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THE CANOVIS PROJECT:
Studying internal and external factors that may influence livestock guarding dogs' efficiency against wolf predation

LIVESTOCK GUARDING DOGS IN EUROPE:
paying attention to the context is important when managing complex human-wolf-dog relationships

AN INNOVATIVE APPROACH
to mitigate the conflict between large carnivore conservation and local communities

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EDITORIAL

Dear Readers,

It seems hard to believe that it has been nine years since we last wrote an editorial for Carnivore Damage Prevention News. But it's true. CDPNews ran from March 2000 until December 2005, producing nine issues that covered just about all aspects of the conflicts between large carnivores and people, with a focus on livestock production. During its first incarnation, CDPNews provided a valuable forum to exchange experience and ideas, filling a niche that the more scientific journals could never fill. However, funding ran out and the newsletter went into a long hibernation. Unfortunately, the conflicts between carnivores and people have not diminished during the intervening period, and the need for this newsletter has been underlined many times to facilitate the transfer of the ever increasing body of experience and methods that exists on conflict mitigation. Luckily for us all a new project (MedWolf www.medwolf.eu), funded by the European Commission's LIFE program has recognized the need for this newsletter and has decided to fund it for the next three years. The new Editor-in-Chief is Silvia Ribeiro from Portugal, and she is joined by Daniel Mettler from Switzerland, and the two of us who now represent the old guard.

The initial goal has been kept: "to facilitate the collaboration between specialists and to improve the exchange of information among carnivore damage prevention projects". Thus, we hope that the CDPNews will continue to be a forum for many agricultural advisors, scientists, conservationists, wildlife managers, and policy makers dealing with the issue of damage prevention and large carnivore management. However, we must never forget those who experience the problems of carnivore conflict at first hand, and those who successfully practice damage prevention as part of their daily lives. So far, the knowledge and experience of these people has not been sufficiently taken into account. There is considerable focus on dialogue between stakeholders and experience transfer at the moment, with the European Commission taking an active role in bringing stakeholders together in Brussels to discuss the challenges of large carnivore conservation. In order for the results of these discussions to make a difference on the ground there is a need for many different arenas where different stakeholders, experts and users can "meet" to discuss issues and exchange experience. Therefore, we hope that CDPNews will become a good platform for these types of exchanges between users and experts. Its success will now depend greatly on you, the readers, and your willingness to share not only your successes, but also your failures. Do not hesitate to spread the CDPNews and to translate it to make it available for a broader public.

Jean-Marc Landry & John Linnell

Project

MEDWOLF:

A NEW PROJECT TO DECREASE MAN-WOLF CONFLICTS IN MEDITERRANEAN-TYPE AREAS

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MedWolf - Best practice actions for wolf conservation in Mediterranean-type areas - www.medwolf.eu

A new LIFE+ project to tackle the wolf damages to livestock and its related conflicts with humans has been co-funded by the EC. The MedWolf project "Best practice actions for wolf conservation in Mediterranean-type areas" had its start in October 2012 and it is now in the phase of completion of the main preparatory activities to set the background for the implementation of the concrete conservation actions, mainly focused on damage prevention, but also on improvement of wolf presence detection, and control of illegal activities, such as poisoning and the use of snares.

LIFE MedWolf is implemented in Italy and Portugal, in two areas characterised by rural environments and where the presence of the wolf is slowly expanding. Such expansion process is associated to high levels of conflicts, mainly due to the fact that the local communities are not prepared to live with the predator and find it difficult to change their livestock raising practices.

In Portugal, the areas targeted by the project are south of the Douro river, where there is an isolated wolf nucleus consisting of less than 50 individuals. The project's intervention area is localized in the eastern part of this nucleus, the bordering region with Spain, in the Districts of Guarda and Castelo Branco. In this region livestock is still a very important economic resource, mainly represented by sheep and free-ranging cows. Although the number of wolf packs present in the project's area is estimated to be low, the level of conflict is increasing and in order to facilitate the highly endangered portion of the Iberian population to establish and expand - southwards and westward, establishing contact with the Spanish population -, interventions to prevent the interruption of the slow, but steady, expansion of the wolf are crucial.

In Italy the project is being implemented in the Province of Grosseto, where very few protected areas exist and the local economy is strongly based on rural activities, mainly related to production of typical food items, and tourism. The expansion of wolf in the area has been recorded in the last decades and attacks to free-ranging livestock are becoming so frequent that they cannot be considered a risk of the entrepreneurs activities. The local economy is based mainly on sheep farming and its associated products. Due to the virtual absence of wolf, local traditions have evolved in the last 70 years into free ranging flocks poorly guarded, left grazing on large pastures at night during summer months, when it is too hot to confine them and leaving

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them out in the sun during the day time.

Measures to be implemented in the two project areas include fences of various type and nature and livestock guarding dogs. Such interventions will be associated to a series of activities in support to the livestock producers and the local managers, in order to set the basis for a long term process of active management in full consideration of the local realities. The overall aim is to provide guidance to the Instituto da Conservação da Natureza e das Florestas (ICNF, the environmental agency responsible for wolf management and conservation and for damage compensation) and to the livestock owners for adopting measures that will be tested during the project and proven to be effective. Preliminary results from a survey in the Portuguese project study area, to evaluate the real impact of wolf damage and the interest of livestock owners to collaborate in the Project, reveal a general willingness to adopt the prevention measures proposed, despite some conflict hotspots, implying the need for a well-founded collaboration. The survey also allowed to characterize the holdings and identify the main prevention problems and needs, in a region where livestock management and husbandry are not adapted to the wolf presence. The information gathered will be used to better define the implementation of the concrete conservation actions.

In Portugal the project will enjoy the partnership with the EU-funded, LCIE-coordinated pilot action on traditional practices for livestock raising and coexistence with wolves (see also this issue), which also sees the active participation of the responsible institution for the management of wolf-caused damages, the ICNF.

In Italy the participation of the three agricultural association as well as the provincial administration

will set the bases for a shared approach to damage prevention and conflict reduction. A preliminary analysis of the current regional legislation has revealed a high percentage of undeclared damage that is to be interpreted as both an indication of the discontent of the rules to be applied and a minimal estimate of the level of conflict, including the willingness of the local livestock producers to accept rules and conditions set by the authorities and not shared preliminarily with them. The current law foresees the reimbursement for lost heads to predator attacks only through an insurance system, and the Regional Government covers up to 80% of the premium. Nevertheless, only less than 10% of the livestock breeders subscribe an insurance system, and up to 24% of them abandon the scheme after a couple of years. One long term objective of the project is to investigate further such system and explore the possibility to lobby for the modification of the Regional Law in order to include further assistance to livestock owners and at the same time stimulate them to comply with the current law. An in depth analysis of the efficacy of measures or combination of them in different environmental and social context will be done, so as to identify the most effective ones to be implemented ad hoc in selected farms.

Within the frame of the project we plan to implement a Carnivore Damage Prevention Working Group (CDPWG) that will exchange experience and information through a forum platform that will be activated on the project website. The working group will also share information through the production of articles to be published in the Carnivore Damage Prevention Newsletter, taking over from the work coordinated by Kora until 2005.

The project, with an overall budget of over 3 million Euros, 75% of which are funded by the European Commission, will last until March 2017, when we aim to reach the goals of decreasing the damage suffered by 20% and involve at least 30% of the livestock owners in the adoption of best practices for preventing damages.

