves having an impact on farming practices and the symbolic value of the wolf and its representation through the media. The process of the MCDA allowed participants to cover the areas they perceived as being critical to the wolf management issue through a number of different outlets – including thematic outlets (discussion of the criteria, discussion of the management option), but also procedurally through plenaries and smaller working groups.

4. Management options

By the end of the second day, a set of five management options were identified and agreed on by the group. The management options identified by the group are not necessarily options that all participants support, but rather best summarize the shared views on factors that most characterize the conflict. The management options identified included:

1. Efficient damage prevention;
2. Satisfactory damage compensation;
3. Effective management of the wolf and other predators – e.g. wolf-dog hybrids (through either lethal or non-lethal measures);
4. Higher levels of poaching control through enhanced rule enforcement and anti-poaching patrols;
5. Incentives to either limit or promote livestock raising activities and rural development in general.

Participants also identified a number of transversal elements, such as research, monitoring, communication and funding that were felt to be essential to ensure the success of any management option. In the following workshop, the management options that reached higher consensus from across the different stakeholders were the first two, while in principle the management of predators is supported, the way it will be implemented will require further debate. Such encouraging results were presented to a wider audience during the final project symposium held in Grosseto on 9th November 2017.

When asked whether their expectations from the workshop had been met, the response from participants was positive. Most participants highlighted that their expectations had in fact been surpassed, and all of them stated they were willing to be involved in a longer-term participatory process if it would lead to some concrete solution. One of the benefits of the workshop was that it was “different from when I meet with other hunters because it allowed me to listen to other perspectives. It’s interesting to hear people speaking from a scientific perspective, from an emotional perspective, because that is how we progress on this issue”. The perception of the process having allowed them to listen to others was repeated by the other participants who said that they were “surprised with our result, and how environmentalists acted, as I expected a different behaviour from them”. This led one participant



Stakeholder discussion during the MCDA workshop in Grosseto. Photos: Juliette Young.

to say he was “looking forward to coming back, with less prejudice”. In addition to being surprised by the views of others, there was also a recognition of commonalities (albeit unlinked to wolf management...): “I’m sorry if sometimes I disagreed with [the animal right group representative] – but we have something in common, we both like wine!”

There was an acknowledgement that such an exercise can be demanding and emotional. One participant highlighted that, whilst her point of view had been emotional, “I think contributing with emotions is good. I felt everybody is also emotionally involved”. This highlighted again the openness witnessed at the start of the workshop. Perhaps the most positive response to the workshop was from the livestock owner, who summarised the outcomes of the workshop as follows: “I no longer feel alone. I realise we share ideas, we got to a joint understanding. This was the first time I took part in such an event and this method really helps you to express what you think. It helps you talk about things with regards to what other people think. I discovered new things, new points of view, and am completely satisfied, even if it was tiring!” All participants called for dissemination and sharing of the work they had done over the two days and for action to follow the work done in the workshop.

Following on from this process, which is long-term and ongoing, the next steps will be:

- i) Raising funds for more structured identification of first level and second level stakeholders;
- ii) Involving larger groups from different sectors, including the Regional administration, which has expressed high interest in the process.

5. Lessons learned for MCDA processes

Although the above approach has been developed at a small local scale, the potential for such a participatory approach could be considered with larger groups, in other regions and contexts where a species is protected and expanding in numbers, causing negative impacts on economic activities. This was identified early on by participants as a desired outcome of the process and repeated at the end of the workshop, with one participant stressing “it should be the starting point to something bigger”.

The approach was implemented in an area where the project team had invested effort in building trust with local stakeholders through collaboration and involvement in LIFE MEDWOLF activities. We suspect that this was essential not only in creating an environment in which stakeholders could debate and share information and views, but also for the selection of stakeholders attending the workshop. The organisers took great care in inviting individuals who they knew held strong views and represented the views of others, but could also clearly put forward these views and be constructive. Such knowledge of individuals takes time to gather, which should not be underestimated. The result in this case was a group who, whilst vocal, was still able to engage in the process.

The workshops were also carried out following the realisation from the stakeholders themselves that the conflict was complex, revolved around social dimensions, not easily resolved through the implementation of technical fixes or increased research. There was a sense among stakeholders that something needed to be done, but not just anything. The stakeholders had

obviously already tried a number of technical tools (e.g. fences, livestock guarding dogs), but realised that the conflict went deeper than the implementation of such approaches. This led to a situation in which stakeholders took ownership of their problem.

A key aspect that impacted on the success of this workshop was professional facilitation. Whilst this may be seen as a given, it is not always implemented. Often, scientists involved in a conflict will take it upon themselves to lead such processes, without acknowledging that they themselves are a stakeholder. Having a professional facilitator, perceived as being independent (although not necessarily neutral), can help ensure that all stakeholders can express their views and can encourage fair processes in which stakeholders feel they have a say. In addition, the facilitator was knowledgeable about the local culture – another important aspect to consider, not only in terms of understanding the pers-

pectives of stakeholders but also in terms of managing the process in a culturally sensitive manner.

Finally, the workshops also allowed sufficient time for informal interactions, not only during the breaks but also through the smaller group interactions. By the end of the two days, group members clearly knew each other far better and were less formal than when they first met, allowing certain barriers to be reduced. Whether this leads to a reduction in conflict remains to be seen. To conclude, these workshops are the start of a long process, and an effort will be made to obtain further funds to continue the process with the direct involvement of Regional administrators. Whilst progress seems encouraging so far, there is a need in all MCDA processes to include a more long-term formal evaluation that can assess the process and outcomes, including an understanding of how these processes affect behaviour.

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ARE INSTITUTIONAL INTERVENTIONS EFFECTIVE IN MITIGATING HUMAN-FELID CONFLICT? A CASE STUDY IN NORTHERN COSTA RICA

Margarita Gil-Fernández^{1*}, Juan Luis Peña-Mondragón², Sergio Escobar-Lasso^{1,3}, Herson Ramírez¹, Eduardo Carrillo-Jiménez¹

¹ International Institute of Conservation and Wildlife Management, National University of Costa Rica, Campus Omar Dengo, Heredia, Costa Rica. Avenue 1, Street 9. Zip code: 86-3000

² National School of Superior Studies Campus Morelia (ENES), UNAM-Campus Morelia, Old road to Patzcuaro 8701, col. La Huerta, Morelia, Michoacan, Zip-code: 58190, Mexico

³ Fundación R.A.N.A (Restauración de Ambientes Neotropicales Alterados), Manizales, Caldas, Colombia

1. Introduction

Local benefits of the presence of large carnivores are not always understood by the coexisting human communities. Unfortunately, the negative outcomes of the presence of large carnivores, such as economic and psychological impacts, are widely perceived. These negative interactions result in human-wildlife conflict (Inskip and Zimmermann, 2009). Retaliatory killing in response to conflicts is one of the most important threats to many large carnivores, particularly felids (Ripple et al., 2014).

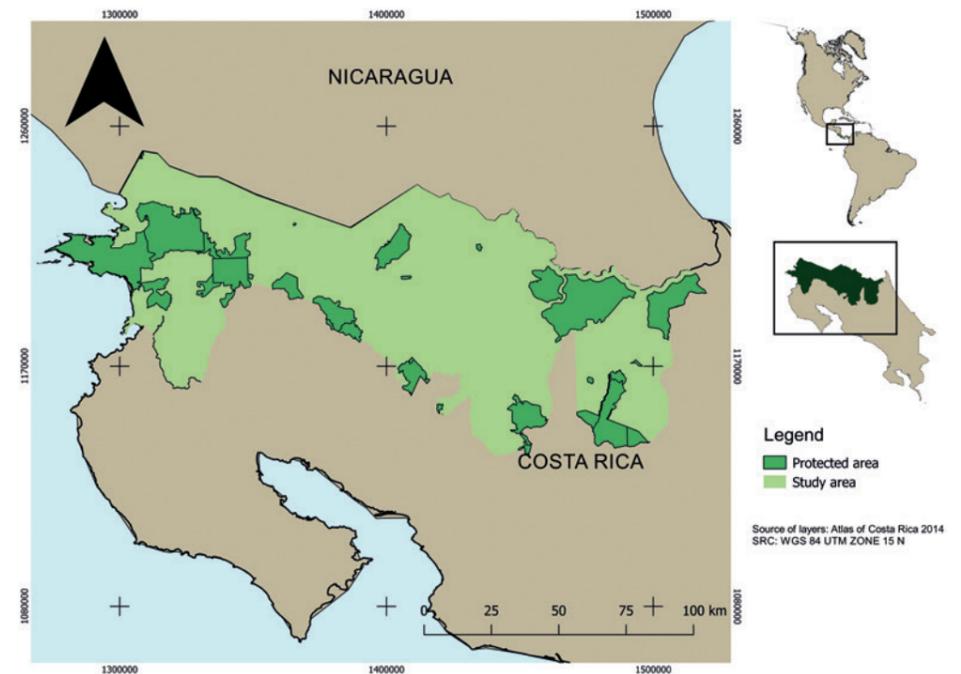
Livestock husbandry methods have a great influence on predation (Peña-Mondragón et al., 2016) and in most cases appropriate practices can reduce felid predation significantly (Distefano, 2005). There is a considerable literature about measures to reduce predation (e.g. Amit et al., 2009; Azuara et al., 2010; Hoogsteijn and Hoogsteijn, 2011). Nevertheless, preventive measures are not always applied or evaluated adequately (Dickman et al., 2011; Eklund et al., 2017).

Besides technical solutions, an essential component of conflict mitigation is addressing human attitudes to-

ward coexistence with carnivores (Carter et al., 2014). Attitude can be defined as a mental structure based on cognitive and affective components that affect our evaluation of attitude objects (Eriksson et al., 2015). This evaluation can be positive or negative. Undeniably, a change of attitudes is needed to increase tolerance towards large carnivores (Thorn et al., 2015). As attitudes and perceptions are constructed solidly over values, beliefs, education, religion and economic status it is difficult to change them (Inskip and Zimmermann, 2009). Few intervention strategies have been scientifically proven (Inskip and Zimmermann, 2009).

The aim of this paper is to evaluate the intervention of institutions in human-felid conflict in northern Costa Rica and its relation to ranchers' attitudes towards two native felids, the cougar (*Puma concolor*) and the jaguar (*Panthera onca*), and to evaluate the effectiveness of preventive measures from the ranchers' point of view. In Costa Rica, the assumption that technical assistance may improve attitudes towards felids has not been fully validated. As we are dealing with a dynamic process, evaluation of attitudinal change and the perceptions of people involved in the conflict must be continuous.

Fig. 1. Location of the study area, comprising most of Chorotega and Huetar Norte regions of Costa Rica, with fourteen protected areas.



2. Study area

The Chorotega and Huetar Norte regions of northern Costa Rica comprise around 22,413 km² and form a continuous block from the Pacific coast to the interior (Fig. 1). Huetar Norte is the most important region in the country for livestock productivity, with a total of 12,055 ranches registered in 2013 and around 91,973 head of cattle (Madrigal and Fallas, 2013). The Chorotega region has 7,210 ranches with approximately 79,143 head of cattle (Madrigal and Fallas, 2013).

There are two large carnivores in the study area: the jaguar and the cougar. The jaguar is the largest felid in the Americas (Fig. 2A). Its distribution extends from northern Mexico to northern Argentina. At the international level, the jaguar is listed by the IUCN as Near Threatened (Caso et al., 2008). The cougar (Fig. 2B) is found from the centre of Canada

to southern Argentina and Chile. It is one of the most widely-distributed mammals in the Western Hemisphere and it is listed as Least Concern (Nielsen et al. 2015). These species also coexist with smaller carnivores such as coyote (*Canis latrans*), ocelot (*Leopardus pardalis*), margay (*L. wiedii*), jaguarundi (*Herpailurus yagouaroundi*) and others.

In Costa Rica, felid attacks on livestock have been recorded throughout the country (Fig. 3). Economic losses in 1991–1998 totalled 60,000 USD (54,081 EUR), and 21 jaguars were poached in the same period (Saenz and Carrillo, 2002). The most affected areas of the country are found in the north (Amit et al., 2009). Furthermore, an annual rate of 15.9 felid attacks per year was estimated for the sector of San Cristóbal, in the Guanacaste Province (Amit, 2006), which is inside our study area.

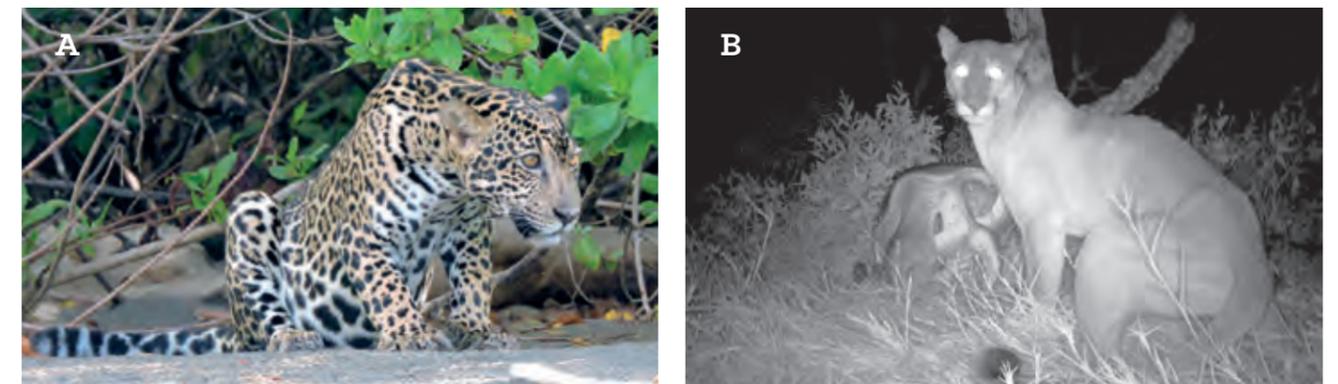


Fig. 2. Large felid predators of the study area. A) Jaguar (*Panthera onca*), B) Cougar (*Puma concolor*). Both pictures were taken in the study area, in Santa Rosa National Park, Chorotega Region, Costa Rica. Photos: Sergio Escobar-Lasso.

*Corresponding author: mgilfedz@gmail.com



Fig. 3. Mule injured by jaguar (*Panthera onca*) at the Península de Santa Elena, in northern Costa Rica, May 2017. Photo: Eduardo Carrillo.

3. Materials and Methods

3.1. Sampling and interviews

We gathered data on conflicts and attitudes using a semi-structured interview protocol. A total of 153 ranchers were interviewed in 2015. Ranchers were contacted from a database of people who had previously experienced felid attacks provided by the Programa Jaguar research group at the Universidad Nacional de Costa Rica. This included information from Ronit Amit, Carolina Sáenz-Bolaños and Francisco Morazán-Fernández. From this database, all functional phone numbers were used. Additional ranchers were contacted at livestock auctions. Furthermore, we made a random selection from the ranchers' telephone database of the National Service of Animal Health (SENASA). We applied the snowball method to reach more ranchers with felid problems.

The structure of the interview was based on a psychometric test of attitudes towards tigers (Thorn et al., 2015, Appendix). The interview considered three main topics: coexistence with big cats, illegal killing and perceptions of institutions responsible for addressing conflicts. Interviews were conducted as an open conversation, leaving space for ranchers to answer freely (Peña-Mondragón et al., 2016). They were carried out either face-to-face at livestock auctions (13.1%) or by telephone (86.9%). Most of the interviews were conducted by Margarita Gil-Fernández (96.7%). The rest of the interviews were carried out by two women with previous experience who worked in the research group. We did not record interviews to reduce mistrust from the ranchers. During the interview brief notes were written, and completed afterwards. Since the interviews were conducted as conversations, their duration was highly variable, from 20 to 80 minutes.

3.2. Institutions and type of institutional intervention

The institutions considered in this research are:

- Programa Jaguar - which has given technical assistance since 2011;
- UACFel, Unit of Attention to Conflict with Felids - an agreement between the NGO Panthera and the Ministry of Environment and Energy of Costa Rica (MINAE), which has responded to reports of felid attacks since 2013, giving technical assistance and partial economic resources for the implementation of preventive measures;
- Las Pumas Rescue Center - occasionally responds to reports and gives general information;
- Gente y Fauna - which has conducted interviews and workshops since 2015.

Owing to the variable types of intervention, we put ranchers into five groups according to the level of institutional intervention they received:

- no attacks by felids at the ranch (44 ranchers);
- no damage reported to institutions and no intervention (58 ranchers);
- no institutional response to reported felid attacks (18 ranchers);
- moderate intervention from institutions (only interviews or visits) (13 ranchers);
- complete intervention of institutions (workshop, technical assistance) (20 ranchers).

Groups 2 and 3 were distinguished because ranchers in group 3 were expecting an answer from the institutions in response to a reported felid attack but were ignored, whereas ranchers in group 2 never reported attacks to institutions. In contrast, those in group 5 attended workshops which included detailed explanations of the felid attack protocol and information about preventive measures.

3.3. *In vivo* codes analysis of attitudes towards big cats

We created a series of *in vivo* codes to analyse the information of the interviews. This consisted of a line-by-line reading of the transcript information to identify the ideas related to the research objective. Each code represents an idea related to the research topic. These codes were modified during the analysis to better reflect the content of the interviews. A network of codes was developed in relation to attitudes toward felids and a narrative was constructed based on these relations.

We included a network of codes related to perceptions of the institutions dealing with conflict. Perceptions of institutions were classified as positive or negative. The number of phrases and individuals who mentioned them were used to assess the importance of each code.

3.4. Comparative analysis of intervention and attitudes toward felids

All interviews were analysed with Atlas.ti, version 7 (Friese, 2013). To examine the relationship between perceptions of institutions and their levels of intervention, three categories were created: 1) coexistence with big cats; 2) elimination of big cats; and 3) perception about institutions. The number of positive and negative phrases was quantified to allow comparison among the five levels of intervention.

3.5. Analysis of the efficacy of preventive measures

A series of *in vivo* codes was created to understand perceptions of preventive measures. In addition, a comparison of the percentage of application of preventive measures by the level of institutional intervention was

made. To compare the efficacy of preventive measures they were grouped into three categories: 1) livestock management practices, including changing livestock areas and use of enclosures; 2) felid deterrence by loud noises, bells, and livestock guardian dogs; 3) illegal retaliatory killing of felids by ranchers. A contingency table was used to compare the categories of measures and their effectiveness.