For more information please visit the project website: www.medwolf.eu

Project

RECOVERING

TRADITIONAL HUSBANDRY PRACTICES TO REDUCE WOLF PREDATION ON FREE-RANGING CATTLE IN IBERIA

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In large carnivores, the frequency of livestock depredation is inversely related to availability and vulnerability of natural prey and directly related to availability and vulnerability of livestock (Polizar et al., 2003). The vulnerability of livestock depends mainly on the husbandry methods, which determine the patterns of depredation in different areas (Swenson and Andrén, 2005). This can lead to unexpected patterns of livestock depredation. For instance, in Spain wolves cause proportionally much more damages on livestock in the Cantabrian Mountains, where there are large natural forests and the wild ungulates are very abundant. In contrast, in some agricultural habitats, where the natural prey is very scarce, the damages are proportionally much lower because the livestock is better protected (Blanco and Cortés, 2009). Thus, the degree of conflict arising from wolf damages to domestic animals is mostly ruled by human-related factors, such as the economic impact of wolf attacks, the sociocultural background of livestock owners and the efficiency (or lack of it) of the practices used to prevent wolf damages (Fritts et al., 2003). Management and conservation implications of these issues are particularly relevant when wolves occur in human-dominated landscapes, such as the Iberian Peninsula, and in scenarios where wolf depredation affects livestock species with high socioeconomic value, such as cattle.

More than any livestock species, cattle have a high socioeconomic value among rural communities in the Iberian Peninsula. For centuries, cattle have been a traditional working animal highly appreciated in rural areas, most of them belonging to autochthonous breeds, well-adapted to local conditions and with a high market value. Besides, cattle owners have a strong emotional connection with these animals, often naming or blessing their own cows or bulls, in contrast to other livestock species. Consequently, cattle breeders invest considerable effort and care to guarantee the

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wellbeing of their animals, allowing them to graze in the most productive pastures under different husbandry practices. In mountainous areas, cattle are grazed under an extensive grazing system for most of the year. They can be either confined in fields and pastures next to villages, especially during the day or in winter, or completely free-ranging on mountain meadows without protection, normally from late spring to early autumn, which makes them, particularly calves, highly vulnerable to wolf predation.

Cattle breeders have traditionally invested in prevention measures to minimize predation by wolves, namely by equipping grazing herds with shepherds and livestock guarding dogs during the day, and by employing different regional types of constructions for livestock confinement and protection during the night (Fig. 1). In particular, in highland pastures far from villages across the northern mountains of the Iberian Peninsula, simple stone corrals with adjacent stone igloo shaped huts were commonly used as nocturnal shelters for cattle and shepherds in order to ensure a more efficient protection and surveillance of cattle herds and calves from wolf predation, during seasonal grazing in the summer. The use of all these procedures for the prevention of wolf damages was widespread up to few decades ago. However, due to the decline and socioeconomic changes of traditional rural life, cattle breeders have been investing less time and effort to efficiently and actively protect their livestock from wolf attacks, and currently it is not rare for cattle to be free-ranging all year round, with irregular or no surveillance at all.

Fig. 1. Extensive grazing of cattle under different husbandry conditions. **A:** diurnal surveillance with presence of shepherds and livestock guarding dogs; **B:** traditional stone-made shelters for nocturnal cattle surveillance in mountain meadows; **C:** semi-confinement next to villages during the day; **D:** free-ranging all year round with irregular or no surveillance. Photos: A, D-Francisco Álvares, B-José Domingues, C-Juan Carlos Blanco.

Two mountainous regions in northern Iberian Peninsula, located in the Peneda-Gerês National Park (Portugal) and Cantabrian Mountains (Spain) are a clear example of areas with cattle-wolf conflicts. In both regions, high wolf densities of up to 6 individuals/100 km^2 occur in a human-dominated landscape where livestock husbandry, and especially cattle production, is an important cultural and economic activity (Blanco et al., 1992; Álvares, 2004). As a consequence, wolf damages on livestock are frequent, with cattle constituting a significant share of wolf kills and compensation values due to their greater economic importance (Fig. 2). Moreover, probably due to recent economic subsidies for cattle production from the EU, cattle numbers are getting proportionally higher among livestock species and, consequently, the share of this species in wolf damages is showing an increasing trend during the last decades. For example, in Peneda-Gerês, even though the number of wolves has been stable, cattle represented 13% and 33% of wolf damages on livestock in 1997 and 2012, respectively (Álvares, 2011; Pimenta/ICNF, unpub. data).

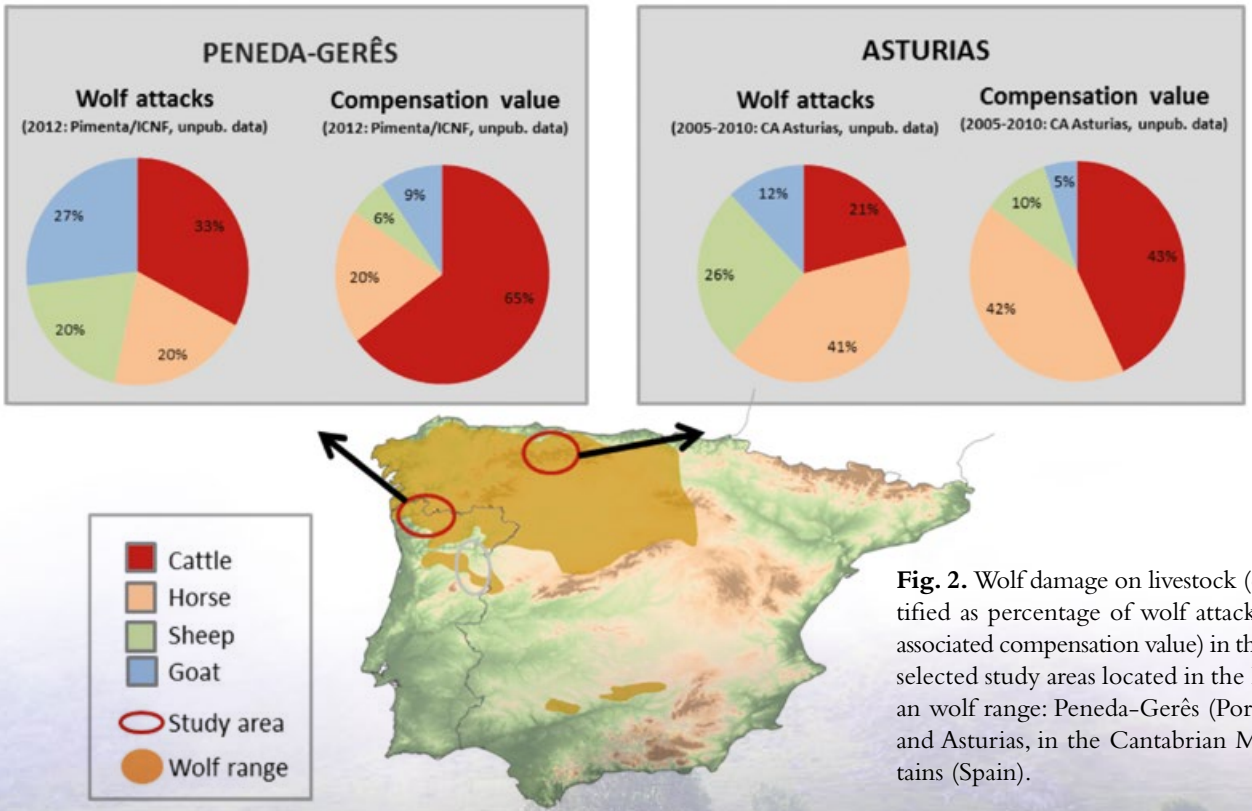

Fig. 2. Wolf damage on livestock (quantified as percentage of wolf attacks and associated compensation value) in the two selected study areas located in the Iberian wolf range: Peneda-Gerês (Portugal) and Asturias, in the Cantabrian Mountains (Spain).