4. Results

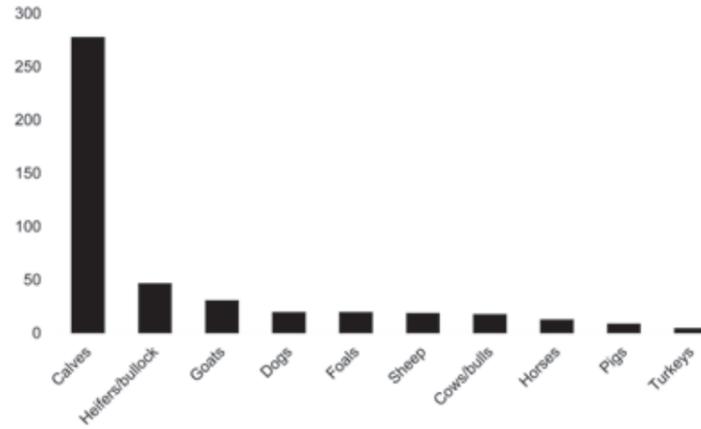
4.1. Sample and farm characteristics and predatory impact

Almost all the 153 interviewees were men (92.8%). Most of them applied primarily extensive livestock husbandry (75.8%), although a few maintained livestock in rotative extensive husbandry (5.2%), semi-enclosures (9.2%) or enclosures (2%). There was no information available for the remaining 7.8%. In rotative extensive husbandry, there were several divisions in the ranch and livestock was moved among them from time to time (Fig. 4B). In semi-enclosures, livestock was not permanently locked in the pen but moved freely in and out (Fig. 4C).



Fig. 4. Husbandry practice among the interviewees. A) Extensive livestock husbandry, B) Rotative extensive husbandry, C) Semi-enclosure husbandry, and D) Enclosure husbandry. Photos: Margarita Gil-Fernández.

Fig. 5. Number of domestic animals reported killed by large felids by 103 ranchers during interviews in 2015.



Twenty percent of ranchers had suffered an attack by felids on their livestock within the last year, 30% 1–2 years before the interview and 18.9% more than 3 years before the interview, with a maximum of 15 years before. Only the attacks of the Programa Jaguar database had been assessed to confirm the kill and the species responsible (40.5% of the interviews).

A total of 580 felid kills of domestic animals (excluding missing animals) were reported by 103 ranchers. Unfortunately, the complete time period over which these losses occurred is unknown because we only asked the date of the most recent loss. Of the total losses, 460 were identified by domestic species and age (Fig. 5). Most of the reported losses (60.4%) were of calves.

4.2. In vivo codes analysis of attitudes towards felids

In the following text, the percentage of people supporting each idea is shown in parentheses. Many ranchers considered felids to be pests (because of their abundance and predatory behaviour), in some cases, they thought problematic felids needed to be controlled by elimination (31%). People mentioned that killing felids was the main solution to the problem or the most practical (10%). The second reason to kill felids was the lack of support from institutions (5%). The least mentioned reason for elimination of felids was killing for amusement (1%).

Some respondents mentioned that coexistence would be possible mainly without human hunting of wild prey (20%). These ranchers mentioned that hunting makes natural prey scarce, inducing felids to kill livestock. For some, tolerance is imperative to allow coexistence (12%), while others said that coexistence is possible without livestock damage (7%).

The strongest reason to support coexistence was the intrinsic value of felids (14%). Felids were appreciated by a minority of ranchers for their important ecological role, which includes the regulation of wild herbivores or mesocarnivores such as coyotes (8%).

Also, felids were perceived as being good for tourism (4%). Finally, it was mentioned that felids are an endangered species (1%). Some people mentioned coexisting with felids without major problems (5%).

4.3. Analysis of attitudes towards institutions

Perceptions of institutions were mostly negative, with 47% of ranchers using 89% negative phrases (Fig. 6). Negative phrases fell into three main categories: i) institutions have no credibility (26%); ii) they provide bad assistance (18%); or iii) there is a lack of information (16%). Some respondents thought that institutions imprison those who harm felids (5%) while others mentioned that they release felids near ranches (5%), and some do not have information about institutions in charge (5%).

Only 8% of the statements about institutions were positive. People mentioned that they were a good option in case of attacks (3%), and showed interest in the conflict (2%). A minority mentioned that the response to reported depredation was satisfactory (3%).

4.4. Comparative analysis of intervention

The group using a higher percentage of phrases in favour of killing felids was the group that did not receive an answer when reporting felid attacks (100%) (Fig. 7). On the contrary, the groups least supportive of elimination were those who had attacks but never reported them (55.6%). Ranchers reporting moderate intervention and complete intervention used 53.8% and 33.3% of phrases against elimination, respectively.

The group with more phrases in favour of coexistence contained people with no intervention by institutions (68%) (Fig. 7). In contrast, the group with the lowest percentage of pro-coexistence phrases was that which received no response to damage reports (38.1%). The groups with moderate and complete intervention each used 50% of phrases in favour of coexistence.

Ranchers with the most negative positions toward institutions were those who had received no response or

no intervention from the institutions (100%) (Fig. 7). However, even people with the highest level of intervention had a marked negative perception of institutions (73.3%).

4.5. Analysis of the efficacy of preventive measures

Two thirds of ranchers (69.3%) said they applied measures to prevent felid attacks on livestock. The group with the highest application of preventive measures were ranchers who received moderate institutional intervention: 84.6% of them applied at least one measure to prevent felid attacks on cattle. On the other hand, the group with the lowest percentage of preventive measure usage were ranchers without felid attacks, where only 56% used preventive measures. Regarding the ranchers who did not receive a response from institutions, 58.8% used preventive measures.

The most common category of preventive measure was a change in management practices. Forty percent of interviewees applied management measures including calf enclosures, night enclosures, moving livestock away from the forest and fencing. Deterrent measures such as fireworks, fladry lines, vigilance, bell collars, light installation, fire and guardian dogs were used by 17.6% of ranchers. A combination of management and deterrent measures was used in 11.8% of cases.

A large majority (83%) of interviewees who applied preventive measures perceived them to be effective. Deterrent measures were effective for 92% of ranchers and livestock management practices for 77% (Table 1). Seven ranchers (4.6%) admitted having practiced retaliatory killing of felids, and 42 (27.5%) mentioned that they had heard of or observed retaliatory killing.

Perception of preventive measures were categorized into eight main codes (Fig. 8). Most of the respondents considered measures to be ‘successful’ (26%). However, another frequently mentioned code (more phrases) was that measures are not applicable (19%). The latter was subdivided into three explanations: measures are

Codes related to attitude towards felids in northern Costa Rica

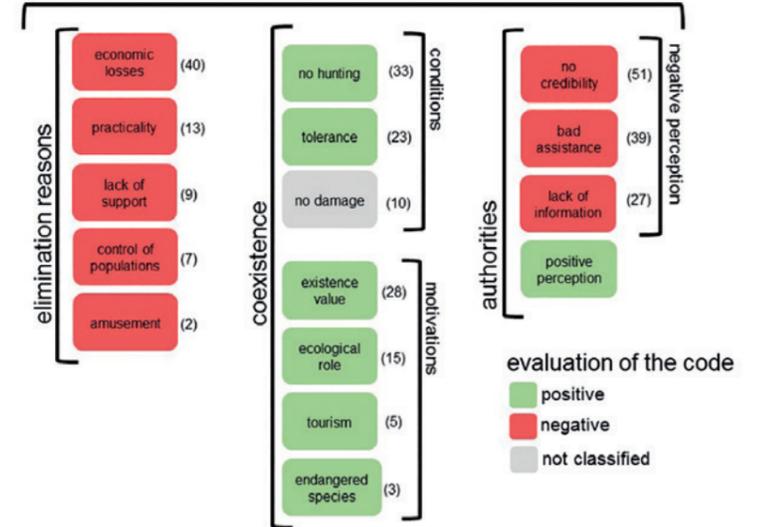


Fig. 6. Codes used to classify statements made by ranchers in northern Costa Rica to evaluate their attitudes towards large felids and management institutions. The number of phrases for each code is shown in parentheses.

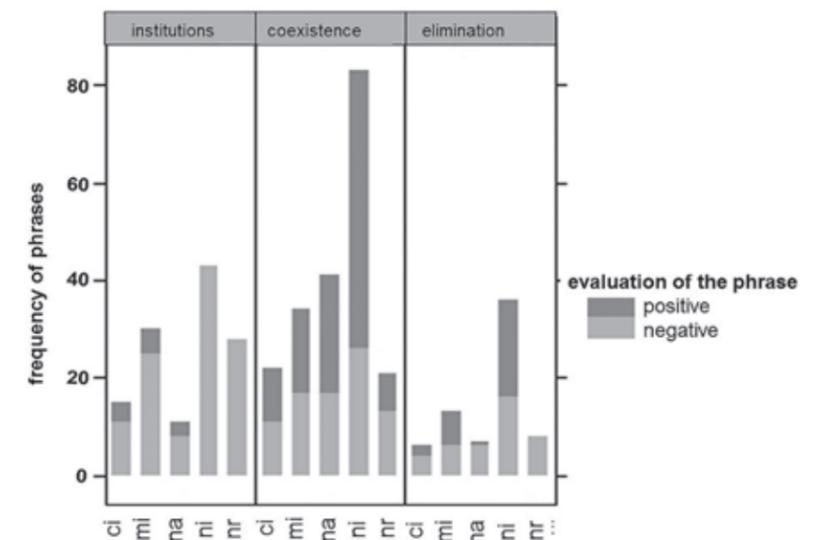


Fig. 7. Number of positive and negative phrases in each evaluated category concerning human-felid conflict in northern Costa Rica. The x-axis shows the level of intervention of institutions in case of reported attacks by felids on livestock: ci=complete intervention (workshop, technical assistance), mi=moderate intervention (interviews, visits), na=no attacks reported, ni=no intervention, and nr=no response.

not practical (13%), are expensive (5%) or cause other problems (1%). Among those who had used such measures, some respondents had doubts about their success (12%), attributing the lack of attacks to the absence of felids in the area due to their high mobility (9%).

Preventive measures were reported to have failed at some ranches (12%). This was said to be primarily because felids learnt how to avoid them (9%). A small

Table 1. Perceived effectiveness of measures used to prevent felid predation on livestock in northern Costa Rica.

Category of measure	n	Reported percentage of success		
		successful	uncertain	unsuccessful
Management practices	61	77	16.4	6.6
Felid deterrence	27	92	0	8
Combination*	18	88.2	0	11.8
All non-lethal measures	106	83	9.7	7.3

* Use of livestock management practices and felid deterrence at the same time.

minority of ranchers who used livestock guardian dogs reported that felids were not deterred by them and that they could even eat such dogs (3%). A group of ranchers had not used preventive measures but believed them to be ineffective, which is an *a priori* negative perception (5%). Another group believed that measures could be efficient, but have not tried them yet (3%). Some mentioned that they would use such measures only if they had an attack (6%). Finally, some individuals did not know anything about preventive measures (9%).

5. Discussion

Historically, management of carnivores worldwide has been characterised by attempts to eradicate them followed by tolerance of remaining low populations. In fact, this situation is common throughout the range of big cats (Peña-Mondragón et al., 2016). In our study, only seven ranchers admitted having killed felids, but 27.5% of respondents had seen or

heard about illegal killing. Similarly, in the Brazilian Pantanal at least 33% of ranchers still use killing as a preventive measure (Boulhosa and Azevedo, 2014). Nevertheless, retaliatory killing is not easy to assess due to its illegal and therefore clandestine nature (Liberg et al., 2011).

Coexistence is possible and even desirable, as has been proven in several contexts (Dorresteijn et al., 2014). According to our results, felids are appreciated for their ecological function and because they are threatened with extinction. The possible touristic value of felids was also mentioned, thanks to which perceptions towards carnivores may improve, as has been observed in other regions (Bhattarai and Fischer, 2014). However, it should be stated that felids might not be an ideal focus for touristic activities, as they may be dangerous for humans (Neto et al., 2011).

Some of our respondents were certain about the harmfulness of big cats. In fact, there is a real risk: the cougar and the jaguar can both kill humans (Neto et al., 2011). Fear and social motivations must be understood in order to design appropriate conservation interventions in our study site, because these can be even more important than economic losses (Bhattarai and Fischer, 2014). However, it should be highlighted that reports of felid attack on humans are especially scarce in Central America (Amit et al., 2009). Most of the scientific reports of jaguar attacks on humans are from South American countries (e.g. Neto et al., 2011), whereas reports of cougar attacks on humans are more common in North America (e.g. Mattson et al., 2011).

One outstanding finding of our study is that people mentioned that hunting of wild prey was one of the main barriers to coexistence. This has not been reported from other sites (Boulhosa and Azevedo, 2014). In sites with people who understand ecological relations there is a more positive position about coexistence (Dorresteijn et al., 2016).

Lack of knowledge about institutional actions could act as a brake on any effort (Dorresteijn et al., 2014). Few respondents in our study reported complete ignorance of institutions, but there was some misinformation among them. This leads, along with a lack of trust, to negative perceptions of authorities (Dorresteijn et al., 2016). Ranchers also mentioned a lack of action by institutions, as reported by Dorresteijn et al. (2016). Trust is fragile and negative actions tend to have greater impacts than positive actions (Sponarski et al., 2014). Ignoring people that have reported attacks can have serious negative effects on attitudes towards felids and responsible institutions. Killing felids may not only be an act of vengeance on the big cat itself, but also on authorities (Dorresteijn et al., 2014).

With regard to the efficiency of preventive measures, a high proportion of interviewees reported that measures were effective, which corroborates the findings of a study carried out on 30 ranches in several sites of Costa Rica (Quigley et al., 2015). Nevertheless, there are external factors, such as low economical resources and social acceptance, that can prevent the ap-

plication of such measures (Rust et al., 2016). Prevention is not a static behaviour: it requires maintenance and constant monitoring (Amit and Jacobson, 2017).

Previous research in Costa Rica concluded that the influence of institutions over the application of preventive measures was unclear (Amit and Jacobson, 2017). We found that the group with the highest application of prevention measures had received institutional intervention, although the group without intervention also had a high rate of application. Nevertheless, a lack of response by institutions to reports of felid attacks could be related to a low disposition from ranchers to apply preventive measures. In fact, this group had almost the lowest application of such measures, only slightly more than ranchers who had no attacks by felids.

In conclusion, institutions can be effective in mitigating human-felid conflict in our study area. Nevertheless, damage reports should never be ignored, because this could have a very negative effect on trust in institutions and attitudes toward felids. Finally, there are positive values around felids to be reinforced and negative perceptions that should be more deeply understood.

Acknowledgements

We thank the auction managers who permitted us to contact ranchers at their events. We especially thank the interviewees for their participation in this research. The comments of Manuel Spínola and Luis Diego Alfaro were deeply appreciated. Furthermore, we thank Monse Romero and Carolina Saenz for their support in the interviews. Finally, we deeply thank Francisco Morazán for sharing his database. We thank the Universidad Nacional de Costa Rica for financial support for this project and the U.S. Fish and Wildlife Service for study grants given to Margarita and Sergio. We also thank Idea Wild for donation of equipment.

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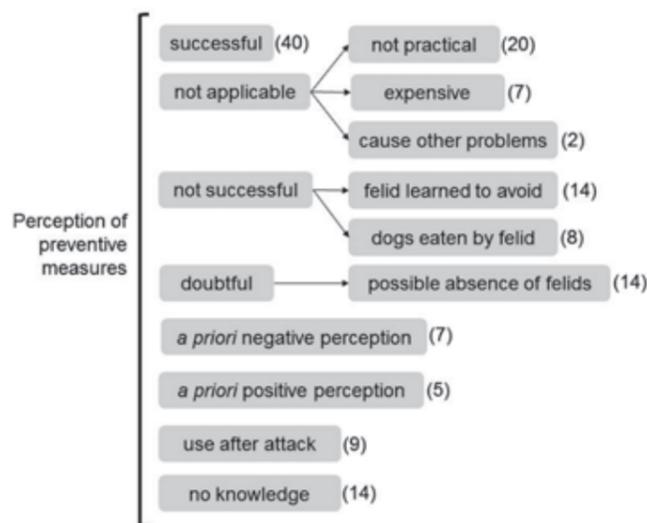


Fig. 8. Codes used to classify perceptions of measures to prevent attacks on livestock by large felids in northern Costa Rica (The number of ranchers supporting each code is shown in parenthesis).

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Appendix

Interview protocol used to gather data on the attitudes of livestock farmers towards felids.

1. Have you suffered from attacks by jaguars or cougars on livestock at your farm?
2. Have you received any attention or recommendations from institutions or authorities about this problem? Which institution?
3. Have you applied any of the preventive measures suggested by this institution? Which measure did you apply?
4. Has this measure been effective in reducing the number of felid attacks at your farm?
5. Answer if you agree or disagree with the following statements (closed questions were asked, but a conversation about each key topic in the question was fostered).
 - a) Big cats and livestock can coexist without conflict
 - b) Big cats are dangerous to people
 - c) It would be fine if big cats disappeared completely
 - d) Felid attacks on livestock can be prevented
 - e) Authorities are helping to solve the conflict with big cats
 - f) Big cats should only live in nature reserves
 - g) Big cats are important for the forest
 - h) Big cats cause economic losses
 - i) Killing felids is simpler than applying preventive measures
 - j) If livestock losses are few, they can be tolerated

Research Article

PERFORMANCE OF TWO INSURANCE-BASED COMPENSATION SYSTEMS FOR WOLF DAMAGES IN ITALY AND SPAIN

Agnese Marino^{1,2*}, Anna Planella Bosch, Simone Ricci³, Valeria Salvatori³, Paolo Ciucci⁴, Juan Carlos Blanco⁵, José Vicente López-Bao⁶

¹ Institute of Zoology, Regent's Park, London NW1 4RY, UK

² University College London, London WC1E 6BT, UK

³ Istituto di Ecologia Applicata, Via B. Eustachio 10, 00161 Roma, Italy

⁴ Department of Biology and Biotechnologies, "La Sapienza" University of Rome, Viale dell'Università 32, 00185 Roma, Italy

⁵ Fundación Oso Pardo, C/ San Luis 17 39010 Santander, Spain

⁶ Research Unit of Biodiversity (UO/CSIC/PA), Oviedo University, 33600, Mieres, Spain.

1. Introduction

Livestock depredation is one of the most important factors triggering conflicts between people and wolves (*Canis lupus*) (Newsome et al., 2016; Woodroffe et al., 2005). When conflicts are especially intense, functional coexistence with wolves relies on the ability of managers to devise conflict mitigation strategies that are transparent, have clear goals and are receptive to livestock owners' needs and contexts. Such strategies are expected to build trust between livestock owners, funders, managers and the general public and to engage livestock owners by promoting a sense of shared responsibility (Redpath et al., 2017).

Typically, mitigation strategies have focused on preventing livestock depredations, through lethal and non-lethal interventions (Eklund et al., 2017), and on alleviating the economic burden of coexisting with wolves by compensating the damages they cause (Blanco, 2003; Boitani et al., 2010; Nyhus et al., 2005; Ravenelle and Nyhus, 2017). Insurance-based com-

pensation is one such model (Dickman et al., 2011; Ravenelle and Nyhus, 2017), which requires livestock owners to pay all or part of an insurance premium in order to receive compensation. Other systems include ex-post compensation, paid after the damage has occurred, and ex-ante compensation, consisting of payments made to farmers that coexist with wildlife regardless of whether they experienced damages. Ex-ante compensation is sometimes conditioned to specific conservation outcomes such as the species' reproduction.

Relative to other compensation models, insurance-based compensation has been proposed as a more economically sustainable and therefore secure source of compensation, giving farmers autonomy and ownership of the issue while also increasing their accountability (Hussain, 2003; Nyhus et al., 2003; Psaroudas, 2007). Site specificity is likely to influence the effectiveness of compensation as a conservation tool (Nyhus et al., 2003). Given the high economic, social and conservation stakes involved, there is there-

*Corresponding author: agnese.marino@ioz.ac.uk

fore an urgent need to assess what works in different contexts and under which conditions.

Here, we examine the functionality of two insurance-based compensation models: in the Province of Grosseto, Italy, where the LIFE MEDWOLF project (LIFE11NAT/IT/069) is being carried out (www.medwolf.eu), and in a portion of the communal hunting grounds in the Province of León, which is representative of the compensation system used in most of the wolf range in Castilla y León region, Spain. Marked differences characterise the two areas in terms of wolf population management, history of the species' presence and land ownership systems. This helps explain some of the differences in how the systems operate and sheds light on the conditions under which insurance-based compensation might fall short of its conflict mitigation purpose.

2. Case Study I: The Province of Grosseto, Italy

2.1. Background

In the Tuscany region, of which the Province of Grosseto is a part, different compensation models have been used over time (Fig. 1). Compensation was first adopted in 1982 in the form of ex-post compensation covering up to 80% of the market value of livestock depredated by wolves and up to 60% of the value of livestock depredated by dogs. In 1994 the system was revised in order to cover the full market value of livestock lost. The distinction between wolf and dog damage was removed, but compensation was made conditional on the adoption of at least one type of damage prevention measure (stables, fences, livestock guarding dogs, acoustic deterrents or video surveillance), which, however, did not need to be in use when damage occurred. These two clauses have been maintained in posterior compensation systems. In 2005, the regional authorities switched to an insurance compensation system, claiming that ex-post compensation is incompat-

ible with EU guidelines on state aid to the agricultural sector (Gazzola et al., 2008). This was the first time that an insurance system was used to compensate damages caused by large carnivores in Italy. Subscription was voluntary (i.e. not required or mandated) and the amount compensated was lowered to 70% for killed or euthanized sheep, goats, and cattle, 50% for killed or euthanized horses and 30% for abortions or missing livestock (Fig. 1). Eighty per cent of the basic premium was subsidised by the regional government and 10% by an insurance consortium, while the remainder was covered by farmers. On a yearly basis, regional funding for insurance premiums in the Province of Grosseto amounted to 33,051 EUR (SD=5,746) and the insurance consortium's funding amounted to 4,132 EUR (SD=718) (data from years 2010-2013). On the other hand, farmers' total contribution amounted to 6,605 EUR (SD=1,110) (data from years 2010 and 2012). Individual farmers invested an average of 90 EUR (SD=73) per year on the insurance premium, plus a 20 EUR subscription fee. The insurance premium depended on the value of the insured livestock and, since 2010, compensation was reduced (to a minimum of 10% of the value of killed/euthanized livestock) and premiums were increased (up to 80%) for livestock owners that experienced substantial damages in the previous years (Ricci, 2014). Each year was divided into four-month periods and payments were made within 60 days after the end of each period. Then, in 2014, under pressure from professional livestock associations, the ex-post compensation model was rein-

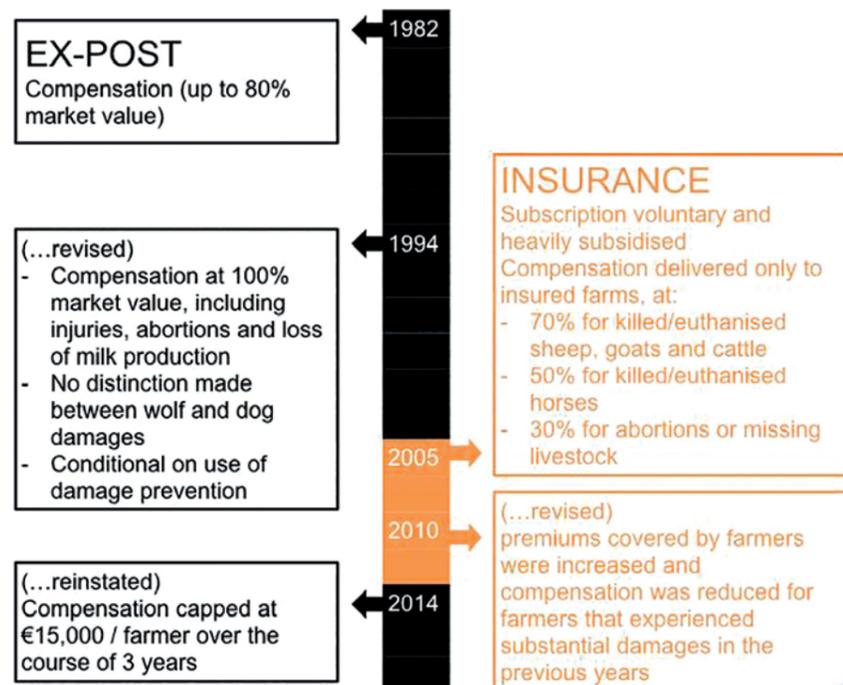
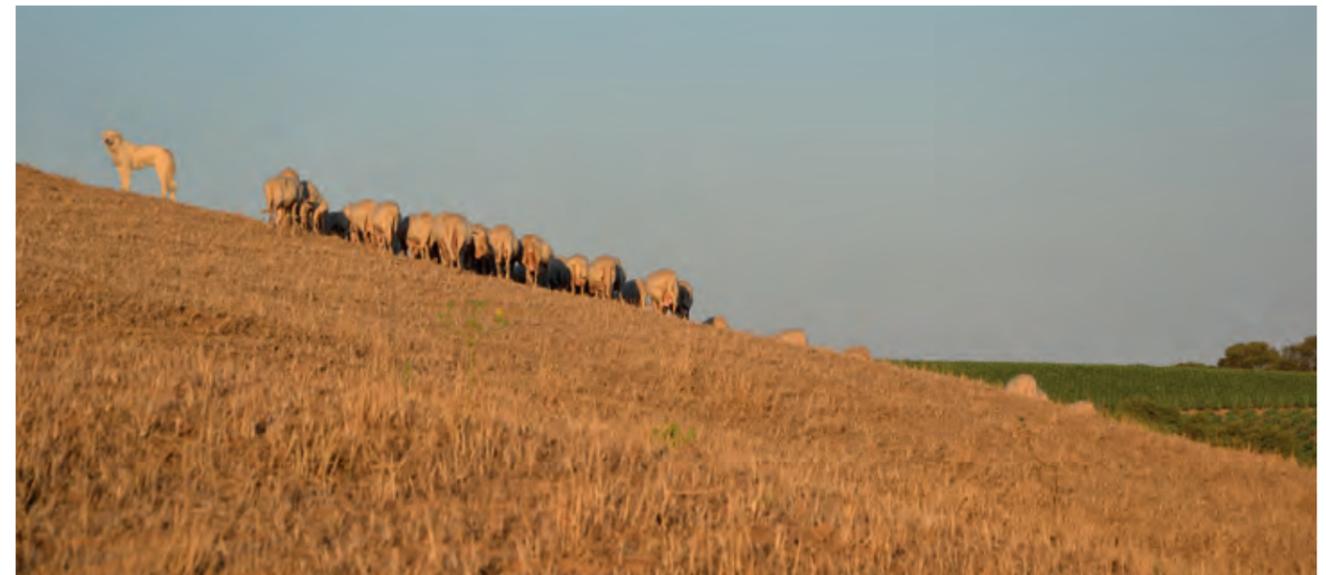


Fig. 1. Chronology of damage compensation systems implemented in the Province of Grosseto.



Sheep flocks in the Province of Grosseto, Italy. Photos: Luisa Vielmi.

stated, but the total amount issued in compensation to each farmer was capped at 15,000 EUR over the course of three years, falling under the EU *de minimis* aid regime (not considered state aid¹).

2.2. Study area

The province of Grosseto (4,479 km²) is an area where wolves re-established a stable presence since the 1980s (Boitani and Ciucci, 1993). Activities to estimate the wolf population are underway under the MedWolf project (LIFE11NAT/IT/069). As in the rest of Italy, the species is listed as strictly protected

in Annex IV of the European Union (EU) Habitats Directive. There is a human-dominated landscape of privately owned, mostly agricultural land, with dairy sheep being the main species of livestock bred following a semi-extensive herding practice where sheep graze in nearby pastures throughout the year. Having abandoned traditional herding systems once employed to prevent damages, farmers are now having to adjust their herding practices to the wolf's return by adopting livestock guarding dogs and predator-proof night shelters. Intense social conflicts surround the presence of wolves in the area and in recent years

¹http://europa.eu/rapid/press-release_IP-13-1291_en.htm.

these have escalated into various episodes of poaching where carcasses have been exposed on roadsides along with menacing signs directed towards conservationists and managers. Moreover, in 2013 a request was made to the Ministry of Environment to obtain derogation to the wolf's protected status, but so far this has not been granted.

2.3. Methods

We analysed several sources of information on livestock damages and damage mitigation policy, spanning the period from 1999 to 2016. These consisted of: a) verified compensation claims under the first ex-post compensation regime (1999–2005) and under the insurance regime, limited to livestock owners that subscribed to the insurance (2007–2013); b) a questionnaire survey conducted through face-to-face interviews in 2013 with a randomly sampled group of 134 sheep owners with more than 50 sheep heads (11.1 % of those active in the Province in 2013; Banca Dati Nazionale); and c) depredations declared to the Regional Veterinary Service, regardless of whether or not farmers subscribed to the insurance scheme (spanning both the insurance-based system and the reinstated ex-post system: years 2012–2016). Here, we summarise the findings of a previous publication (Marino et al., 2016) and update them with data from the recently reinstated ex-post compensation system.

2.4. Results

The results are mostly based on sheep depredations, as these constituted between 95–100% of the livestock depredated in the Province. Overall, we recorded a decline of 81% in the amount compensated annually during the insurance-based period (mean: 33,296 EUR) compared to the old ex-post compensation period (mean: 176,218 EUR) (Marino et al., 2016). Focusing on the insurance period (2007–2013), we found that, annually, only 5% (SD=1) of all the sheep owners officially active in Grosseto subscribed to the insurance (Fig. 2; Marino et al., 2016).

Fig. 2. Percentage of insured livestock owners in a) the Province of Grosseto (data taken from the insurance and official sheep registries) and b) the hunting grounds of León (data taken from a representative sample of livestock owners in the study area).

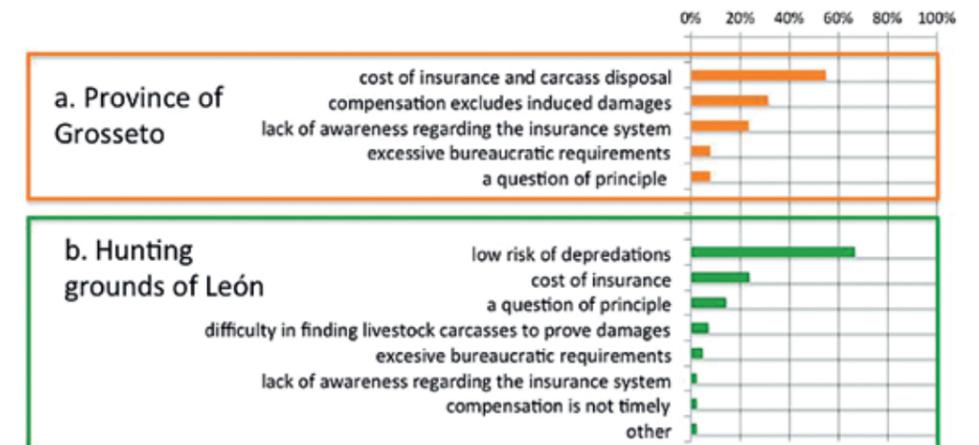


The reasons behind this low level of uptake were elucidated through our interviews with sheep owners (n=51 as not all farmers answered this question), in which most mentioned the cost of the insurance premium, considering also that, when farmers claim damages, they are required to follow costly procedures to dispose of livestock carcasses (Fig. 3). Other factors included lack of awareness regarding the system and, in a minority of cases, questions of principle as farmers felt it was unfair for them to have to insure themselves against something they perceived to be the responsibility of the state. In this respect, it is important to note that only 7% of those that were never insured claimed to be aware of the insurance system's terms and that the average insurance premium covered by livestock owners was not especially costly (Marino et al., 2016).

Finally, we found that 50% of the interviewed farmers claimed to have suffered depredations, while official registries reported damages affecting only between 2% (SD=0.7) and 6% (SD=0.8) of the farmers present in the province, based on data from the insurance system and the veterinary service, respectively (Marino et al., 2016). These results highlight how official figures available from the insurance period largely underestimate the true proportion of afflicted sheep owners and the real impact of wolves in the area.

To estimate the extent of this phenomenon, we extrapolated the proportion of interviewed farmers that declared damage to the veterinary service to the total number of sheep farmers in Grosseto. We found that as many as 34% of all sheep owners in Grosseto may have actually experienced depredations (Marino et al., 2016). Data from the current ex-post compensation system, which was reinstated in 2014, show that the yearly proportion of farmers from the Province of Grosseto declaring damages to the veterinary service had risen considerably from 6% during the insurance

Fig. 3. Reasons given by farmers as to why many of them were not insured against wolf damages in: a) the Province of Grosseto, Italy (n=51); and b) the hunting grounds of León, Spain (n=42).



years to 15% under the reinstated ex-post compensation program (SD=3, referring to the years 2015 and 2016). Since the reinstatement of the ex-post compensation model, each farmer declared, on average, between 7 (SD=11) and 5 (SD=6) livestock heads affected by death or injury due to depredations, per year (data referring to depredations certified by the Veterinary Service in the years 2015 and 2016, respectively). However, considering that compensation is capped to include several other types of subsidies, it is possible that some farmers may not be declaring damages having already reached their compensation limit. Unfortunately, registries are being archived in such a way that it not possible to obtain yearly estimates of compensation paid.

3. Case Study II: The hunting grounds of León, Spain

3.1. Background

In the Province of León in Spain, compensation was first adopted in 1999, providing the portion of damage value not covered by insurance. It was expanded in 2003 to offset other costs related to depredation (such as abortions, loss of milk production and subsidies per livestock head), and was included as a main conflict mitigation tool in the 2008 Wolf Management Plan of Castilla-León (Law BOCYL N.68 09/04/2008). To access this funding, farmers are required to be insured and to have filed a request to the Regional Administration after the damage is verified by local rangers. In addition, state funds subsidise a portion of the livestock insurance premium, which varies slightly from year to year and according to the species of livestock insured. In 2015, the minimum amount subsidised for insurance premiums for cattle, sheep and goats was 22% and the maximum amount was 50%, while the minimum amount subsidised for horses was 20% and the maximum amount was 50%.

In 2016 the minimum amount subsidised for all four livestock species was 23% and the maximum amount was 51%. Differences between minimum and maximum amounts subsidised depend on characteristics of the farms, whether they are certified organic, if insurance was renewed from the previous year and other features (Entidad Estatal de Seguros Agrarios 2015 and 2016).

Payments from the insurance and regional administration are not conditional on the use of damage prevention measures and include damage from wolves as well as dogs. Depredations are included in a basic livestock insurance package which also covers accidents, loss of many livestock in a single event, loss of production due to any event covered by the insurance and certain diseases, depending on the livestock species insured (Entidad Estatal de Seguros Agrarios 2015 and 2016). Insurance payments are made within two months of a damage claim.

Hunting grounds are supposed to reimburse livestock depredations (Article 12 of the 1996 Regional Hunting Law, and Article 33 of the 1970 National Hunting Law) but in reality they seldom do so. Instead, damages occurring inside regionally managed hunting reserves, such as the reserve of Riaño to the north of the study area, are currently fully compensated by the regional administration (according to fixed amounts set by the compensation rules: Law BOCYL-D-25042017-6).

3.2. Study area

The study area is comprised of 11 municipalities (1,053 km²) in the eastern portion of León, an area in N Spain where wolves have always been present (Chapron et al., 2014). In 2012–2013, 0.8 packs/100 km² were estimated to be present in the area (Sáenz de Buruaga et al., 2015). Wolves in this area are included in Annex V of the Habitats Directive and listed as a game species, with the Autonomous Region of Castilla-León setting



Mountain pastures in the private hunting grounds of León, Spain. Photo: Anna Planella Bosch.

a yearly hunting quota for each of its administrative districts. Within these districts, quotas are allocated by giving priority to hunting grounds with greater livestock damages and greater chances to fulfil the quotas (Law BOCYL-D-23052016-2). In the whole province of León, home to 59 wolf packs in 2012–2013 (Sáenz de Buruaga et al., 2015), hunting quotas amounted to 50 wolves in the season 2015–2016.

The landscape is composed of agricultural lands at lower elevations, and mountainous, forested areas. The mountainous area is subdivided into communally owned grounds whose hunting rights, including wolves, may be auctioned off to private holders.

3.3. Methods

We obtained data on livestock depredation by wolves declared to the regional administration (2013–2015) and, in 2017, we carried out 71 interviews with local livestock owners in order to evaluate the representativeness of the official damage registries (collecting data on self-reported, unverified damages from 2015–2016). We randomly sampled 47% of livestock owners in the study area who received subsidies from the Common Agricultural Policy (Fondo Español de Garantía Agraria, 2016). Of the interviewed farmers

58% owned beef cattle, 11% dairy cattle, 33% meat sheep, 4% dairy sheep, 7% meat goats and 6% owned horses. All of them practiced extensive or semi-extensive livestock breeding: grazing livestock throughout the warmer seasons either in mountain pastures or in pastures near their stables. Few farmers, usually sheep owners, kept their livestock in night time enclosures during the warmer season.