Although wolf damages are generally compensated, Peneda-Gerês and Cantabrian mountainous are characterized by one of the highest levels of conflict across all of the Iberian wolf range, with strong sociopolitical implications resulting in intense wolf persecution, both legal and illegal (Blanco and Cortés, 2009; Álvares, 2011). However, wolf predation risk, resulting either from variation in wild prey availability or cattle vulnerability, seems to vary across the diversity of cattle husbandry practices currently employed among breeders. For instance, in an area of Peneda-Gerês where cattle are confined during winter, adult cows represent 13% of wolf kills, while in a neighbouring region where cattle are free-ranging all year round, adult cattle constitute 44% of wolf kills, leading to a much higher economic impact (Álvares, 2011). Furthermore, in spite of artificial selection, cattle from autochthonous breeds are well adapted to the ecological conditions of their grazing areas – including natural predators like wolves – and several studies have suggested that wolf predation risk can be influenced by cattle spatial and social ecology, such as habitat use, group size, herd composition and anti-predator behaviour (Meriggi and Pagnin, 1994; Rio-Maior et al., 2005; Laporte et al., 2010). This evidence underlines the need for an integrative approach where social, economic and ecological aspects should be taken into account to recommend best methods and procedures to prevent wolf damages to cattle and promote experience transfer between cattle herders regarding best practices.

In this framework, a recent study has been developed in order to address the conflict that arises from wolf damages on cattle in the Iberian Peninsula. This study, started in October 2013 and with one-year duration, is one of the pilot actions on Large Carnivores at the population level to be developed within the project entitled "Support to the European Commission's policy on large carnivores under the Habitats Directive – phase 2" (contract nr. 07.0307/2013/654446/SER/B.3), financed by the European Commission and executed by "Istituto di Ecologia Applicata" with the guidance of "Large Carnivore Initiative for Europe (IUCN/SSC LCIE)", and in collaboration with the Institute of Nature Conservation and Forest (ICNF), Grupo Lobo and the LIFE MedWoff project. The Iberian wolf pilot action is focused on the tra-

ditional knowledge of cattle husbandry practices that are compatible with the wolf's presence. By involving local cattle herders from both Portugal and Spain, the project explores how this traditional knowledge can be adapted and applied to a modern day context for conflict management related to wolf depredation on free-ranging cattle.

The work developed in this project will cover four different tasks:

1) Identifying and characterizing the conflict by conducting a review of compensation statistics and bibliography on wolf damages to cattle and on current and traditional husbandry/protection methods. We aim to characterize this conflict in both a socio-oeconomic (e.g. economic and social impact, compensation programmes) and ecological perspective (e.g. kill rates, wolf-prey relationships), and whenever available, to analyse the data at both national (Portugal/Spain) and regional levels (pilot areas);

2) Field evaluation of cattle depredation and husbandry methods by conducting local interviews with cattle breeders to characterize socio-economic parameters, such as: i) intensity of wolf depredation; ii) traditional and current prevention measures and corresponding effort; iii) main source of economic profit (subsidies/meat marketing); iv) willingness to change prevention methods;

3) Workshops for knowledge and experience transfer, namely a national workshop per country and one international workshop to involve and inform stakeholders and achieve a guided discussion between all participants on the best practical solutions;

4) The production of two documents directed to different audiences: a guide of best practice management, addressed to local and national managers; and a manual for best practice implementation, addressed to livestock producers and focusing on technical details of damage prevention and mitigation measures that are known to be efficient.

Furthermore, this project will make an effort to involve NGOs and national/regional administrations from Portugal and Spain in order to assure their active participation, especially in the organization of the workshops, and will promote the involvement of other current projects aiming to address similar topics in the Iberian Peninsula (such as the LIFE MedWoff project). With this approach, we intend to bring together several stakeholders and maximize efforts for a common goal: achieving a sustainable coexistence between wolves and the livestock industry, by exploring traditional knowledge and practices.

References

Álvares F (2004) Status and Conservation of the Iberian Wolf in Portugal. Wolf Print 20, 4-6.

Álvares F (2011) Wolf ecology and conservation in northwest Portugal. PhD Thesis. Faculty of Sciences of the University of Lisbon, Lisbon, 193 p.

Blanco JC, Reig S, Cuesta L (1992) Distribution, status and conservation problems of the wolf *Canis lupus* in Spain. Biological Conservation 60, 73-80.

Blanco JC, Cortés Y (2009) Ecological and social constraints of wolf recovery in Spain. In: Musiani M, Boitani L, Paquet PC, editors. A new era for wolves and people: wolf recovery, human attitudes and policy. Energy, Ecology and the Environment Series, Nº 2. University of Calgary Press, Alberta, pp. 41-66.

Fritts SH, Stephenson RO, Hayes RD, Boitani L (2003) Wolves and Humans. In: Mech LD, Boitani L, editors. Wolves: Behavior, Ecology and Conservation. The University of Chicago Press, Chicago, pp. 289-316.

Laporte I, Muhly TB, Pitt JA, Alexander M, Musiani M (2010) Effects of wolves on Elk and cattle behaviors: implications for livestock production and wolf conservation. PLoS ONE 5, e11954. doi:10.1371/journal.pone.0011954.

Meriggi A, Pagnin E (1994) Influence of wolves (*Canis lupus*) on social behaviour and habitat selection of free grazing cows (*Bos taurus*). Boll. Zoll. 61, S1, 40-40.

Polisar J, Maxit I, Scognamillo D, Farrell L, Sunquist ME, Eisenberg JF (2003) Jaguars, pumas, their prey base, and cattle ranching: ecological interpretations of a management problem. Biological Conservation 109, 297–310.

Rio-Maior H, Álvares F, Guerra A, Petrucci-Fonseca F (2005). Eco-ethological relationships between the Iberian wolf and free-grazing livestock: implications for conservation in Northwest Portugal. Frontiers of Wolf Recovery: Southwestern United States and the World, Colorado Springs, Colorado, October 1-4 (Paper Presented, Oral).

Swenson JE, Andrén H (2005) A tale of two countries: large carnivore depredation and compensation schemes in Sweden and Norway. In: Woodroffe R, Thirgood S, Rabinowitz A, editors. People and Wildlife. Cambridge University Press, Cambridge, pp. 323-339.

Note

MANAGEMENT AND CONSERVATION OF WOLVES IN ASTURIAS, NW SPAIN: IS POPULATION CONTROL JUSTIFIED FOR HANDLING DAMAGE-RELATED CONFLICTS?

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1. Introduction

Lethal control of large carnivores as a tool to minimize losses on stock and to handle conflicts associated to depredation is a highly controversial issue, moreover when performed by culling the population rather than directed to specific individuals. Lethal control rationale looks to handling problems (e.g. damages) after these are identified, although quantitative evaluations of its effects are uncommon (Treves and Naughton-Treves, 2005). Indeed, lethal control by culling populations of apex carnivores, such as wolves, can lead to environmental costs (e.g. overgrazing by increases in herbivores densities, mesopredators release) through cascading trophic effects (Estes et al., 2011). Such a background leads to the need of deeply justify any lethal control program of large carnivores, and carefully evaluate its effects, particularly if the intended goal is to cull a population. In this contribution we discuss about the correlates between the numbers of wolves killed in control operations on a wolf population in Asturias, NW Spain and the number of damages on stock, and therefore, discuss on the potential justifications to perform control operations at a population level.

This contribution is conceived as an outline of a chapter in the author's Ph.D. dissertation (Fernández-Gil, 2013), available at: http://hdl.handle.net/10651/17711; furthermore, some additional references and comments have been included for this contribution. Data came from the public agency responsible for wolf management and conservation, Consejería de Agroganadería y Recursos Naturales, within Autonomous Government of Asturias (NW Spain), and refer to numbers of confirmed wolf packs, numbers of wolves killed in population control operations, and to statistics of verified and compensated damages.

Asturias autonomous region (10,000 km^2, Fig. 1) spans along the Cantabrian Mountains and holds about 30 wolf packs, i.e. around 10% of the Iberian wolf population (Álvares et al., 2005). Autonomous

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Government of Asturias approved in 2002 a Wolf Management Plan (Decree 155/2002) and informed yearly an advising Technical Committee on data and actions performed or planned to the concerned wolf population. Main management actions implemented through the Plan are: 1) an ex-post compensation scheme for damages after field verification by official rangers; and 2) annual lethal control programs (hereafter, culling) of the wolf population to minimize and to prevent damages to livestock, and to handle the so-called social conflict. Around 40% of the wolf range in Asturias lies within Natura 2000 (Habitats Directive 92/43/EEC) although the population is subject to lethal control elsewhere, including Picos de Europa National Park (PENP). PENP encompasses 670 km^2 of mountain landscape, with most of its surface in Asturias territory, and it is the sole national park in Spain with resident wolf packs.

Asturias administration implemented different levels of wolf culling each year, after the approval of annual programs of population control (sic;"programa anual de control de la población de lobo", in Spanish). Culling is spread among seven zones following a priori three criteria: a) wolf abundance, i.e. number of packs; b) amount of damages; and c) intensity of social conflict. Each zone averaged about 1,000 km^2, and co-management with PENP authority is included in one of the zones (Fig. 1). The data discussed in this contribution referring to wolf abundance and damages statistics are thus official data; those that are used by the responsible agency to manage the wolf population.

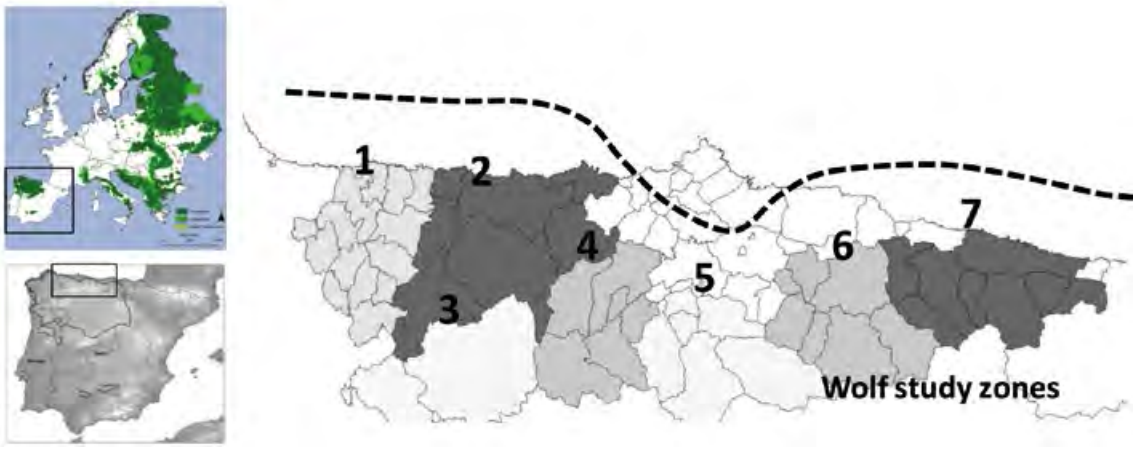

Fig. 1. Study area in Asturias (Cantabrian Mountains, NW Spain) showing wolf range (dashed line, around 7,000 km^2) and seven zones, following Asturias Wolf Management Plan. Zone 7 includes Picos de Europa National Park.

2. Wolf population, damages to livestock and compensations

In Asturias, numbers of confirmed packs during 2003-2010 averaged 29 every year and did not show any significant trend during that period (exponential growth rate, $p > 0.1$). In Asturias, more than 400,000 heads of domestic stock (half of them bovine, but also horses, sheep and goats) are raised in a so-called extensive regime, that is, grazing in pasturelands and relatively unattended. Annual percentage of livestock, all species combined, affected by wolf depredation in the period 2003-2010 averaged 0.7%. Annual number of heads affected by wolf depredation averaged 2,951 heads/year in that period, resulting in an average of 700,000 €/year paid as compensations during the same period. About 45% of the affected animals were horses, which are largely kept unattended year round.

In the PENP, wolf packs numbers ranged 3-6 every year in the period 2003-2012 (Table 4.8 in García et al., 2011; and table 2.53 in García et al., 2013a), and did not show any significant trend (exponential growth rate, $p > 0.1$). In the PENP, there are about 20,000 heads of livestock, and losses by wolves were estimated as 0.3% of heads present, which resulted in 19,000 € paid as compensations for all losses in the park in 2008 (Rivas et al., 2011).

3. Lethal population control and correlates with damages

In Asturias, the average number of wolves culled in population control programs every year was 15 in the period 2003-2010 (range = 6-23 wolves killed every year). The number of culled wolves positively correlated with levels of losses to stock in the following year: more wolves killed, more damages in the following year in a given management zone. Nevertheless, variability in damages associated to numbers of killed wolves the previous year was low for the same period (R^2 = 0.14); other factors were presumably playing stronger roles (e.g. husbandry of stock, although no data were available for analyses).

The number of killed wolves was strongly correlated with number of news about wolves featured in the regional media, which we used as a surrogate of "social conflict". Nevertheless, the management zone with more news published, which included the PENP (zone 7 in Fig. 1) suffered fewer losses in the regional context of Asturias: 41% of the news and 5% of the damages.

In the PENP, lethal population control was approved almost yearly because of the alleged increase in the wolf population, and to minimize damages to livestock. At least 32 wolves were culled in the PENP during 2001-2011, including several pregnant females and a complete litter of seven newborn pups in 2004. In august 2012, PENP authorities approved the culling of six wolves within two packs inside the park. With data provided by the PENP, García et al. (2013b) found some positive correlations between the number of killed wolves and the amount of damages afterwards, at a pack scale and with data for the period 2000-2011.

4. Are lethal control programs justified when performed at a population level?

As a highly controversial issue, lethal control of apex predators should be carefully justified (e.g. in scientific, technical, but also in ethical grounds), moreover if culling is performed at a population level. In the case of wolves, a highly social carnivore, culling of the population can lead to serious environmental effects, given their relevant role as keystone species (Wallach et al., 2009; Ripple et al., 2014). Therefore, it has been advised that only individual wolves should be targeted for lethal control in certain cases (Brainerd et al., 2006); otherwise, social disruption by population control can derive in demographical and behavioural effects (Haber, 1996; Wallach et al., 2009), with consequences on predation rates, including losses on stock, because of the complex dynamics of wolf-prey relations (Jedrzejewski et al., 2002; Vucetich et al., 2002). Indeed, lethal control of a wolf population does not necessarily diminish depredation on stock (Harper et al., 2007; Krofel et al., 2011) and may even have contrary effects.

Asturias Government and PENP authority have been culling the wolf population because of alleged high levels of damages to livestock. Moreover, in recent years they are also arguing population control of wolves with some so-called "biological criteria", that is, because the current wolf population in Asturias and in PENP is resulting in presumed "disequilibrium" of wild ungulates populations, as it has been explicitly phrased in culling resolutions. Nevertheless, no metrics of such "disequilibrium" have ever been provided.