3.4. Results

Out of the farmers who claimed to have suffered damages in 2015 or 2016 (18/71 and 21/71 of those interviewed, respectively) most owned beef cattle (56 and 57%, respectively) or meat sheep (28 and 30%); the rest owned meat goats (4 and 11%), horses (0 and 9%) or dairy sheep (0 and 6%). Self-declared estimates of farmers who claimed damages ranged between 5 (SD=4) and 6 (SD=9) livestock heads affected by death or injury due to depredation per year, referring to 2015 and 2016, respectively. These represent on average 3% (SD=3) of stock owned by each damaged farmer at the time of the interview.

Overall, 38% of interviewees were insured against livestock depredations (Fig. 2). Only 20% of them (and 30% of insured farmers) were aware that the re-

gional administration offered match funding to compensate damages suffered by insured farmers. Other than the fact that some farmers considered themselves to be at low risk of depredation, the main reasons cited by uninsured farmers ($n=42$) for not being insured mirrored those of livestock owners in the Province of Grosseto: farmers lamented the cost of the insurance and felt that insuring their livestock against predators was not their responsibility (Fig. 3). Neither farm size (measured as the total number of livestock owned), whether farmers experienced damage, nor how many livestock they claimed to have lost to depredation significantly influenced the likelihood of being insured (Wilcoxon and Chi-square tests, $0.14 \leq p \leq 0.78$). Similarly, the species of livestock owned did not influence the likelihood of being insured, (Fisher and Chi-square tests, $0.24 \leq p \leq 1$), except in the case of dairy cattle owners ($n=8$) none of which were insured. Of those interviewed farmers who had claimed damages from insurance at some point in the past, the majority (9/13) were satisfied with the compensation they received, in terms of the amount compensated and the timing of payments.

When asked which types of compensation they would prefer, 74% opted for ex-post compensation funded by the regional administration and 33% were open to prepayment compensation schemes (i.e. farmers that coexist with wolves would receive a fixed annual sum regardless of whether they experienced depredations). It is worth mentioning that less than 3% of interviewees preferred private or co-financed insurance-based compensation, or compensation programmes funded by the hunting grounds. Preference for the type of compensation system was not influenced by whether farmers had experienced depredation or not, or the average number of livestock heads they lost to depredations per year (Chi-square and Fisher tests, $0.36 \leq p \leq 1$).

Finally, on average 28% of sampled farmers (SD=3) claimed to have suffered damage per year (18/70 farmers in 2015 and 21/70 farmers in 2016, NA=1 in both years). Of these, 36% (SD=4) had claimed from insurance on a yearly basis and 2% (SD=3) had claimed from the regional administration on a yearly basis but had not received match compensation at the time of the interview. The official records on livestock depredations showed that only one depredation event was declared to the regional administration between 2013 and 2015 in the study area, amounting to an average of 45 EUR (SD=45) per year being paid out to match the insurance compensation.

To obtain a further measure of conflict, farmers were asked whether they thought that wolves were killed illegally in the area. Fifty-nine percent believed that they were and some believed as many as three wolves were killed illegally per year in one municipality of the study area.

4. Discussion

Although data available to us from the two sites are not always comparable, the case studies allow for some general conclusions. Overall, livestock owners from both sites exhibited low levels of support and uptake of the insurance compensation model. Both in the Province of Grosseto and in the hunting grounds of León included in our study, the majority of damages occurring under the insurance compensation system went unclaimed. These results highlight the importance of assessing the functionality of compensation systems (Ravenelle and Nyhus, 2017) and finding ways to ensure that conflict mitigation strategies are accepted by those they are intended to benefit.

Overall, we found higher levels of subscription to the insurance scheme in León than in Grosseto (Fig. 3). This is most likely due to the fact that the insurance's basic package also included other types of accidents and risks, as well as the fact that farmers in León are more accustomed to wolf presence and therefore may be more inclined to consider depredation as one among many other business risks. Moreover, unlike the province of Grosseto, in León other more convenient types of compensation were never available before. However, the fact that a large number of damaged farmers did not claim compensation from the Castilla-León regional administration even though, given the choice, almost all farmers wanted it to fund compensation payments, is evidence that the area is experiencing unresolved conflicts. This is supported by the fact that illegal killing was believed to be widespread, despite the presence of a legal hunting system. The case study of León is interesting as its communally managed wildlife system, as well as its compensation history, should theoretically make it a candidate for a successful insurance scheme (Hussain, 2003). Instead, our results suggest a greater level of government commitment (see also Young et al., 2012) might be necessary if damage compensation is to be understood as a tool meant to alleviate the economic burden of depredations in return for coexistence.

In both study areas, the prevalence of unreported damages may be influencing the perception of wolves' impact on livestock activities and indicates a lack of robust indices against which to measure the effectiveness of conflict mitigation strategies. In the case of León, this is all the more significant given that wolf hunting quotas are officially allocated on the basis of conflict levels and are carried out in order to reduce livestock depredations (Law BO-CYL-D-23052016-2). In the case of Grosseto, the lack of robust indices was coupled with a lack of clear management objectives, as the top-down implementation of the insurance-based system was most likely aimed at reducing costs for the public administration. This is not unique to the Tuscany region, as others in Italy have also revoked compensation policies or withdrawn funds to support them due to economic pressures (Boitani et al., 2010).

Our two case studies exemplify what have been termed "conflicts of information", occurring when information is lacking, misinterpreted or misunderstood (Redpath and Sutherland, 2015; Young et al.,

2010). Scientists and managers share a responsibility to disseminate objective and transparent information concerning depredation levels and the progress of conflict management strategies, yet the challenge remains that of finding ways to ensure that information is accepted and trusted (Lopez-Bao et al., 2017). In this regard, it is important to recognise that wildlife conflicts are mediated by a range of factors that go well beyond wildlife's material impact. These have to do with the trust and power relations between stakeholder groups (Lüchtrath and Schraml, 2015; Young et al., 2016), people's expectations, interests and priorities (Dickman, 2010; Holland, 2015) as well as their culture and values (Agarwala et al., 2010).

Conflicts over the impact of wildlife are just the tip of the iceberg and even if we are able to accurately estimate depredation levels this does not mean we will achieve conflict mitigation. However, we consider it an important step in order to challenge the status quo that dominates conflicts surrounding wolf depredations in many parts of the species' range.

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FARMERS' ACCEPTANCE OF WOLVES IN PORTUGAL: JUST A QUESTION OF TIME?

Clara Espirito-Santo^{1*}, Francisco Petrucci-Fonseca^{1,2}

¹ Grupo Lobo – Departamento de Biologia Animal, Faculdade de Ciências da Universidade de Lisboa, Edifício C2, Campo Grande, 1749-016 Lisboa, Portugal

² Centre for Ecology, Evolution and Environmental Changes (Ce3C), Faculdade de Ciências da Universidade de Lisboa, Edifício C2, 5º Piso, 1749-016 Lisboa, Portugal

1. Introduction

Understanding attitudes toward wolves and wolf management is important because it can help researchers and managers to predict how people may behave toward wolves and respond to wolf-management actions (Bruskotter et al., 2009). In Portugal, wolves live in close contact with people and feed mainly on livestock (>70%) (Álvares et al., 2015), thus creating frequent situations of potential conflict between farmers and the national administration, which may result in wolf persecution. Official records from the Institute for Nature Conservation and Forests (ICNF) report 96 wolves found dead between 1995 and 2015 in Portugal, 42% of which as a result of poaching (18 were shot, 18 caught with snares and 4 poisoned) (Barroso et al., 2016).

Wolves are fully protected under Portuguese law (Law no. 90/1988) and damage to livestock is compensated by the government. Compensation covers

the payment of the market value for killed livestock and treatment costs of injured animals, but not of missing animals or indirect losses such as milk production. The legislation (Decree no. 139/1990) foresees eligibility for compensation when livestock is guarded by shepherds and livestock guarding dogs (LGDs) or confined, although confinement conditions are not defined and hence they are usually not wolf-proof. The revision of the legislation that is being undertaken requires livestock, if not guarded by a shepherd or LGD, to be confined in infrastructures that are considered wolf-proof (Decree no. 54/2016). The ICNF is responsible for assessing damages and payments, with values being defined according to weekly local market values. According to the law, payments should be made within 60 days, but this is seldom achieved.

Wolf presence is not uniform throughout its range, with higher densities in the NW and NE of the country and less stable packs at the edge of the distribution, particularly south of the Douro river (Godinho et al.,

2012; Pimenta et al., 2005). According to the national wolf census conducted in 1997/97 and 2002/03 (Pimenta et al., 2005), the Portuguese wolf population seems to be stable, occupying less than 20% of its original range, which corresponded to the entire country (Petrucci-Fonseca 1990). Nevertheless, recent and localized monitoring studies reveal episodes of extinction of some packs and establishment of others with expansion of the wolf range in recolonisation events (Álvares et al., 2015).

We examined the results of two human dimension studies (Espirito-Santo, 2006, 2013) developed in different regions in order to see how farmers from regions with distinct characteristics and coexistence habits, namely concerning wolf presence (long-standing and stable vs. recent and irregular) and density (medium vs. low), damage risk and levels, husbandry systems and damage prevention measures, feel about wolves and how they accept the presence of the species.

In 2005, under the LIFE COEX project (LIFE-04NAT/IT/000144), farmers were interviewed in two regions with long-standing presence of wolves and where damage to livestock was high at the time of the survey (Pimenta et al., 2005). The main goal was to understand the conditions for coexistence of

humans and wolves. In 2013, under the LIFE MED-WOLF Project (LIFE11NAT/IT/069), farmers were interviewed south of the Douro River along the Spanish border (Fig. 1). The goal was to document farmers' attitudes toward wolves and wolf management, their knowledge and fear about wolves in a region with irregular but increasing wolf presence.

2. Study area

The study areas were selected based on wolf densities and levels of damage to livestock. The study area sampled in 2005 included a region north of the Douro river with four wolf packs and 1.6 to 3.0 wolves/100 km² and a region south of the river with six wolf packs and 0.5 to 1.3 wolves/100 km² (Pimenta et al., 2005) (Fig. 1). In both regions, 86% of damage caused by wolves was to sheep and goats (Álvares et al., 2015; Pimenta et al., 2005). Livestock was usually guarded by shepherds and LGDs and confined during the night (Fig. 2). The area covers 2,409 km² and includes nine counties and 125 parishes (“freguesias”), mostly with small rural villages in mountainous regions that reach a maximum altitude of 1,382 m (Fig. 3). According to the last census before the survey, there was a human population density of 53 people/km² (INE, 2001).

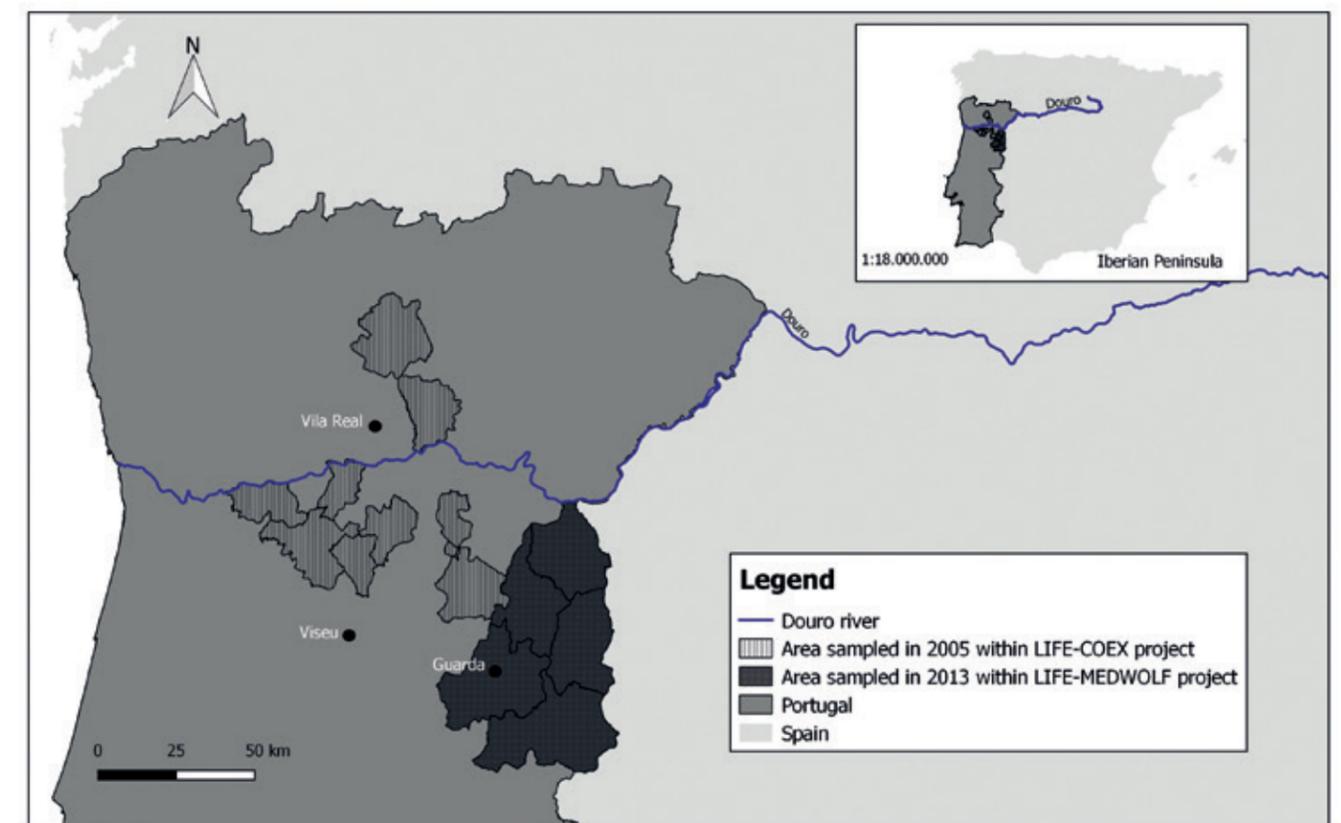


Fig. 1. Study areas where farmers were interviewed in 2005 and 2013.

*Corresponding author: cesanto@hotmail.com



Fig. 2. Livestock guarded by shepherd and dogs in Vila Real and Viseu regions. Photos: Clara Espirito-Santo, Sílvia Ribeiro.

Livestock represents around 70% of wolf diet in Portugal, primarily goats north of the Douro river (Carreira and Petrucci-Fonseca, 2000) and cattle south of it (Quaresma, 2002) (Fig. 4). In the latter case it is also common for wolves to feed on carrion (carcasses of cows, pigs, chicken or rabbits) dumped in farms (Roque et al., 2005). The prevalence of livestock in the diet of wolves is due to a lack of roe (*Capreolus capreolus*) and red deer (*Cervus elaphus*), which were almost eradicated by hunting (Salazar, 2009) and currently face a lack of ecological conditions for recovery as a viable prey for wolves.

In the 2013 study area, one of the two probable wolf packs identified in the previous national wolf



Fig. 3. Mountain pastures and village in the region of Vila Real. Photos: Clara Espirito-Santo.



Fig. 4. Goats are the main domestic prey of wolves north of the Douro river and cattle south of it. Photos: Clara Espirito-Santo.



survey (2002–2003) (Pimenta et al., 2005) had disappeared and one new pack (in Almeida) was detected (Cadete et al., 2012). More recently, the results obtained in the MEDWOLF Project indicated a 6-fold increase of wolf presence in the area but confirmed the presence of only one established pack with a minimum of eight members (although no reproduction has been confirmed since 1995) and two other probable packs, one of them sharing its territory with Spain (García et al., 2016). The wolf population density in this region is therefore estimated at 1.55 wolves/100 km² (Palacios et al., 2017).

The area covers 3,046 km² and includes five counties and 118 rural parishes in mountainous and plateau regions reaching a maximum altitude of 1,286 m, with a human density of 26 people/km² (INE, 2011) (Fig. 5).

There are not many studies of wolf diet in the region. The most recent study south of the Douro River, implemented from 2001 to 2003, indicated the in-



Fig. 5. Grazing areas in the MEDWOLF project region include plateaus and human density is lower closer to Spain. Photos: Clara Espirito-Santo.



Fig. 6. Cattle grazed extensively in wolf country near Guarda (Portugal). Photo: Clara Espirito-Santo.



creasing presence of roe deer in the diet of some packs (Roque et al., 2005).

Wolf predation on cattle gradually increased between 2003 and 2013 (Álvares et al., 2015). According to the official records of wolf attacks on bovines provided by ICNF, there was an increase of 34% to 74% from 2012 and 2015. The number of bovines injured or killed increased from 14% to 45% in the same time period. This was due to an increase in the number of animals per farm, corresponding to an increase in the number of farms with >100 cattle heads, and a sharp decline in the number of farms with smaller herds (INE, 2016; Pimenta et al., 2017). It was also due to a lack of prevention methods, since cattle are mostly extensively grazed day and night, 365 days/year with no surveillance, LGDs or wolf-proof fences (Fig. 6). In the same period, the percentage of wolf attacks on sheep and goats decreased from 31% to 23%, and the percentage of animals killed went from 73% to 53% (data from ICNF) (Fig. 7).

In all areas, the density of roe deer was low, similar to its situation in other parts of the country (Torres et

al., 2011), but there are some signs of recovery due to natural dispersal processes and re-introduction programmes (Lovari et al., 2016a; Salazar, 2009; Vingada et al., 2010). Red deer was absent from both study areas but the population in Portugal is increasing



Fig. 7. Livestock guarded by shepherd and dogs in the county of Guarda. Photo: Clara Espirito-Santo.

(Lovari et al., 2016b; Salazar, 2009). It is uncertain whether the species has already reached the south-eastern tip of the area sampled in 2013, resulting from its expansion from subpopulations reintroduced further south or from trans-border Spanish populations. The wild boar (*Sus scrofa*) has shown a significant increase in number and distribution in Portugal (Fonseca, 1999) and is now widespread across the country, including most of the study areas (Fonseca et al., 2011; Oliveira and Carmo, 2000).

3. Methods

In 2005 and 2013, respectively 30 and 62 farmers were interviewed by the same person (female) through face-to-face interviews, in areas with the highest level of damage to livestock caused by wolves, selected according to official records made available by ICNF (Fig. 8). Farmers were selected randomly, not by socio-demographic characteristics such as gender, age or level of education, in areas with frequent livestock depredation by wolves.