Although no significant trend in wolf abundance has been found, Asturias Government approved in late 2012 the culling of 66 wolves plus four litters during the next twelve months, from a total of 23 confirmed packs in the last available count from 2011. Although there are no empirical estimation of the population size, given that average winter pack size is around 4 individuals (see Fernández-Gil, 2013), such extraction may eventually derive in the collapse of the population. The prescribed culling effort for 2013 was four times higher than the annual average harvest quotas of 18 wolves proposed during 2003-2008. Indeed, the number of legally killed wolves in 2013 was 31, the highest toll in the last decade and doubling the annual average for the period 2003-2012.

The loss and reduction of populations of top predators have overarching impacts on ecosystems (Estes et al., 2011). Moreover, recent suggestions to improve or reinstate areas with functional densities of large carnivores are becoming urgent as encroachment of land continues (see e.g. Ripple et al., 2014). Population control of top predators may alter predator-prey relations and competition among apex consumers, and eventually destabilize ecosystems through trophic cascades; it can also have profound effects in predation rates, both in wild prey and on domestic stock. Yet, management of wolves in Spain by lethal population control operations is being justified to minimize damages to livestock without any evidences of such results, but also recalling on some so-called "biological arguments" (see above), although no metrics have ever been provided. It seems rather hard that some can be obtained, given robust and astounding evidences of the relevant role that functional densities of top carnivores have in ecosystems (Ripple et al., 2014) (Fig. 2).

Fig. 2. A wolf feeding upon the remains of a red deer *Cervus elaphus* freshly killed by the pack, while avian scavengers (griffon vultures *Gyps fulvus* and corvids) await for leftovers. Photo: Alberto Fernández-Gil.

Asturias administration has paid all verified damages by wolves in its territory during the last 25 years, through an ex-post compensation scheme that suffered no variations during that period. This coincided with the implementation of the Common Agricultural Policy (CAP), which subsidized every domestic head in Asturias and, complementarily subsidized the heads that were raised in Natura 2000 areas (Directive 92/43/EEC). For instance, in the PENP, where there are about 20,000 heads of livestock, in 2008 each breeder received in average 8,000 €, up to a total of 7.5 million € for all breeders in that year in the park; about 25% of those subsidies were provided by Natura 2000 programme. In 2013, an estimated 2/3 of the sector's total income rent in Asturias was provided by subsidies from the CAP. Regarding damages by wolves, all verified losses (i.e. those claimed and considered as probable or confirmed of being predated by wolves) were paid by the Asturias Government and PENP authorities, so costs of damages to stock owners are kept at a minimum. Nevertheless, during the last years and with strong vehemence in 2012 and 2013, spokesmen and stock associations have expressed in the mass media the "legitimate demand" of the complete extirpation of wolves within and around the PENP, a "justified" demand that received the support of farmers' unions, several mayors in the PENP area, and deputies to the autonomous parliament.

In synthesis, we found that: 1) there are no evidences that lethal control programs of the wolf population in Asturias are minimizing wolf depredation on stock (i.e. so-called technical arguments are not met); 2) control of the population could hardly ever be justified with scientific (i.e. biological) arguments (e.g. Ordiz et al., 2013): wolves are key-apex-predators with relevant roles in ecosystems; 3) ex-post compensation schemes in Asturias are not currently facilitating wolf conservation (see e.g. Boitani et al., 2010 for similar findings elsewhere in Europe) neither minimizing conflicts related to losses by depredation; 4) programs in Asturias for culling the wolf population are implemented in virtual absence of actions on factors with presumably strong incidence in the vulnerability of prey (e.g. those related with the husbandry of stock); and 5) by definition, control of the population penalize individuals not involved in depredation on stock; this meant that ethical justification can hardly ever be met if the culling is performed at a population level.

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References

Álvares F, Barroso I, Blanco JC, et al. (2005) Wolf status and conservation in the Iberian Peninsula. Abstracts of Frontiers of Wolf Recovery, 1-4 October 2005. International Wolf Center, Colorado Springs, Colorado, pp. 66-67.

Boitani L, Ciucci P, Raganella-Pelliccioni E (2010) Ex-post compensation payments for wolf predation on livestock in Italy: a tool for conservation? Wildlife Research 37(8), 722-730.

Brainerd SM, Andrén H, Bangs EE, et al. (2006) The Effects of Breeder Loss on Wolves. The Journal of Wildlife Management 72(1), 89-98.

Estes JA, Terborgh J, Brashares JS, et al. (2011) Trophic downgrading of planet earth. Science 333, 301-306.

Fernández-Gil A (2013) Comportamiento y conservación de grandes carnívoros en ambientes humanizados. Osos y lobos en la Cordillera Cantábrica. PhD Thesis, Universidad de Oviedo, Spain, 278 pp. Abstracts in English.

García EJ, Llaneza L, Palacios V, et al. (2011) Aspectos poblacionales del lobo en el Parque Nacional de los Picos de Europa 2008-2010. ARENA SL & Consorcio Interautonómico del Parque Nacional de Picos de Europa, Informe inédito, 186 p.

García EJ, Llaneza L, Palacios V, et al. (2013a) Aspectos poblacionales del lobo en el Parque Nacional de los Picos de Europa 2011-2012. ARENA SL & Consorcio Interautonómico del Parque Nacional de Picos de Europa, Informe inédito, 162 p.

García EJ, Llaneza L, Palacios V (2013b) Medidas de gestión del Lobo en el Parque Nacional de Picos de Europa. ARENA SL & Consorcio Interautonómico del Parque Nacional de Picos de Europa, Informe inédito, 95 p.

Haber GC (1996) Biological, conservation, and ethical implications of exploiting and controlling wolves. Conservation Biology 10, 1068–1081.

Harper EK, Paul WJ, Mech LD, Weisberg S (2008) Effectiveness of Lethal, Directed Wolf Depredation Control in Minnesota. The Journal of Wildlife Management 72(3), 778-784.

Jedrzejewski W, Schmidt K, Theuerkauf J, et al. (2002) Kill rates and predation by wolves on ungulate populations in Bialowieza Primeval Forest (Poland). Ecology 83(5), 1341-1356.

Krofel M, Černe R, Jerina K (2011) Effectiveness of wolf (Canis lupus) culling as a measure to reduce livestock depredations. Zbornik Gozdarstva in Lesarstva 95, 11-21.

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

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

Rivas O, García EJ, Palacios V, Llaneza L (2011) Aspectos sociales en la gestión y conservación del lobo en el Parque Nacional de Picos de Europa. ARENA SL & Consorcio Interautonómico del Parque Nacional de Picos de Europa, Informe inédito, 150 p.

Treves A, Naughton-Treves L (2005) Evaluating lethal control in the management of human–wildlife conflict. In: Woodroffe RW, Thirgood S, Rabinowitz A, editors, People and Wildlife, Conflict or Coexistence? Cambridge University Press, Cambridge, pp. 86–106.

Vucetich JA, Peterson RO, Schaefer CL (2002) The effect of prey and predator densities on wolf predation. Ecology 83(11), 3003-3013.

Wallach AD, Ritchie EG, Read J, O'Neill AJ (2009). More than mere numbers: the impact of lethal control on the social stability of a top-order predator. PLoS ONE 4, e6861. DOI:10.1371/journal.pone.0006861

Project

SHEEP PASTURES IN THE VALAIS

SUSTAINABILITY, MANAGEMENT STRUCTURES AND PROTECTION OF THE FLOCKS

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Since the wolf's return to the Swiss Alps in 1996, structures for sheep summering have been discussed in the Valais region, located in the southwestern part of Switzerland. The lost shepherd tradition and the difficult topographical conditions in high mountain areas pose additional difficulties for the pastoralists and farmers. Thus, the role of sheep grazing on alpine pastures has been strongly politicized. To account for the extraordinary cultural and ecological significance of sheep summering in this canton, sheep summering should be analyzed in detail in order to guarantee its sustainable management in the future.

After long and constructive discussions between all the stakeholders, a project was agreed upon: from 2012 to 2014 an in-depth analysis of the sheep pastures in the Valais should be conducted. In the context of an assignment by the federal and cantonal authorities, the team from AGRIDEA has visited and analyzed 150 sheep pastures with approximately 70,000 summered sheep. In the year 2012, 64 alpine pastures were visited and analyzed in the Upper Valais. The analysis of the remaining 90 alpine pastures in the Upper and Lower Valais was carried out in 2013.

The results will serve as the basis for the disqualification of the non-suitable pasture areas according to the "Summering Subsidy Ordinance" ("Sömmerungsbeitragsverordnung", SöBV). This legal frame gives positive incentives to replace the free grazing system with a systematic management of the flocks by shepherd and dogs. The long term goal is to make possible herd consolidations resulting in the development of an efficient and effective protection of the flocks. The project will be completed in the spring of 2014. The baseline report should give the federal and cantonal government a basis for the implementation of legal provisions (Direct Subsidies Ordinance and the Swiss Hunting Ordinance).

The project is organized in two stages:

Phase 1: **Analysis of the alpine pastures with pasture managers and shepherd, to create a management plan for improving the management and the protection of the flocks**

1. Cartographic records of all sheep pastures of the canton;
2. Creation of a pasturing plan for each alpine pasture unit/summering farm;
3. Optimization recommendations for herd management regarding the available food and the sensitive vegetation types;
4. Delineation of areas suitable or unsuitable for grazing (according to the summering subsidy ordinance);
5. Creation of a plan for pastures and herd consolidation;
6. Recommendations for the implementation of herd protection measures for each sheep pasture.

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Phase 2: **Implementation of a collective management plan with farm managers and community representatives, to discuss structural changes and infrastructure investments**

1. Each pasture report will be written in the farm-managers' languages (French or German) and handed to them after completion to give them the opportunity to comment it and eventually to change it;
2. Evaluation of the individual pasturing plans with managers and pasture owners;
3. Classification of the alpine pastures for possible structural changes;
4. Planning meetings with selected alpine pasture owners for herd consolidations;
5. Composition of a final report as a decision basis for the cantonal administration;
6. Accompanying and coaching with the agricultural consultation to implement the measures.

The project illustratively shows how the cooperation between researchers, consultants and administrative bodies can combine both technical-analytical and participative methods, to work on a complex theme within a dynamic process. The management of alpine sheep pastures is not only a traditional agricultural use, but is also rooted within a socio-cultural background. Incorporating these two roots plays a crucial role in the selection of methods and the procedure for planning the alpine management. Thus, communication and systematic exchanges with pasture managers is a central success factor to accomplish long-term improvements. Accompanying the process of change becomes the central challenge for agricultural consultation, in order to bridge the gap between science and rural everyday life.

Project

ALTERNATIVES TO LIVESTOCK GUARDING DOGS

LLAMAS, DONKEYS, FENCE-SYSTEMS AND AVERSIVE CONDITIONING: POSSIBILITIES AND LIMITS

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The term "livestock protection" includes all measures that can prevent loss and damage to livestock herds caused by large carnivores. Used as an umbrella term, herd protection implies a combination of different measures that are joined together in a "prevention system". Herd protection in the sense of a prevention system needs to be differentiated from other preventative fields for domestic animals, such as animal health and epizootic diseases, animal welfare or other risks like natural hazards or theft. Generally, prevention can be understood as "anticipatory problem avoidance" and directly entails a risk-analysis. For herd protection this "anticipatory damage-minimization" indicates an open process within a dynamic system, in which both the predator situation and the operational conditions can be changing at all times. Besides the "protected" large carnivores, small carnivores, birds of prey or stray dogs can also cause losses.

The term "herd protection measures" is differentiated between the operational measures, such as adaptations to pasturing, fencing and infrastructure (stable and paths) and the specific, additional preventative measures. Operational measures create the framework using the common, reliable agricultural practices to keep the animals together in a controlled manner (e.g. these being herd protection and aversive conditioning), in order to appropriately implement specific measures. These are additional measures that aim exclusively at protecting the herds. These are the deployment of herd protection animals, electrification and reinforcement of pasture fences, or temporary aversive conditioning measures. The implementation of "herd protection measures" depends on the farm's management, the topographical preconditions and the carnivores' threat and risk potential. The carnivore needs to be distinguished between large and small carnivores, protected and not protected species, as well as its predatory behaviour (single or group hunting, cursorial, like wolves, or stalk hunt, like lynx) in order to choose the adequate measures.

"Livestock guarding dogs" are shepherd dogs with the specific purpose of protecting livestock from carnivores. The dogs belong to a breed suitable for this use, are systematically trained, kept and bred, and are used exclusively for the protection of livestock. Nowadays, livestock guarding dogs are the most known herd protection measure, as they are the most effective against wolves and are the traditionally embedded method in many countries. Yet, in the densely used

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regions of the Alps, they bare a specific conflict potential, which is reflected through the different user interests in these mountain regions, especially hiking or cycling tourism.

Therefore, the search for alternative herd protection measures has arisen a few years ago, which could replace livestock guarding dogs under certain conflictual situations. The national agency for agricultural consulting, AGRIDEA, has been managing different projects over the last years to investigate and depict the possibilities and limits of such alternatives. For short-term dissuasion, measures as "Foxlights" (visual dissuasion) or "Alarmguards" (acoustic dissuasion) are implemented. Moreover, in valley regions positive experiences have been made with electric fences. However, all these technical methods are usually static and the carnivores get used to them. Therefore herd protection animals possibly represent a more sustainable solution.

Donkeys and llamas were punctually introduced to regions with low levels of carnivore pressure. In the selection process of these animals, sufficient experience and knowledge is still lacking. A pilot project with llamas as herd protection animals illustrates the

challenges, which can arise on both the methodological and the behavioural-biological levels as well as when selecting the animals. The first results can be summarized under the following six points:

1) The integration into the herd should take place on a small, open and fenced-in area;

2) In most cases a single male llama (around 2 years of age) builds a stronger relationship with the sheep than when several llamas are integrated into the same herd;

3) The sheep herd should be compact (ideally consisting of one breed and/or one owner);

4) Ideally the pasture to protect should be rather small, open and fenced in. The optimal pasture size depends on the degree of dispersion of the herd and the openness of the pasture;

5) The animals generally show a protective behaviour towards dogs;

6) Animals with suitable protection behaviours need to be carefully selected.

As the evidence for the protection efficiency under the presence of carnivores is difficult to obtain, the defensive behaviour of the llamas was assessed by means of aversive behaviour towards dogs. If it is possible to efficiently use llamas as herd protection animals, a cost-efficient and low-maintenance alternative to herd protection dogs could have been found, under certain operational prerequisites. The results with lamas confirm the experiences with donkeys which have been made during the last ten years. A systematic evaluation of the use of these two species as protection animals still doesn't exist. To improve the use of lamas and donkeys and to get more detailed results about their protective behaviour, more data should be collected in a further project.