In 2005, using an open-ended questionnaire, we analysed the major concerns of farmers and saw how important wolf related issues were in comparison to other agricultural issues mentioned by the respondents. They were also asked about the positive and negative aspects of having wolves in the region where they lived, if coexistence of humans and wolves was possible and, if yes, under what conditions. Questions were open-ended in order to allow respondents to provide more complete answers and to develop their ideas as deeply and freely as possible. The issue of wolf damage to livestock or coexistence of humans and wolves was not mentioned right at the beginning of the interview. The interviewer waited for the respondent to mention wolf-related issues and then continued with questions about these issues. Responses were hand-written as the respondents answered freely, and a content analysis was then done in order to identify all the issues and count the



Fig. 8. Livestock owner interviewed in 2013 for the MEDWOLF Project survey. Photo: Duarte Cadete.

number of times each issue was mentioned during interview. Although this is not a quantitative analysis, it provides useful information on the importance of each issue. A descriptive analysis was done based on diagrams presented ahead.

In 2013, a questionnaire with closed questions was used. This was mainly based on the attitudinal and belief items used in several previous human dimension studies (Bath and Buchanan, 1989; Bath and Majic, 2001; Espirito-Santo, 2007) and attempted to address the four components of attitude: affective, cognitive, behavioural intention and behaviour (Fishbein and Ajzen, 1975). Screening and preparation of the data followed the procedures described in Espirito-Santo (2007, 2013). For each respondent, several attitudinal scores were computed using Principal Component Analysis, with the 32 items resulting in several components (attitude scores) that represented how respondents felt about wolves and wolf management. A knowledge score was computed for each respondent by summing all the correct answers given to twelve questions about wolf biology and ecology (0 represents no knowledge; 12 represents high knowledge). A fear score resulted from the sum of answers to four fear items, which were coded in a gradient of fear (4 represents no fear; 18 represents strong fear). Descriptive analysis was used for examining responses to attitudinal questions and Spearman correlation coefficient to check the correlation between attitudes, knowledge and fear. A p-value of 0.05 was considered for significance of statistical results. More details on the methodology are available in Espirito-Santo (2007, 2013).

4. Results

Results revealed that in areas with a long-standing presence of wolves, damage caused by wolves to livestock and compensation issues are not major problems for farmers in comparison with other concerns

Data from the two studies are not directly comparable, but a qualitative comparative analysis provides some understanding of farmers' attitudes regarding wolves and wolf management in two areas with distinct levels of wolf presence and of coexistence with this predator.

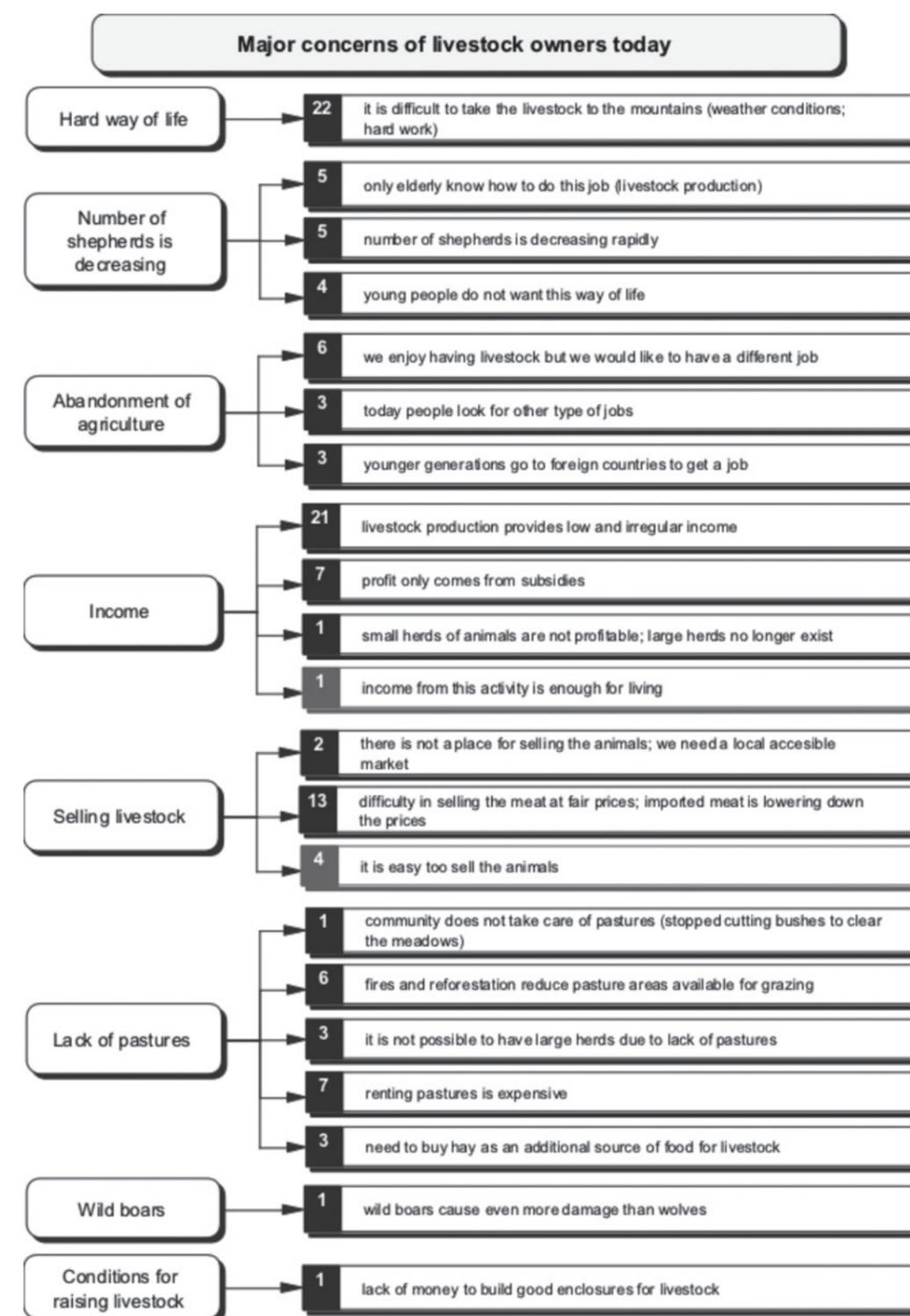


Fig. 9. Major concerns of farmers in areas with a long-standing presence of wolves. Numbers inside the black boxes refer to the number of times the issue was mentioned by farmers. Text boxes in grey present opposing points of view.

in their lives, although 77% of them claimed to have suffered damage by wolves. Most important were the harshness of the farmers' lives, the availability of pastures and economic issues related to low prices/demand, low/irregular income, livestock mortality due to diseases and fear of losing subsidies (Figs. 9, 10). Only when asked specifically about wolves did

farmers mention predation and compensation issues as relevant.

When asked about the negative impacts of having wolves nearby, respondents mentioned 11 different negative impacts, repeated 54 times in 30 interviews. The most negative consequence of having wolves nearby was said to be damage caused by wolf

predation on livestock (#40) [# is number of times the issue was mentioned by respondents]. The fear of wolves attacking people was mentioned six times, followed by the concern with compensation for damage caused by wolves (#3), emotional impact (#2), dislike of wolves (#2) and predation on dogs (#1).

Although half the respondents argued that wolves had no positive effects, the other half listed seven different positive effects of wolf presence nearby, which were mentioned 44 times. Wolves were seen as part of nature (#21) and some respondents argued that people enjoyed seeing a wild wolf in its natural habitat (#7). The utilitarian role of wolves was also important (#16), whether it be their potential for wolf watching tours (#2), their "cleaning" role of dead animals in the wild (#4) or their indirect effect over shepherds who feel obliged to herd livestock to prevent depredation, thus keeping herds out of crops and avoiding conflict among shepherds (#10).

Although many farmers argued that coexistence of humans and wolves is not possible either because wolf survival is threatened (#23) or because traditional livestock production and shepherds tend to disappear (#11), some farmers believe wolves will naturally continue to live in the wild (#14) and most think coexistence is possible under certain conditions, namely rapid and fair payment of compensation for damage (#13), receipt of subsidies for livestock production (#8) and use of prevention methods such as livestock guarding dogs (#7), among 22 other conditions (Espírito-Santo, 2006). Although payment of compensation for damage was the most important issue, it was not unanimous since some respondents argued (#5) that livestock has to be guarded appropriately, and this is not a responsibility of the government. Even some respondents who had already had damage caused by wolves shared this opinion.

In areas where wolves are now recovering after decades of absence, farmers' attitudes toward an increasing wolf population were negative (82%), 95% agreed that wolves cause substantial damage to livestock, 79% stated they were entitled to compensation independent of the use of prevention measures, 76% disagreed with full protection of the species and opinions were divided concerning mandatory insurance for wolf predation on livestock. Data from a previous study on public attitudes, done in 2002 in the region south of Douro river where wolves have always been present, are in contrast to this view, as 55% of farmers agreed with payment of compen-

sation only to those who used preventive measures (Espírito-Santo, 2007), while in the MEDWOLF region only 18% agreed.

Farmers' attitudes toward wolves and wolf management were not correlated with their knowledge about biological and ecological aspects of wolves. The average knowledge score was low (4.24 on a scale from 0 to 12) and almost all respondents informally stated "what are the benefits of having wolves in the wild? If, at least, we could understand what wolves are useful for...". These spontaneous statements show a possible link between knowledge on the benefits of wolf presence and increased acceptance of the species. However, farmers' negative attitudes toward wolves were correlated with fear, mostly fear of wolves attacking children. The average fear score was 9.89 on a scale from 4 to 18.

5. Conclusions

The objectives and methods of the two studies were different, but the results provide important clues on the acceptance of wolves by local agricultural communities in areas of recent and potential future recolonization. The differences between regions reveal the effect that different time-spans of cohabitation with wolves can have on the level of social tolerance. Acceptance is higher in areas with a long-standing wolf presence and where traditional herding techniques and prevention methods for reducing depredation have always been in place. The existence value of wolves is also visible in regions where wolves have always existed, but not so evident in areas now being reoccupied by wolves, such as the MEDWOLF Project area. Coexistence in this area requires an adaption of herding techniques by local farmers but results show some resistance to that change. Social acceptance of wolves in these areas is a complex achievement that can more easily be reached through an effective and fair compensation system that farmers agree with. Economic incentives can be used to increase tolerance for some predators and protect some from poaching, but these are not a panacea (Treves and Bruskotter, 2014). We recommend working with farmers in the improvement of prevention methods in wolf areas where social conflict is high, or expected to be high, providing early technical support as well as specific/increased subsidies to implement them. We also recommend developing communication campaigns to reduce fear and increase awareness of the ecological and socio-economic benefits of wolf presence in those areas,

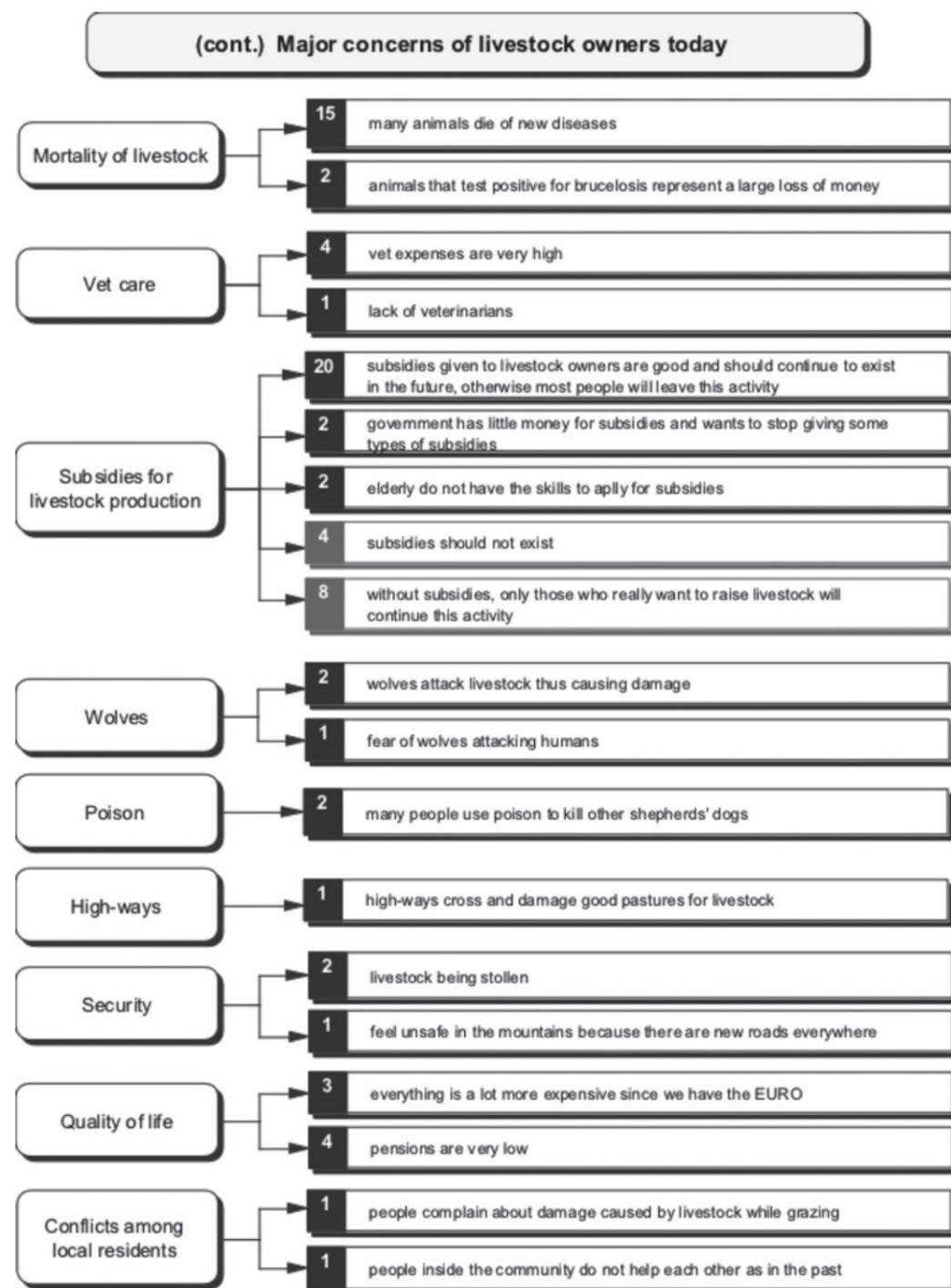


Fig. 10. Major concerns of farmers in areas with a long-standing presence of wolves (continuation). Numbers inside the black boxes refer to the number of times the issue was mentioned by farmers. Text boxes in grey present opposing points of view.

since providing information about the benefits people gain from predators, in combination with information about how to reduce risks posed by predators, may increase people's acceptance of predators in their region (Slagle et al., 2013).

As the proportion of people with a negative attitude increases to a maximum with the arrival of large carnivores, and decreases with experience over time (Zimmermann et al., 2001), we highlight the importance of reducing the chances of negative experiences, such as episodes of surplus killing or livestock depredation in general, as these are likely to deteriorate attitudes toward wolves. In areas showing the first signs of wolf recolonization and in potential wolf re-appearance areas, as identified through a GIS model-

ling approach implemented within the MEDWOLF Project (Ferrão da Costa and Petrucci-Fonseca, 2013) and integrated in the Portuguese Wolf Action Plan (Álvares et al., 2015), it is important to document people's attitudes, values and intentional behaviours toward wolves, and work ahead with farmers on effective damage prevention measures.

Results highlight the importance of economic issues to farmers, reveal the potential controversy of changes in the compensation system to increase requisites for compensation and reduce amounts paid, and stress the need to involve farmers in the development of wolf management actions. A collaborative approach involving livestock owners in the decision-making process is highly recommended.

Acknowledgements

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BREEDING SOLUTIONS: PARTICIPATORY MEETINGS WITH LIVESTOCK BREEDERS IN IBERIA CONCERNING COEXISTENCE WITH WOLVES

Luís Rainha¹, Sílvia Ribeiro¹, Clara Espírito-Santo¹, Francisco Petrucci-Fonseca¹, Carolina Martín Cortijo², Isabel Díez Leiva², Elisa Oteros-Rozas², Theo Oberhuber²

¹ Grupo Lobo – Departamento de Biologia Animal, Faculdade de Ciências da Universidade de Lisboa, Edifício C2, Campo Grande, 1749-016 Lisboa, Portugal

² Ecologistas en Acción, C/ Marqués de Leganés 12, 28004 Madrid, Spain - www.ecologistasenaccion.org

1. Introduction

For some decades now, the sociological aspects of conflicts involving wildlife conservation have been rendered clear: in the days of the Anthropocene, Man may well be the single most important determinant in many species' habitats. Thus, human dimensions represent a main concern in wildlife management, above all when a species' growing presence in a given area in some way is perceived as hindering economic and social activities, namely in the case of large carnivores in Europe.

The wolf (*Canis lupus*) has been expanding its range in many parts of Europe, returning to regions where it had been absent for decades (Chapron et al., 2014). Such is the case south of the Douro river in the Iberian Peninsula, namely in the provinces of Castilla y León Community, in Spain, and in Portugal, in the region along the border (MAPAMA, 2014; Álvares et al., 2015). In 2002–2003, when the last Portuguese survey was done, wolf presence was considered prob-

able in the area, although with no packs established, being the region with the lowest number of reported damages to livestock within Portugal's wolf range (Pimenta et al., 2005) (Fig. 1). Ten years later, the number and range of damages had increased. Since 2012, the Institute for Nature Conservation and Forestry (ICNF), responsible for wolf management and for assessing and compensating damages to livestock, recorded an average of 90 wolf attacks per year, affecting an average of 243 domestic animals. Attacks also began to occur in three other municipalities (Pinto de Andrade et al., 2015).

Soon the expectable breeders' complaints, about wolf depredation, soon attracted the attention of regional media outlets, followed suit by TV newscasts and national newspapers that struck a chord in other regions of Portugal where wolves were also making a slow but steady comeback. These news pieces often included bogus elements regarding the number of wolves present in a given area, false claims that they had been artificially reintroduced, and inaccurate



The transition to extensive cattle and sheep production, while wolves were less present in the region, with no adequate protection measures, resulted in higher damages to livestock after wolf densities increased, especially since wild prey remained scarce, in the border region, south of the Douro river, in Portugal. Photos: Sílvia Ribeiro, Joaquim Pedro Ferreira.

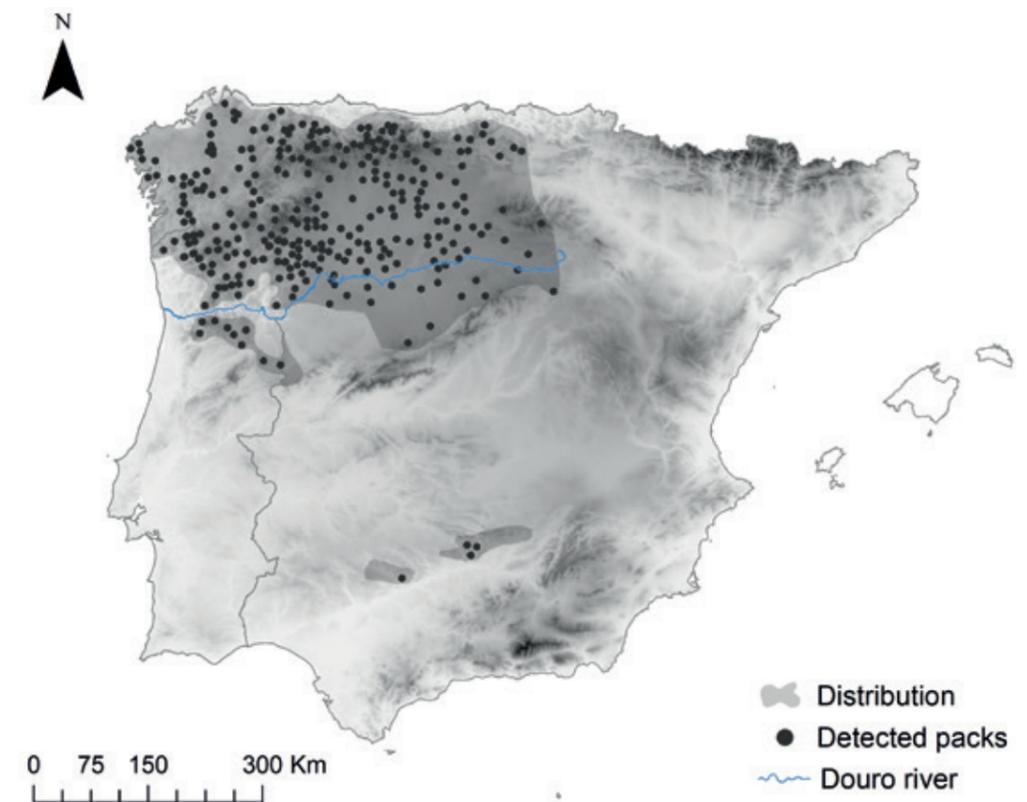


Fig. 1. Wolf range and distribution of packs in Portugal, according to the last national wolf survey of 2002/2003, and in Spain, according to regional surveys developed between 1999 and 2003. The Douro river is a barrier for the wolf in Portugal and defines the protection status of the species in Spain. Adapted from: Álvares et al., 2005.



The lack of shepherds, guard dogs or anti-predator fences makes livestock very vulnerable to wolf attacks in Castilla y León. Photo: Carolina Cortijo.

information about wolf behaviour (e.g. the notion that wolves have “fun” while killing is ubiquitous). Choreographed by some breeders and amplified by the media, the outcry made itself heard at local and national offices of power, with most mayors and parish leaders supporting the protests whole-heartedly. In November 2014, many herders and breeders congregated at the town council of Almeida, the municipality registering the highest number of damages, to voice their complaints. Adding insult to injury, the prevalent opinion about compensation payments offered by the state, complying with the Wolf Protection Law of 1988, was that they were chronically tardy and fell short of fair values, following an approval process not clear enough to those who bore the losses. This was clearly a recipe for the rapid growth of conflict between livestock owners on one side and the wolf and conservation-centred entities on the other.

Although the average human population density in the area is much lower than the national average (see Study Areas), its communities are tight-knit and economically depressed, thus detrimental impacts on livestock holdings tend to have a significant social echo. For instance, in 2016, an ex-post survey on the knowledge level and attitudes towards wolf presence found that 79% of livestock owners in the region knew someone who had suffered damages to their cattle by wolves (Espírito-Santo, 2017).



Wolf culled by the Spanish authorities of the Junta de Castilla y León. Photo: Junta de Castilla y León.

A similar situation had been evolving in Spain in recent decades, since the wolf started to slowly regain its former range south of the Douro river, with the inevitable increase of social conflict due to a surge in attacks, mainly on extensive-grazing cattle. An increase in wolf poaching duly followed, with farmers demanding lethal control of the species by the authorities, despite its strictly protected status south of the Douro (EC Habitat Directive).

1.1. Involving the breeders

Livestock breeders constitute, naturally, a group of the utmost interest for wolf conservation efforts. Not only are they in the “front line” of a growing conflict between human activities and increasing wolf presence, but also mitigation efforts such as the implementation of livestock guarding dogs (LGDs)

and permanent fences rely on their acceptance and commitment.

An opinion survey undertaken in 2013 in Portugal, in the areas near the Spanish border in the districts of Guarda and Castelo Branco, showed that, on average, livestock breeders concur that wolves should exist and do not support the hunting of wolves (Espírito-Santo, 2013). However, there was little homogeneity within this group: many respondents had polarized, either strongly agreeing or strongly disagreeing with the existence of wolves. On the other hand, a 2016 survey (Espírito-Santo, 2017) found that the general public still held the exaggerated view that wolves cause an inordinate amount of damage to livestock, bringing to light a strongly emotional factor: even if wolf-caused livestock losses are in fact low when compared to other causes of livestock mortality, they are nonetheless consistently perceived as being of paramount importance (Boitani, 2000). The 2016 survey showed that livestock breeders kept their views relatively unchanged, remaining “the only interest group with scores always on the negative side”, although not extreme (Espírito-Santo, 2017).

There seems to be a consensus that higher degrees of public involvement are propitious to successful human-wildlife conflicts’ management, even if achieving this may prove difficult (Treves et al., 2009). Early engagement with stakeholders is more likely to lead to high-quality and durable decisions (Reed, 2008). Deliberative, participatory processes may assume multiple guises, from individual interviews to popular assemblies and committees, but they are all designed to allow some degree of direct participation and empowerment, also in domains that concern environmental decision-making, as well as to facilitate deeper discussions and understanding of the values and attitudes at work in each situation, as noted by Bloomfield et al. (1998). According to O’Riordan et al. (1999), the devices of democratic participation also aim to contribute to foster a “creative sense of citizenship in participants”, even if this requires an educated citizenry, able to endure the “arduous processes of co-governing for a better society and environment”. However, these results are highly dependent on the very nature of the process that can bring them about, as Reed (2008) points out. This same author sums up the most relevant promises and known pitfalls of stakeholder participation, such as “consultation fatigue”, which strikes participants in too many ineffectual participatory processes that gain them meagre rewards. Pertinent to the present discussion, another risk is the emergence or strengthening of a dysfunctional consensus, when group discussion

only adds robustness to unfair privileges and minority disenfranchisement.

The plethora of approaches to participation makes it difficult to summarize all methods and strategies in an abbreviated taxonomy. Treves et al. (2009) enumerated no less than 13 different genres of interventions and several dozen subtypes, all aimed at the mitigation of human-wildlife conflicts. Tippet et al. (2007), based on the objectives previously laid out for participation, listed methods that tend to: inform; conceive engagement processes; consult; inform about ongoing implementation of plans; or monitor the participatory practice itself.

1.2. The LIFE MEDWOLF Project

The LIFE MEDWOLF Project (LIFE11 NAT/IT/069), implemented since September 2012 along the border with Spain, in the centre of Portugal, south of the Douro river, foresaw from the start a participatory level of engagement with local stakeholders to reach its goal: to decrease the conflict between wolf presence and human activities in rural areas where the cultural tradition of coexistence with predators was lost. To this end, workshops and public debates were implemented in an effort intended to bring about several benefits: to appease the more irate stakeholders by lending ears and attention to their opinions and grievances; to increase knowledge of their state of mind, attitudes and planned behaviours; and to involve stakeholders in the search for and adoption of remedies to attenuate conflict.

Within the MEDWOLF Project, several steps were taken and different models implemented. Firstly, in October 2014, a workshop was organized in Castelo Branco, bringing together 20 representatives of ten entities, namely local and national livestock breeder associations, as well as wolf researchers and managers from Portugal and Spain. The aim was to inform local stakeholders about the Project and the actions proposed to mitigate conflicts, as well as to survey their main concerns about the wolf presence.

In the same spirit, two meetings were held in November 2014 in two villages in the Almeida municipality, involving a total of 130 participants from 25 parishes and 3 municipalities (Almeida, Pinhel and Guarda).

Originally intended solely for livestock breeders, these meetings were hijacked by the agendas of some local actors and turned into rowdy ceremonies of polarization and mob-like attitudes. The most vocal and angry participants dominated the debate, launch-

ing tirades against wolf conservation, the compensation scheme and the (imaginary) “reintroduction” of wolves. The less angry attendees cried out for the imprisonment of all wolves in enclosures, while the really irate ones demanded that they be shot without a second thought.

Clearly this “open” model for participatory meetings risked working against the Project’s objectives, spreading polarization and silencing moderate voices. Another strategy was needed; one presenting committed stakeholders with an opportunity to collaborate in the search for practical, feasible solutions to the problems they face regarding coexistence with the wolf. A final model was implemented, intended to diagnose poorly understood problems and searching for tentative solutions, all from the stakeholders’ point of view. The majority of invited participants were livestock breeders.

1.3. The Living with Wolves’ Project

Coincidentally, a similar meeting had taken place a month before, in Valladolid, on the other side of the border, organized by the Spanish NGO Ecologistas en Acción. Its stated objectives were to allow farmers to learn about other management experiences, share concerns and exchange opinions; to search for consensus on a series of measures that may facilitate coexistence between wolf and livestock; and to enhance the visibility of livestock farmers who are favourable to coexistence with Iberian wolves. This meeting was the kick-off for a more ambitious project, entitled “Vivir con Lobos” (Living with Wolves), that encompassed further meetings and actions. The most relevant issues identified therein were later subject to an online survey¹ amongst livestock breeders, edited in subsequent meetings, with the goal of creating a consensus document identifying key actions towards coexistence between extensive livestock breeding and wolves, eventually producing a document with formal claims to the different levels of Spanish authorities. This overall process involved over 50 breeders and also resulted in the production of a video documentary and a leaflet focusing

on coexistence between extensive cattle breeding and wolves².

Here, we present the main results of both meetings and provide a brief comparative analysis of their conclusions, in order to achieve a clearer idea of the key issues that affect livestock breeders across the border, with the intention to devise and reinforce common strategies to better mitigate conflicts and help manage this expanding transnational wolf population.

2. Study areas

The LIFE MEDWOLF intervention area covers 5,026 km² in seven different municipalities of Central Portugal along the border with Spain: Figueira de Castelo Rodrigo, Pinhel, Almeida, Guarda, Sabugal, Penamacor and Idanha-a-Nova (Fig. 2). The aver-



Fig. 2. LIFE MEDWOLF Project intervention area, with location of municipalities, Natural Parks and Natura 2000 areas.

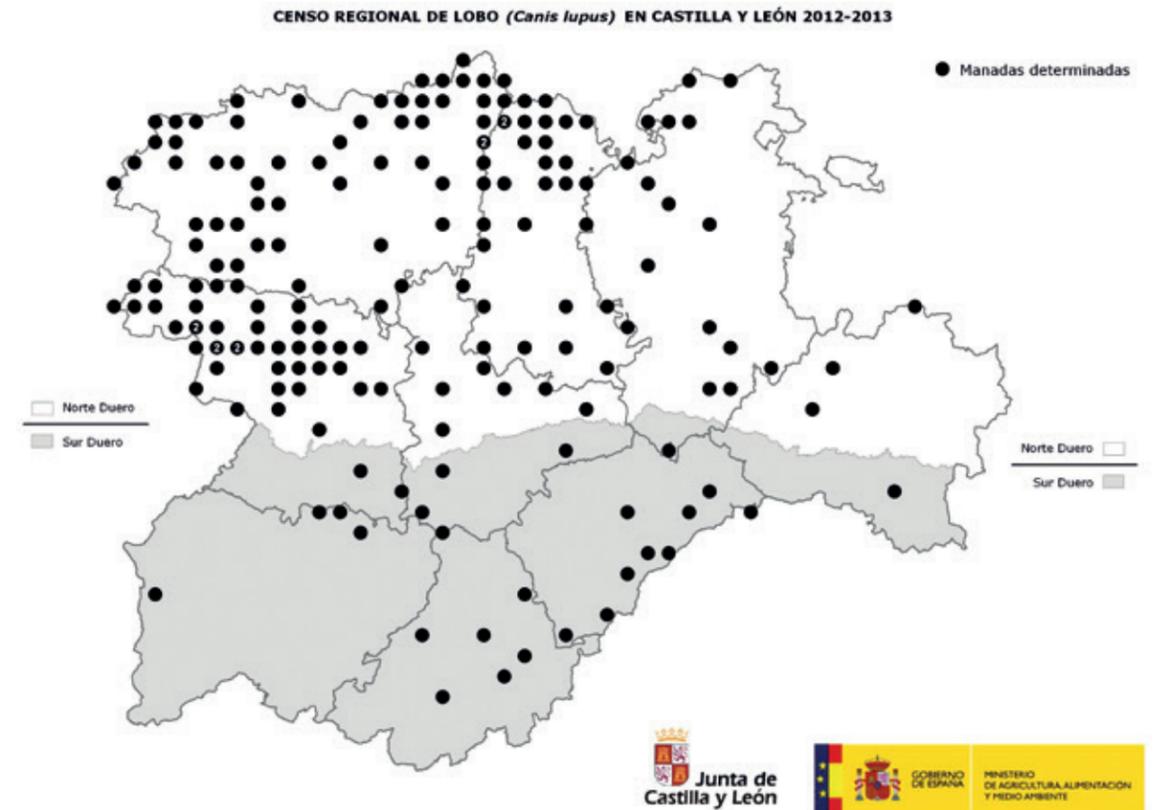


Fig. 3. Distribution of wolf packs in Castilla y León, North and south of the Douro river, according to the last regional census, in 2012–2013. Map from: Sáenz de Buruaga et al., 2015.

age human population density is 18 inhabitants/km², much lower than the national average of 115 inhabitants/km² (INE, 2012). Agriculture and livestock production are the basis of the local economy and the land is mainly divided into small properties.

From the last national survey in 2002–2003 to 2016, the wolf range increased by a factor of 5.5, mainly in the northern part of the area, where one pack’s territory extends into Spain (Palacios et al., 2017). In Portugal, wolves are currently limited to less than 20% of their former distribution area, that once included the entire country (Petrucci-Fonseca, 1990; Pimenta et al., 2005). Now, as wolves are highly dependent on livestock since wild prey is generally scarce (Álvarez et al., 2015), potential for conflict is high.

MEDWOLF’s study area and the autonomous community of Castilla y León (where the Spanish meeting was held) are quite different in size (the latter is larger than the whole of Portugal), although there is not much difference in human population densities. Castilla y León has around 60% of packs confirmed in Spain during both national wolf surveys, in 1987–1988 and 2012–2014 (Blanco et al., 1990; MAPAMA, 2016). According to the most recent survey, the Spanish wolf population has remained more or less stable in number

of breeding packs (297 vs. 294 in the previous survey), but caution should be applied when comparing data, since there was a difference in methods that may have overestimated the number of packs in the earlier study. In several areas of Southern Spain, wolves had been extirpated (e.g. Sierra de San Pedro, Extremadura) or they are on the verge of eradication, as in Sierra Morena (MAPAMA, 2016). In the Castilla y León region, where three official surveys have been carried out during the last 26 years (Blanco et al., 1990; Llaneza and Blanco, 2005; Sáenz de Buruaga et al., 2015), there is a positive evolution of the number of packs but with no overall clear trend in wolf range and number of packs, except in the areas south of the Douro River, where wolves have been trying to establish in the last decades and the number of packs has been increasing, with 27 packs identified in the last survey (Sáenz de Buruaga et al., 2015) (Fig. 3). Where wild prey is abundant, wolf diet is less dependent on livestock, but husbandry systems less adapted to the presence of the wolf may result in more attacks on livestock, especially in areas recently recolonized by wolves, south of the Douro, and where conflicts with livestock breeders may threaten wolf recovery (Llaneza et al., 1996; Barja, 2009; Salvatori and Linnell, 2005).

¹ docs.google.com/forms/d/1kVt6b8q7ORyJ85hfCu-nNDhe3A2jj78dfjhPxMCZuHY/viewform?edit_requested=true

² www.ecologistasenaccion.org/article33288.html

Both countries also differ regarding wolf management: in Portugal the species is listed as endangered, being fully protected under the aegis of national and international laws; whereas in Spain the wolf is a game species north of the Douro river (except in Galicia, where it is partially protected), with hunting quotas established yearly, and fully protected south of the river, under the Habitats Directive (but permits for controlling “problem” animals that prey on livestock are issued annually).

Poaching may have slowed the wolf’s southward expansion in some Spanish provinces, delaying reconnection of the isolated nucleus in Portugal south of the Douro river (a barrier to wolf in the Portuguese territory), with the rest of the Iberian population. In fact, some wolves that seemed to issue from a trans-border pack (Palacios et al., 2017) have been culled in recent years, close to the international border, bringing to light the lack of a concerted strategy between Portugal and Spain regarding the management of the common Iberian wolf population. Moreover, in Portugal a system for compensating wolf damage has been set up, while this is only true in some regions of Spain, while in others, insurances have been implemented.

3. Methods

3.1. The Portuguese meeting

An international meeting was organized in the scope of the MEDWOLF Project and was held on 26th November 2016 at the Agrarian School of Castelo Branco. It involved 38 participants, mostly men 30-60 years old, from Portugal (16), Italy (13), Spain (3), Switzerland (4), France (1) and Canada (1). Livestock breeders formed a majority (20, of which 19 men), but damage prevention specialists and agricultural and livestock production technicians were also present, mainly as observers but also providing technical expertise when required. The participant breeders, originating from wolf areas and representing different regions and husbandry systems (from shepherded flocks to extensively grazed herds), were invited on the basis of their willingness to search for solutions concerning management decisions to reduce wolf impact on livestock in the context of wolf protection, although not all shared a high degree of goodwill towards this predator. Every Portuguese farmer came from the north or centre of the country, four from the MEDWOLF area. Outlooks on their profession ranged from the modern/open to innovation to more traditional/prudent stances.

Each livestock breeder made a brief presentation describing his/her holding, livestock husbandry, main predation issues and difficulties faced, and the measures implemented to deal with them. Talks were grouped according to the type of livestock bred and the production systems employed. Translations were made by the facilitator and the organizers. Farmers of the same nationality were placed together to minimize the need for translations.