Article

THE CANOVIS PROJECT:

STUDYING INTERNAL AND EXTERNAL FACTORS THAT MAY INFLUENCE LIVESTOCK GUARDING DOGS' EFFICIENCY AGAINST WOLF PREDATION

PRELIMINARY RESULTS AND DISCUSSION

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1. Introduction

The wolf's return to the Alps has led to many changes in the pastoral practises due to the need for damage prevention measures. The most effective non-lethal tool is the livestock guarding dog (LGD) (Gehring et al., 2010), preferably in combination with shepherds and night-time enclosures (Espuno, 2004). For millennia, LGDs have been the keystone for the protection of small domestic animals against large predators throughout Eurasia, and are being reintroduced in areas that wolves are recolonizing, like the Alps. However, in the southern part of the French Alps wolf damage remain a chronic problem, and may even be increasing (MEDDE and MAAF, 2013), despite nearly all flocks are guarded by LGDs. Data suggest we are facing the limit of LGDs' efficacy in the present French pastoral system, especially in flocks with frequent attacks.

In the early 1980's, LGD researchers assumed that dogs' working abilities were based on three essential traits: attentiveness to the flock, trustworthiness and protectiveness (for more details see Coppinger and Coppinger 1982; Coppinger et al., 1983). Unfortunately, very few studies were conducted to understand how LGDs protect a flock and how their efficacy could be improved. Data are lacking because wolf attacks on livestock are difficult to observe. They are unpredictable and occur mostly during the night or on heavily vegetated terrain. Consequently, the effectiveness of LGDs has commonly been evaluated through indirect methods like questionnaires (Gehring et al., 2010). Nevertheless, these kind of studies are not free from confounding factors (e.g. density of predators, vulnerability of livestock, husbandry system, behavioural variability of LGDs and breeds, experience of the shepherds, or the existence of predator control programs) (Gehring et al., 2010). Census of losses gathered from livestock owners may also be unreliable (Green and Woodruff, 1983), and questionnaires do not provide information about how LGDs interact with wolves to protect a herd.

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Thanks to a set of military-grade thermal (night-vision) binoculars (Matis type) with recording capabilities, provided by the Sagem Society, 20 night interactions between LGDs and wolves were videotaped in 2000 and 2004, in the National Park of Mercantour (NPM) (Maritime Alps). This new technology provided us a first time view of how LGDs and wolves interact on alpine pasture (for more details see Landry, 2013). Although those images provided valuable information, the number of dogs, wolves and locations was insufficient to draw any conclusion. Fortunately, we had the opportunity to conduct further observations, resulting in the implementation of a new project named "CanOvis", designed to study night-time interactions between LGDs and wolves.

The main objective of the CanOvis project is to study the LGDs' innate and learned abilities to protect flocks. Furthermore we want to know how internal (e.g. age, sex, physical conditions) and external factors (e.g. social structure of the group of LGDs, density of predators, shepherding) influence their effectiveness. To achieve this goal, we plan to record: a) interactions between LGDs and wildlife, focusing on wolves (mainly during the night); b) LGD and flock movements, to study LGDs spatial distribution relative to the herd; c) LGD vocalisations, to study their effect on other LGDs and wolves. We will also study the practical knowledge of shepherds about predation and protection.

In the summer of 2013 we set up a pilot study to test the equipment (e.g. GPS collars), logistics and the sampling protocols. During this testing period we collected night-time footage of LGD-wolf interactions that we present in this article. The results are preliminary but suggest the need to select LGDs for alpine pastures based on new criteria, as well as the need to refine their training, monitoring and management in the herds.

2. Materials and Methods

The study area is located in the southern French Alps (Alpes Maritimes department) where frequent wolf damage is recorded. In 2013, 2,416 head of livestock, mainly sheep, resulted in producer compensation, which constitutes 39% of wolf-damage compensation in the whole country (Yoann Poncin Bressan, DREAL Rhône-Alpes, pers. comm.). This region represents a typical alpine landscape with forests (e.g. *Larix decidua*), meadows and heaths. On southern slopes, the forest edge can reach up to 2400 metres. Its location near the sea and a rapid elevation on a few kilometres make this territory extremely rich in plant and animal communities (Muséum National d'Histoire Naturelle 2003-2013). The study was conducted in the MNP. Five species of wild ungulate inhabited the area:

red deer (*Cervus elaphus*), roe deer (*Capreolus capreolus*), wild boar (*Sus scrofa*), mouflon (*Ovis aries musimon*) and chamois (*Rupicapra rupicapra*).

We selected three flocks (Fig. 1), which graze on pastoral units (PU, alpine pastures where a particular sheep flock grazes during the summer season) based on three criteria: the past and current pressure of wolf attacks (high and low), the PU's accessibility and the willingness of the sheep owners to participate in the project. Two PUs had high wolf pressure. One of the flocks grazes in the core area of the MNP where no shooting permits (to defend the flock or cull a wolf) are issued (MEDDE and MAAF, 2013). The number of sheep per flock ranged from 1,750 to 2,500 head and altitudes range from 1,500 to 2,550 MASL*. One PU had two flocks at the beginning of the grazing period (500 and 2,000), and then was gathered in one herd at the end of the summer (due to frequent wolf predation on the small herd). All flocks were protected by LGDs, mainly Great Pyrenees (GP) or crossbreds (GP x Maremma sheep dog). One of them had 11 LGDs and the other two had 4 LGDs each.

The sheep were observed during their night-time bedding, penned or free, from a distance of 100 to 700 m. Observations lasted from one hour before sunset until sunrise. We used a long-range infrared binocular designed for the army (SAFRAN/Sagem) connected to a video recorder. Everything emits thermal radiation and those of animals are infrared. The warmer the object is, the brighter it appears on the screen (Fig. 2). Therefore, animals are easily detectable, even at a distance of more than 3,000 m (but not necessarily identifiable). In our study, the practical distance for video analysis was 700 m. This equipment does not allow sound recording (e.g. LGDs vocalizations).

We also fitted LGDs with GPS collars (I-gotU GT-120) during the night-time surveillance. Since wolf chasings by LGD last an average of 5 seconds to 2 minutes (Landry, 2013), we adjusted the GPS collars accordingly with a threshold speed of 10 km/hour. A point was recorded each 10 seconds (primary interval) under this speed limit (maximum displacement of 20 m) and each 2 seconds after that (secondary interval). The GPS autonomy was around 20 hours and so we fitted the dogs with the GPS collars every evening and removed them the next morning to charge the battery during the day.

Fig. 1. Location of the three UP in the National Park of Mercantour (Maritime Alps).

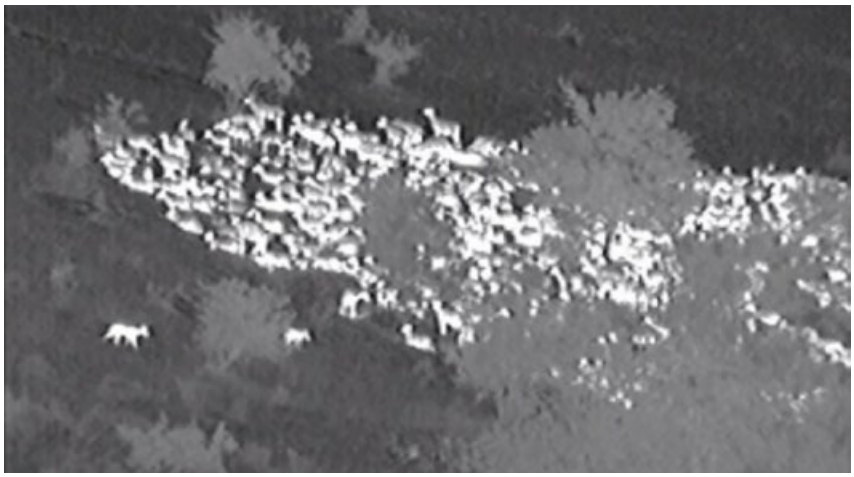

Fig. 2. The back of the sheep is more insulated and appears darker in comparison to the two wolves, on the left lower section of the image, that are less insulated due to their short fur. Photo: CanOvis/NPM.