After each set of presentations, participants were asked to identify the main difficulties and issues associated with each husbandry system and livestock production in each region. These were written on a board and grouped by topic with the help of the facilitator. Afterwards, a mediated workshop was set up, in a manner akin to Open Space Technology (openspaceworld.org), where groups discussed the difficulties in a debate session meant to find solutions which were then presented to the other groups and listed in a chart, and consensually grouped into topics (Fig. 4).

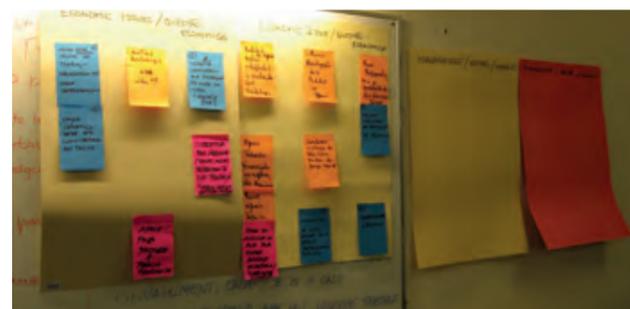


Fig. 4. Talks, working groups and results of the discussion during the Portuguese meeting.

Due to the lengthy debates that ensued, only topics considered most important by participants were discussed during the meeting, while solutions to the less relevant ones were provided later by eight of the participants.

This “marketplace of ideas”, as O’Connor and Cooper (2005) put it, was then captured in a proceedings document, to be delivered afterwards to all participants.

3.2. The Spanish meeting

The meeting, held on 31st October 2016 in Valladolid, northwest central Spain, involved only livestock breeders (20, of which 18 men), from holdings producing sheep, goats and cattle. All came from wolf areas in the autonomous regions of Extremadura, Madrid and Castilla y León, and were between 35 and 60 years old. The goal was to replace discussions between them and conservationists with a process that relied solely on their inputs and analysis to identify the main problems faced by their activity and propose workable solutions. The participants came from different contexts, whether pertaining to the wolf’s legal status, habitat characteristics, predominant grazing systems or types of livestock.

The proceedings started with the participants presenting themselves, their holdings and their struggle to coexist with the wolf. Then, a preordained list of themes to discuss was introduced, based on previous meetings with farmers. This comprised: a) measures to be taken by the state (processing of compensation claims, improving valuation of damage, management

of feral dogs); b) preventive measures that can be adopted by breeders with state support (non-collection of carrion, selection of breeds, LGDs, donkeys, etc.); c) socio-economic valorisation of products associated with extensive grazing in areas with wolves (fair prices, special branding, cultural interest, ecotourism); d) improvement of communication and spreading of information and research in this area between the media, social organizations, ecologists, livestock associations, researchers, administrations, etc. Each of these subjects was discussed in a dedicated group with its own table using the World Cafe method (www.theworldcafe.com): a system that subdivides participants into groups that discuss a specific theme in 20-minute sessions. Subsequently, groups share their insights with the whole assembly.

One participant at each table was fixed and the rest rotated every 10 minutes, until they had all been through all the tables. The ideas discussed were written on paper tablecloths, in a continuous fashion. When this stage ended, a spokesperson for each table shared with everyone the recommended measures. These were expressed in the most consensual way possible, written on post-it notes and placed on the wall (Fig. 5). The next step, assigning a priority degree to each proposal, revealed itself to be rather complex, since all of them were deemed important, and thus this was not factored in at this stage. The conclusions formed, later on, the basis for a subsequent survey – intended to rank the proposals by their order of relevance.

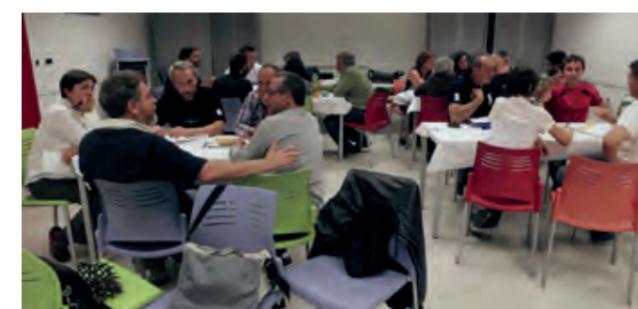


Fig. 5. Discussion, working groups and results of the Spanish meeting³.

³Some of the images are from the documentary produced by Ecologistas en Acción, focusing on coexistence between extensive cattle breeding and wolves: www.ecologistasenaccion.org/articulo33288.html.

4. Results

4.1. The Portuguese meeting

The initial discussion that arose during the workshop identified 35 different difficulties that were divided into five broad categories: economical, management/grazing systems, product value, societal and environmental. Thirty-four solutions were proposed regarding the difficulties included in the first two of these categories and 77 pertaining to the last three categories. A consensual list of proposals was produced and is summarized in Table 1.

The proposed solutions to deal with the economic difficulties revolved mainly around the need to have feasibility studies and technical support to holdings in terms of predation risk and use of prevention measures that should also be subsidized; on the need to improve damage assessment processes and compensate indirect costs of predation, even if this entails creating special subsidies for holdings in the wolf range, whilst all subsidies' granted should be better controlled and linked to the use of prevention measures and take in consideration the predation losses. The subsidy procedures should avoid detrimental con-

Table 1. Summary of solutions proposed by Portuguese livestock breeders for each of the difficulties identified, grouped into five broad categories.

Issues identified	Proposed solutions
Economics	
Actual costs caused by wolf attacks and insufficient compensations.	Include reproductive stress in damage costs, as well as the genetic value of livestock and the hours spent looking for runaway animals. Grant special subsidies to all the holdings located in wolf territory. Closer inspections of state support to livestock production. Take into account wolf attacks, regarding those support schemes. Make them partially dependant on the implementation of protective methods.
Costs brought by changes to cattle management systems.	More support from breeders' associations in the elaboration of feasibility studies. The state should give technical support to holdings.
Tardiness and difficulties of the compensation process.	Require more professional and sensitive attitudes from technicians evaluating damage. Improve their capabilities, e.g. through the use of DNA analysis.
High costs of LGD maintenance, penning and fences.	Implement support measures that are adequate to the holding's realities. Demand subsidies for protection methods such as LGDs, shepherding and fencing.
Management/grazing	
Confinement: during winter, animals stay confined between 4pm and 8am, a long period without feeding. Problems with humidity when confining calving cows in fences. Difficulties when confining animals: some are frightened and do not want to get inside. Animal welfare at risk with confining procedures. Hoof problems during confinement. Increasing sanitary risk with confinement in smaller pastures/fences.	Distribute food to all animals evenly during confinement inside fences, to make the entry of all animals easier, avoiding dominant animals preventing others from entering. Increase the size of the fences: they should be adjusted to the size of the flock/herd. Train livestock to stay inside fences. Use temporary fences, e.g. electric fences, which are easy to move.
Management: heterogeneity among holdings precludes any one-size-fits-all solution; specific management measures and support systems are needed. The magnitude of all previous problems increases in large holdings (> 1,000 sheep), where more LGDs and fences are needed. Entities on the ground do not work together.	Transition to smaller herds/flocks. Each holding should have its own management plan. More pilot actions should be developed. Provide training/ information to livestock breeders and shepherds about production, nutrition and health/welfare of livestock
Imminent loss of autochthonous breeds, replaced by other breeds less adapted to the region. Changing management may entail a loss in quality and value of local products.	Raise awareness about the advantages/disadvantages of producing specific breeds of livestock in a given husbandry system. Financial support to autochthonous breeds.

Issues identified	Proposed solutions
Birth detection and breeding synchronization are complex tasks.	Provide training to shepherds.
It is hard to change livestock breeders' mentalities, making them accept LGDs and, with night penning, getting to know the habitat and the surroundings.	New technologies (e.g. GPS collars) should be implemented. Promote studies to evaluate damage prevention measures and deepen understanding of predator behaviour. Provide more information to livestock breeders and shepherds.
Insufficient rapport with society and the government.	Increase society's respect for the work done by livestock breeders and promote the self-reliance of younger breeders. A group of mediators that support livestock breeders and report to the government should be created. Livestock breeders should always be consulted when solutions to their problems are being sought.
Product value	
Environmental services of production are not considered in the payment of wolf damage compensation.	Include environmental services of production in the financial compensation for wolf damage.
Uncontrolled selling chain and low selling prices. Even though they have premium quality, meat and milk are increasingly hard to sell.	A shorter selling chain from producers to consumers and local restaurants and fairs, maybe even with the help of mobile abattoirs. Certified brands, products, perhaps linked to a Producers' Association that gives added value to products from wolf territories. Synchronize births to maximize them in the best-selling months (e.g. August).
Society	
How to alert society to the problems faced by livestock breeders?	Awareness campaigns by agricultural associations to show the origin of our daily food.
Local communities sometimes find it difficult to accept the presence of LGDs.	Local networking to improve acceptance of farmers and dogs and their impact on the landscape and ecological aspects. Teach neighbours to get to know them. Distribute leaflets and information panels near zones where LGDs are active.
Lack of awareness of the shepherd profession.	Upgrade the social status of shepherds through specialized schools, uniforms and proper wages.
Poor knowledge of rural areas and of the specificities of each region.	Fight the tendency for depopulation of rural areas, nurturing the passion for nature and adding value to associated experiences.
Uncontrolled and intensive tourism in natural areas.	Monitor tourist presence, inform them about recommended paths and proper behaviour when facing LGDs. Promote small and sustainable ecotourism projects. State tourism offices should treat livestock holdings as partners, making sure that they get their fair share of tourism revenues – after all, they are responsible for much of the beautiful landscape.
Environment	
Lack of wild prey, inadequate hunting management.	Protect and improve the status of ungulate populations, starting with more studies. Better control of hunting activities and zero tolerance of poaching. Liaison between hunters' associations and livestock breeders. Start cereal plantations that may help feed ungulates.
Poisoning when wolves appear: poison linked to wolf expansion, kills the predator community.	Provide alternatives to poison, even if this entails the culling of wolves by local authorities. Spread information on the damage and danger posed by poison. Stricter enforcement of the law.
Removal of carrion should be avoided, since it represents a food source for other species.	Hardly compatible with tourism or water-sensitive areas, but it could be standard practice away from populated zones.

sequences to farmers. In terms of the concrete difficulties of livestock management, confinement can be eased by adjusting the size and type of fences and livestock behaviour, by reducing the number of head and selecting adequate breeds (higher support to local breeds should be considered). Demonstration actions and research about predation and prevention measures should be promoted, as well as extra training for farmers, including the use of new technologies (e.g. GPS collars). Each holding should count on a suitable management plan and the help of mediators, connected to authorities. Boosting farmers' confidence and societal recognition of their important role must further their involvement in decision-making.

Increased product value, certification processes and shorter market chains should be implemented, as well as the adaptation of production to seasonal demand, while environmental services provided by farmers should also be compensated. Regarding the relation of farmers with society, a better understanding of the important work they do (e.g. production of quality food, biodiversity and landscape conservation) could be achieved through awareness-raising campaigns and by networking within the community. This can also be attained through specialized training of farmers aimed at upgrading their social status, promoting farming and nature conservation as a means to fight depopulation of rural areas, as well as ecotourism with farmer involvement. It was deemed necessary to explain to passers-by and neighbours how to behave in the presence of LGDs in order to increase their acceptance, possibly by posting informative signs.

Concerning environmentally-related issues, the promotion of wild prey (e.g. feeding crops, poaching control) was seen as important and should benefit from a closer collaboration between farmers and hunters. Measures to prevent use of poison should also be considered, given the huge impact this practice has on the faunal community. Not removing livestock carcasses, that can be an important source of carrion for predators and may reduce the need to attack livestock, can also be a partial remedy for the scarcity of wild prey, considering the dependence of wolves on livestock.

It should be noted that removing carcasses may not be beneficial in this case, as opposed to regions where wild prey is abundant and carcass removal may avoid attracting wolves to farms and increasing the probability of them preying on livestock (Morehouse and Boyce, 2011).

4.2. The Spanish meeting

A total of 66 actions and solutions were identified by the discussion groups within the four topics proposed at the onset of the meeting, with some transversal to all topics (Table 2). Regarding the first topic, supporting measures by the state authorities, proposals focused mainly on improving the existing conditions for livestock breeding, including the legal framework (e.g. grazing limitations); providing subsidies and infrastructures to enable farmers to develop their activity (namely smaller holdings); adapting, in advance, to the presence of predators, even by promoting shepherding; stopping wolf control from becoming a profitable activity; focusing on problem wolves; adapting game management to wolf presence; demanding timely and fair compensation (including profit losses), linked to the use of prevention measures and based on independent assessment; clearing vegetation around pastures to reduce refuges for predators; creating sites for carcass disposal (so they can be fully consumed by necrophagous birds, such as vultures); collaborating with authorities in management issues; and training and promoting training in schools and universities.

Regarding livestock management and damage prevention measures, proposals focused on the improvement of herd management (e.g. clearing vegetation, protecting young animals); resorting to the institution of communal flocks and shepherding; increasing knowledge about wolves and the territory; improving training (e.g. shepherd schools), namely on the use of damage prevention measures, that should be in place in advance of wolf expansion; adapting a proactive stance; disposing of carcasses for necrophagous animals (as mentioned before); sharing success stories but also looking into mistakes made.

Vis-à-vis product valorisation, proposals were to differentiate and add value to those products resulting from coexistence efforts; to promote networking among farmers; to support working collaboration with environmentalists; to dignify and value the profession and increase its visibility and proximity with the public.

The “communication and research” proposals included better communication from breeders and with environmentalists; a more efficient imparting of information about the wolf in rural areas; and conveying correct data without concealing the facts.

Table 2. Measures proposed by Spanish livestock breeders to deal with four main topics: supporting measures, management and prevention measures, valorisation of products, communication and research.

Supporting measures by the authorities
Help to maintain LGDs.
CAP payment in cash.
Recognize the work of LGDs, also regarding the general population.
Adapt legislation for all uses of the forest.
Wolf hunting must not be turned into a business, either for hunters or the state.
Fair and timely compensation, but only for those with preventive measures in place.
Pay profit losses, not only south of the Duero river.
Wolf population control, not necessarily by culling, removal of problem individuals.
Clear bushes to remove refuges for predators.
Shepherds paid to tend livestock in rotating schedules.
Extra costs, such as fencing, should be paid by the state.
Preventive measures to be taken before the wolf reaches an area, not only after attacks.
Adequate sites to dispose of carcasses for necrophagous animals should be instigated and maintained.
State biologists should train holding personnel.
The shepherd profession should be dignified.
Laws for extensive grazing, etc.
Plan in conjunction with the administration.
Have the extensive grazing system taught at high school, universities and vocational training.
Independent damage assessment is indispensable.
Corrals on public or communal hills.
Different game management systems in wolf and non-wolf areas, to protect wildlife.
Adapt legislation to small farms.
Create conditions, through subsidies, for people to live in the countryside.
Build or rehabilitate infrastructures to keep sheep in high mountains, so they do not have to return to barns at night.
Livestock management and protection.
Livestock management and damage prevention measures
Unification of herds during summer.
Differentiate the breeder from the profiteer.
Disposal of carcasses in appropriate sites for necrophagous animals.
Learning the management of LGDs.
Electric fences.
Pen cattle at night and at noon.
Capitalism is to blame for profit losses.
We need to return to shepherding.
Get to know your territory.

Livestock management and damage prevention measures

- A school for shepherds.
- Admit our mistakes.
- Guarding donkeys' management is unknown.
- Have a shelter with a good enclosure for calves.
- More careful grazing of calves and their mothers.
- Farmers should learn more about wolves.
- Synchronization of births, scheduling calving cows so that they take care of calves once a year.
- Learn from the elderly but also train, recycle and update.
- Learn a lot about the wolf, its life cycle, etc.
- Prevent rather than regret.
- Close feedlots.
- Create shepherds' networks.
- Learn about LGDs.
- Be with your cattle at all times.
- Breeders should be continuously informed by authorities about wolf presence and related prevention measures.

Product valorisation

- Dignify the profession.
- Programmes to bring the rural world nearer to the cities.
- Make the profession more well-known.
- "Extensive grazing" stamp for products.
- Better product flow between producer and consumer, e.g. direct sales, so that the consumer is not so taxed.
- More local, mobile or ethical abattoirs, like in other countries.
- Environmental groups should have sections on their websites dedicated to selling these products.
- Common ways of working among farmers, creating networks of collaboration and mutual support.
- Breeders should be included in local workshops and festivals.
- Social networks and internet presence.
- Another special brand, for breeders who protect necrophagous birds.

Communication and research

- Better breeders' associations.
- Facilitate the union and collaboration between breeders and ecologists, to share objectives and use a single voice when addressing the state.
- Convey truthful information.
- Avoid denial of attacks.
- Educate people in the countryside as well as in the city.
- Education in schools and universities.
- Communicate the role of the wolf as a regulator of ungulates.
- Bring society outside.

4.3. A brief comparison

Differences notwithstanding, some common leit-motifs are easy to find in the documents that were issued after the two meetings: a strong yearning for the dignification and public recognition of livestock breeding and shepherding; a will to differentiate their products through the creation and marketing of special brands, either showcasing autochthonous breeds or the producers' commitments regarding coexistence with predators; a marked dependence upon state-issued subsidies – to be expected from professionals that feel that their livelihood is threatened and marginalized; nearly equal complaints about compensation measures, from both sides of the border, namely deploring their scope, financial suitability and lengthy/opaque processes; insufficient experience and practical difficulties with the implementation of LGDs, e.g. regarding coexistence with tourism activities; the need for more interconnectedness between professionals; the absolute necessity of more wild prey and to adapt game management in order to improve alternative prey and diminish the number of wolf attacks on livestock.

Besides these broad, omnipresent and somewhat political concerns, other issues of a more technical nature were deemed important by Spanish and Portuguese breeders and should be looked into in detail and encourage further discussion: problems that have to do with calving, stabling, and more. Practical ideas like the synchronization of births in cows, night penning, mainly of young and more vulnerable livestock, and the possibility of legal abandonment of carcasses in the wild also seem of transnational relevance. Furthermore, the suggestion that mobile abattoirs can contribute to the creation of new and more efficient distribution channels cropped up in both meetings.

Whether because of the nature of these two meetings or through differences in data collection methods, the Portuguese side seems to have focused more on the search for solutions, with quite a few being produced in response to each stated problem. This can also be explained by the presence of participants from different regions, that brought to the proceedings greater experience with wolf presence.

Nonetheless, interesting ideas also arose from the Spanish meeting, e.g. persuading environmental organizations to reserve a section of their websites for the sale of wildlife-friendly products, the possibility of instituting communal flocks, subsidizing shepherds and setting up structures to keep sheep in high mountains, during the night in summer pastures.

One must keep in mind that participants in both

meetings were not randomly selected but were all volunteers, most of them already supporting coexistence with the wolf and open to the use of mitigation methods. Even so, the collective state of mind that emerged from these proceedings is remarkable: people of different age brackets that were committed to finding ways to share the land with predators. They were eager for information, support and a role to play in management decisions. Thus, those who fight for wolf conservation can count on an articulate and active segment of livestock breeders that do not view them as adversaries; people that strive to improve their working conditions and the way that the public sees them. Working not against nature but alongside it.

5. Looking forward

These proceedings show the trove of information and ideas that can be obtained from a participatory process and that could hardly be accessible by other means. Some of the suggestions will surely be scrutinized and evaluated by management authorities and other stakeholders.

There are also other advantages to this process. As it spreads, active engagement with stakeholders may have an important consequence, besides civic commitment, trust building, creative citizenship, enhanced Project communication and data mining. When more and more socially relevant members of the livestock breeder community are seen adhering to this ongoing process, the descriptive norms around the profession's praxis will likely undergo subtle but relevant changes: as behaviours and attitudes towards wolves become more and more tolerant or at least muted, more positive intentions will flourish in the community.

A brief analysis of the literature (e.g. Chess and Purcel, 1999) provides us with clues that may help us keep in mind a short set of rules of thumb for future efforts in this domain, e.g. "Stakeholder participation needs to be underpinned by a philosophy that emphasises empowerment, equity, trust and learning"; "Clear objectives for the participatory process need to be agreed among stakeholders at the outset"; "Methods should be selected and tailored to the decision-making context, considering the objectives, type of participants and appropriate level of engagement" (including the need to foresee the participation of illiterate citizens) and, finally, "Participation needs to be institutionalised", highlighting the fact that in the long run, success may depend on institutionally giving livestock breeders' participation a relevant role for future policy-making.



Photo: Joaquim Pedro Ferreira.

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ABSTRACTS OF SCIENTIFIC ARTICLES

LETHAL CONTROL AND HUNTING

WOLF LETHAL CONTROL AND LIVESTOCK DEPREDATIONS: COUNTER-EVIDENCE FROM RESPECIFIED MODELS

Niraj Poudyal,
Nabin Baral,
Stanley T. Asah
PLoS ONE 11: e0148743 / 2016

We replicated the study conducted by Wielgus and Peebles (2014) on the effect of wolf mortality on livestock depredations in Montana, Wyoming and Idaho states in the US. Their best models were found to be misspecified due to the omission of the time index and incorrect functional form. When we respecified the models, this replication failed to confirm the magnitude, direction and often the very existence of the original results. Wielgus and Peebles (2014) reported that the increase in the number of wolves culled the previous year would increase the expected number of livestock killed this year by 4 to 6%. But our results showed that the culling of one wolf the previous year would decrease the expected number of cattle killed this year by 1.9%, and the expected number of sheep killed by 3.4%. However, for every wolf killed there is a corresponding 2.2% increase in the expected number of sheep killed in the same year. The increase in sheep depredation appears to be a short term phenomenon.

CONFLICT MISLEADS LARGE CARNIVORE MANAGEMENT AND CONSERVATION: BROWN BEARS AND WOLVES IN SPAIN

Alberto Fernández-Gil,
Javier Naves,
Andrés Ordiz,
Mario Quevedo,
Eloy Revilla,
Miguel Delibes
PLoS ONE 11: e0151541 / 2016

Large carnivores inhabiting human-dominated landscapes often interact with people and their properties, leading to conflict scenarios that can mislead carnivore management and, ultimately, jeopardize conservation. In northwest Spain, brown bears *Ursus arctos* are strictly protected, whereas sympatric wolves *Canis lupus* are subject to lethal control. We explored ecological, economic and societal components of conflict scenarios involving large carnivores and damages to human properties. We analysed the relation between complaints of depredations by bears and wolves on beehives and livestock, respectively, and bear and wolf abundance, livestock heads, number of culled wolves, amount of paid compensations, and media coverage. We also evaluated the efficiency of wolf culling to reduce depredations on livestock. Bear damages to beehives correlated positively to the number of female bears with cubs of the year. Complaints of wolf predation on livestock were unrelated to livestock numbers; instead, they correlated positively to the number of wild ungulates harvested during the previous season, the number of wolf packs, and to wolves culled during the previous season. Compensations for wolf complaints were fivefold higher than for bears, but media coverage of wolf damages was thirtyfold higher. Media coverage of wolf damages was unrelated to the actual costs of wolf damages, but the amount of news correlated positively to wolf culling. However, wolf culling was followed by an increase in compensated damages. Our results show that culling of the wolf population failed in its goal of reducing damages, and suggest that management decisions are at least partly mediated by press coverage. We suggest that our results provide insight to similar scenarios, where several species of large carnivores share the landscape with humans, and management may be reactive to perceived conflicts.

ECOLOGY OF PROBLEM INDIVIDUALS AND THE EFFICACY OF SELECTIVE WILDLIFE MANAGEMENT

George J. F. Swan,
Steve M. Redpath,
Stuart Bearhop,
Robbie A. McDonald
Trends in Ecology & Evolution 32,
518-530 / 2017

As a result of ecological and social drivers, the management of problems caused by wildlife is becoming more selective, often targeting specific animals. Narrowing the sights of management relies upon the ecology of certain 'problem individuals' and their disproportionate contribution to impacts upon human interests. We assess the ecological evidence for problem individuals and confirm that some individuals or classes can be both disproportionately responsible and more likely to reoffend. The benefits of management can sometimes be short-lived, and selective management can affect tolerance of wildlife for better or worse, but, when effectively targeted, selective management can bring benefits by mitigating impact and conflict, often in a more socially acceptable way.

IMPACTS OF LARGE CARNIVORES

COSTS OF LIVESTOCK DEPREDATION BY LARGE CARNIVORES IN SWEDEN 2001 TO 2013

Marit Widman,
Katarina Elofsson
Ecological Economics 143,
188-198. / 2018

Livestock depredation by large carnivores entails economic damage to farmers in many parts of the world. The aim of this paper is to analyse and compare the costs of livestock depredation by carnivores in Sweden across different carnivore species and counties. To this end, we estimate the government's compensation cost function using Swedish data on the county level over the period of 2001 to 2013. Compensation costs due to depredation by three large carnivores are considered: the brown bear (*Ursus arctos*), the wolf (*Canis lupus*) and the lynx (*Lynx lynx*). The results show that a 1% increase in the density of the carnivores leads to a 0.3–0.4% increase in compensation costs, whereas a 1% increase in the density of sheep results in a 0.8 and 1.1% increase in the compensation costs for brown bears and wolves, respectively. A larger share of unfenced pastures is associated with higher compensation costs for brown bear. The marginal cost of an additional carnivore individual varies considerably between counties, ranging between 1 and 82 EUR for lynxes, 0 and 266 EUR for brown bears, and 52 and 1067 EUR for wolves.

HUMAN DIMENSIONS

MODERNIZATION, RISK AND CONSERVATION OF THE WORLD'S LARGEST CARNIVORES

Bruskotter, J. T.,
J. A. Vucetich, G. Karns,
M. J. Manfredi, C. Wolf, K. Ard,
N. H. Carter, J. Lopez-Bao,
S. Gehrt, W. J. Ripple
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Large carnivores are threatened worldwide by a variety of human-driven factors, including persecution, which regularly results when they come into conflict with people. Although human activities are almost universally viewed as negatively affecting carnivore conservation, we contend that conservation outcomes for carnivores are improved when social and economic forces reduce the risks associated with these species and facilitate the acquisition of values favorable to their conservation. We make three specific propositions: (1) societal tolerance for carnivores is affected by the distribution of risks and benefits associated with these species, (2) modernization and its associated social changes reduce the risks associated with large carnivores and their conservation, and (3) modernization induces lasting effects on conservation by changing societal values. We review existing evidence and present cross-sectional data showing that variation among nations in large carnivore conservation outcomes are related to three facets of modernization believed to reduce the risks associated with large carnivores.

THE ACHILLES HEEL OF PARTICIPATORY CONSERVATION

José Vicente López-Bao,
Guillaume Chapron,
Adrian Treves
Biological Conservation 212(A),
139-143. / 2017

Although participatory planning for conservation has gained prominence over the past few decades, whether this process is successful in protecting biodiversity is still controversial. Moreover, the initial, constitutive decisions about whom to include in the process may undermine the sometimes-implicit goal that non-participants will find the outcomes legitimate and equitable. Different pitfalls relate to the proper representation of all public interests, such as tyranny of the minority or conflicts of interest. We focus on the effective integration of the broad public interest into decisions on use and preservation of the environment, including biodiversity, and we argue why the broad public interest should be considered a prerequisite to processes that are democratic, legitimate and equitable. When narrower interests become entrenched, conservation conflicts can become chronic as opponents take irreconcilable positions and polarize debate. Participatory decision-making processes could be improved by codifying the democratic principles of intergenerational equity and the public trust doctrine. We make recommendations on how to integrate the broad public interest in conservation decisions.

A CULTURE OF TOLERANCE: COEXISTING WITH LARGE CARNIVORES IN THE KAFA HIGHLANDS, ETHIOPIA

Fikirte Gebresenbet,
Brhane Baraki,
Gidey Yirga,
Claudio Sillero-Zubiri,
H. Bauer
Oryx, 1-10 / 2017

We assessed losses of livestock to lions *Panthera leo* and leopards *Panthera pardus* in the Adiyo and Gimbo districts in Kafa Biosphere Reserve, Ethiopia. We quantified the economic impact, conducted household and group interviews, and explored potential solutions with local people. During 2009–2013 there were 350 and 62 attacks by lions and leopards, respectively. Households that suffered attacks on their livestock lost a mean of USD 287 and USD 310 in 2012 and 2013, respectively. Although lion attacks are more frequent than leopard attacks, our qualitative data indicate that tolerance for the former is higher because lions are more respected in the local culture. We describe how depredation is culturally mitigated and how retaliatory killing is avoided. Given people's tolerance towards them, carnivores may persist in their highland refugium, opening an arena for conservation that is not strictly linked to protected areas or to classical economics.

COMPENSATION METHODS

BUILDING PUBLIC TRUST IN COMPENSATION PROGRAMS THROUGH ACCURACY ASSESSMENTS OF DAMAGE VERIFICATION PROTOCOLS

José V. López-Bao,
Jens Frank,
Linn Svensson,
Mikael Åkesson,
Åsa Langefors
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36-41 / 2017

Reliable verification of damage claims is fundamental to create public trust in the legitimacy of compensation programs, and avoid fraud and moral hazards. However, after decades of using this tool, transparency in verification processes and availability of quantitative information on the accuracy and misidentification rates are unresolved issues. Accurate rules overcome several challenges facing compensation programs worldwide, such as the difficulty of proving claims, lack of compensation or insufficiency of community support. Here, we tested the accuracy of the verification protocol of damage claims used in Sweden for large carnivore depredations on sheep. In Sweden, verifiers (who will determine if a livestock owner is compensated or not after a suspected attack) uses rules grounded on typical bite marks from each predator species on animal carcasses. Contrasted with DNA salivary analysis, verifiers correctly identified wolf and lynx as the culprit species in 86% (n = 57) and 91% (n = 11) of cases tested, respectively, and the overall accuracy in identifying a predation event was 94%. We believe that rigorous tests of current damage verification protocols are essential to show people the frequency that predation results in compensation, as well as how often other causes of livestock death or injury are erroneously interpreted as being inflicted by large carnivores. The use of DNA salivary analysis to test the accuracy of damage verification protocols is transferable to any livestock-carnivore conflict scenario worldwide, as well as to other wildlife, such as ungulates browsing on forest plantations and crops.

WILDLIFE TOURISM

THE NUMBERS OF THE BEAST: VALUATION OF JAGUAR (*Panthera onca*) TOURISM AND CATTLE DEPREDATION IN THE BRAZILIAN PANTANAL

Fernando R. Tortato,
Thiago J. Izzo,
Rafael Hoogesteijn,
Carlos A. Peres
Global Ecology and Conservation 11,
106-114 / 2017

Large carnivores fascinate people because of their beauty and potential as human predators and have therefore become focal species for the ecotourism industry. Wildlife tourism has grown exponentially and has often been used as a financial argument for species conservation. However, carnivores depredate livestock, leading to a direct economic conflict with rural livelihoods, often resulting in lethal retaliation action. Here we show that jaguar ecotourism represents a gross annual income of US\$6,827,392 in land-use revenue across a representative portion the Brazilian Pantanal, the world's largest wetland. Considering the aggregate costs of jaguar depredation on livestock within the same area, we estimate that the resident jaguar population would induce a hypothetical damage of only US\$121,500 per year in bovine cattle losses. This large discrepancy between economic gains and losses reinforces the importance of wildlife tourism as a conservation tool in boosting tolerance of jaguars in private ranches. We also evaluate the partnership between ecotourism and cattle ranchers, in which cattle losses induced by jaguars could be compensated by a system of voluntary donations from tourists, ensuring that both traditional livestock husbandry and ecotourism can co-exist within the same ranches, thereby promoting landscape-scale jaguar conservation.

Publications*

BOOKS

Wolves, Courts, and Public Policy: The Children of the Night Return to the Northern Rocky Mountains

By Edward A. Fitzgerald / 2015 / Lexington Books / 223 pp

This book examines the reintroduction and recovery of the wolf in the Northern Rocky Mountains. The wolf was driven to brink of extinction through conscious government policy. The Endangered Species Act of 1973 provided the means for wolf's return, which began in the Carter administration and continues in the Obama administration. The battle over the wolf is part of a larger struggle over the management of public lands, generating public law litigation. Interest groups brought suit in federal courts, challenging the Department of Interior's implementation of policy. The federal courts were required to interpret the statutory mandates and review Interior's decisions to insure statutory compliance. The analysis of this public law litigation demonstrates that the federal courts correctly interpreted the statutory mandates and properly supported and checked Interior's decisions. This book focuses on the controversial role of the courts in the resolution of public policy conflicts. Judicial skeptics argue that the courts should not get involved in complex public policy disputes as Judges lack the expertise and information to make informed decisions. Judicial proponents, by contrast, argue that judicial involvement is necessary so Federal courts can oversee federal agencies, which are under conflicting pressure from interest groups, the President, Congress, and their own internal dynamics. This book supports the conclusions of judicial proponents and points out that the federal courts have been instrumental in the return and recovery of the wolf to the Northern Rocky Mountains.

Conflicts in Conservation: Navigating Towards Solutions. Ecological Reviews

Edited by Stephen M. Redpath, R. J. Gutiérrez,
Kevin A. Wood and Juliette C. Young
2015 / Cambridge University Press / 315 pp

Conflicts over the conservation of biodiversity are increasing and are serious obstacles to wildlife conservation efforts worldwide. Changing patterns in land use, over-exploitation, pollution, climate change and the threat posed by invasive species all challenge the way we currently maintain and protect biodiversity – from the local management of single species to the international management of resources. Integrating approaches from different academic disciplines, policy makers and practitioners, this volume offers a radically new, cross-disciplinary, multi-scale approach to deal with conflicts. Ground-breaking strategies for conservation are analysed and a large section of the book is devoted to exploring case studies of conflict from around the world. Aimed

*Texts from the books' publishers.

primarily at academics, researchers and students from disciplines relating to conservation, ecology, natural resources management and environmental governance, this book will be equally valuable to conservation NGOs, practitioners and the policy community at national and international levels.

Wildlife Politics

By Bruce Rocheleau
2017 / Cambridge University Press / 382 pp

Attitudes towards charismatic animals such as tigers, lions, bears and wolves vary greatly and change over time, resulting in bitter political debates. This comprehensive book identifies and analyses the factors that influence policies across the globe, highlighting how this impacts conservation as a whole. Issues such as overexploitation, hunting, ecotourism and the struggle to prevent illegal wildlife trafficking are examined and science's role in policymaking is assessed. The conflicting forces behind legislation, including institutions, interest groups and the media are analysed, with particular focus on the significance of the Endangered Species Act, covering over forty-five species that have become matters of political debate in sixty-seven different countries. Case studies and conceptual frameworks provide a clear understanding of the key topics, shedding light on this important yet often overlooked area of environmental politics.

Decision-Making in Conservation and Natural Resource Management. Models for Interdisciplinary Approaches

Edited by Nils Bunnefeld, Emily Nicholson and E.J. Milner
Gulland / 2017 / Cambridge University Press / 286 pp

Making decisions about the management and conservation of nature is necessarily complex, with many competing pressures on natural systems, opportunities and benefits for different groups of people and a varying, uncertain social and ecological environment. An approach which is narrowly focused on either human development or environmental protection cannot deliver sustainable solutions. This volume provides frameworks for improving the integration of natural resource management with conservation and supporting stronger collaboration between researchers and practitioners in developed and developing countries. Novel approaches are required when ecological and social dynamics are highly interdependent. A structured, participatory, model-based approach to decision-making for biodiversity conservation has been proven to produce real-world change. There are surprisingly few successful case studies, however; some of the best are presented here, from fisheries, pest management and conservation. Researchers and practitioners need this interdisciplinary approach, focused on quantitative tools that have been tested and applied, and learning from success.

MEETINGS OF INTEREST

Canine Science Forum

Budapest, Hungary
3-6 July 2018
csf2018.elte.hu

Animal Behaviour Society Annual Meeting

2-6 August 2018
University of Wisconsin-Milwaukee, USA
www.animalbehaviorsociety.org

26th International Conference on Bear Research & Management

16-21 September 2018
Ljubljana, Slovenia
dinalpbear.eu/save-the-date-for-life-with-bears

International Wolf Symposium 2018: Wolves in a Changing World

12-14 October 2018
Minneapolis, Minnesota, USA
www.wolf.org/programs/symposium-2018

LINKS

Ganaderos Ibericos Unidos
ganaderosibericosunidos.com

Ganaderas en Red
familydogproject.elte.hu
www.facebook.com/GanaderasenRed/

Human-Wildlife Conflict Resource Library
www.hwctf.org/resources/document-library

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We invite you to continue reading and collaborating with the CDPNews. If you are working on a project or study dealing with any aspect of predation by carnivores on livestock and damage prevention measures please contact the editors to discuss ideas for an article in a future issue. Thank you for your collaboration!

The Editors

You can download the issues of the Carnivore Damage Prevention News produced within the LIFE MEDWOLF at the project's website:

www.medwolf.eu