* Meters above sea level.

3. Preliminary Results

We observed flocks during five working sessions for a total of 23 nights (3-7 nights per session) of surveillance. We recorded 9 events involving wolves (of which 3 were attempted attacks) (Table 1), at least 23 with other wildlife (7 with red foxes *Vulpes vulpes*, 3 with chamois *Rupicapra rupicapra*, 3 with red deer *Cervus elaphus*, >10 with *Lepus ssp*) and 2 events with stray dogs. Additionally, we recorded more than 10 hours of wolf footage.

LGDs' responses towards wolves ranged from no reaction, barking, social or close contacts (33% of the events) to chasing (Table 1). One dog fitted with a GPS collar reached a speed of >40 km/h during a chase (which was also filmed). The length of the pursuits varied from

Table 1. Synthesis of the night interactions between LGDs and wolves on three PUs in the National Park of Mercantour during the summer of 2013.

PU, altitude, flock size, damage reports/nr. losses	Nr. of LGDs	Date and nr. of events	Wolves' behaviours	LGDs' reactions
		30.07-02.08		
Entraunes **1,500-2,000 MASL** **1,750 head** **13 attacks/ /15 head lost**	4	1	2 wolves attempt an attack on the flock confined to an electric fence.	A LGD raises its head.
		2	a. Two wolves approach a LGD (the flock is located at 50 m). One* (high posture) smells the dog (shoulders, back and head). Contact during 38 sec. Retreats for 5 m, returns (no contact), leaves again. d. Returns after 35 sec. Sniffs the ground around the dog during 30 sec. No contact. Leaves. g. Wolves escaping.	b. LGD stays still, no movement. High posture. Turns head to the opposite side. c. LGD orients itself towards the two wolves. High posture (hackles raised). e. No reaction. f. Two LGDs** standing close to the flock chase the wolves (82 sec. after the last encounter). A third dog joins the group. h. Long chase >1 km.
		3	2 wolves roaming around the flock.	No reaction.

* The other stays 5–10 m away from the LGD.
** The LGD sniffed by the wolf showed the same posture towards the two LGDs.

PU, altitude, flock size, damage reports/nr. losses	Nr. of LGDs	Date and nr. of events	Wolves' behaviours	LGDs' reactions
		25-29.08		
Millefonts **1,900-2,300 MASL** **2,000 head** **6 attacks/13 head lost**	3	4*	1 wolf spent 3 nights in the vicinity of the flock (10 hours of recordings).	Different responses of the LGDs: from no reaction to chasing (>1 km).
		5	a. A wolf carefully approaches the flock (not surrounded by a fence), attacks, captures a sheep by the neck, 4 other attempts to catch other sheep. The attack lasts 50 sec. No sheep were wounded. c. The wolf escapes.	b. LGDs bark. Seem to search for the source of the flock disturbance. Chase the wolf.
		6	A wolf carefully approaches the flock (not surrounded by a fence) and attacks. Makes 2 attempts to catch a sheep. The attack lasts 15 sec. The wolf escapes.	LGDs bark. Chase the wolf.
		7	A wolf approaches the flock, walks alongside the flock, lies down during 45 sec. at 20 m, stands up and continues to walk alongside the flock. Leaves. The occurrence lasts 152 sec.	No reaction. A LGD barks. The wolf was already approaching the flock.
		8	a. 2 wolves feeding on a lamb. c. The 2 wolves approach the LGDs →bow behaviour. e. The 2 wolves return to feed on the carcass.	b. A LGD approaches and sniffs the ground. d. The LGD chases off the two wolves. f. The LGD leaves the area sniffing the ground.
		9-13.08		
Longon **2,000-2,550 MASL** **2,000-2,500 head** **12 attacks/32 head lost**	8	9	1 wolf passes by the flock at 300 m. Feeds on a lamb killed during the day.	No reaction.
		10	a. 4 wolves pass by the flock at 300 m (at the same place, during the same night). Feed on the lamb. Social interactions between the presumably two parents (double marking). Leave the carcass. c. The four wolves chase the LGDs. Stop to drink in a stream.	b. A LGD chases the four wolves. Then it suddenly flees before the wolves chase it. Another LGD, which was joining the first one is also escaping.
		11	Two wolves pass by the flock at a distance of 200 m.	No reaction.**
14 – 21.09		12	Two wolves return to the rendezvous site passing by the flock at a distance of 200 m. One wolf is carrying food in its mouth. The other is limping. Marking behaviour from the latter.	No reaction.
11 – 16.10	11		The pack has changed its rendezvous site, presumably after a hunter discovered it. The pack was filmed 2 km from the flock.	

*A presumably young wolf spent three nights around the flock interacting with the flock and the dogs. We have recorded 10 hours of video material on this wolf. To simplify the table, we summed all the interaction in one event.

** It's interesting to note that just before the appearance of the wolves, the LGDs and herding dogs were barking very loud after which the herding dogs began to howl. Suddenly all the dogs stopped vocalizing.

a few hundred meters to more than one kilometre (Fig. 3). Prior to or during long chases (n=3), the wolf being chased seemed to wait for the LGDs instead of running away. In one case, the wolf being chased stopped and watched the LGD running by, even though 2 minutes before it was confronted by it and displayed a fearful aggressive behaviour (with low posture, ears back, tail under the belly, mouth wide open) (Fig. 4).

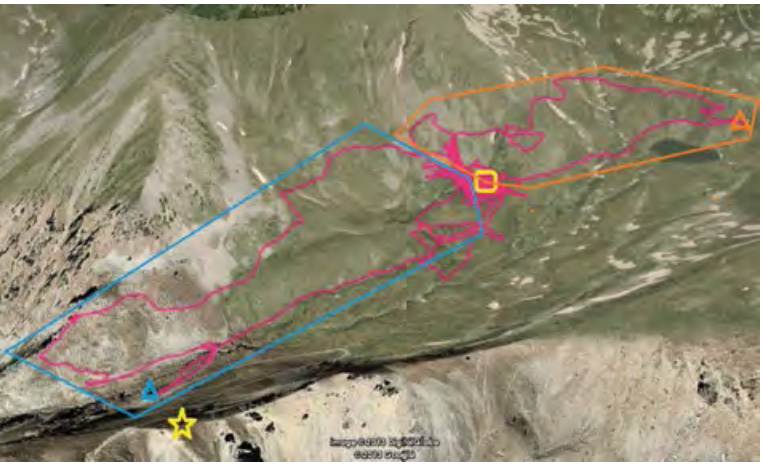

Fig. 3. Routes of one LGD chasing a wolf (pink lines). The blue polygon encloses a chase anti-clockwise initiated in the shepherd hut (yellow square), where the flock was bedded, ending at the blue triangle. The orange polygon encloses a second chase, clockwise from the shepherd hut, ending at the orange triangle. Image from Google earth.

Fig. 4. A wolf (on the right of the image) facing a LGD (on the left). Photo: CanOvis/NPM.

In two separate events, a LGD did not chase away two wolves which were standing nearby. In the first occasion, one wolf approached the LGD and sniffed it (Table 1). In the other event, the LGD sniffed the ground and approached two wolves feeding on a sheep carcass. The wolves then approached the LGD and attacked. The LGD defended itself by chasing them away. After that the wolves returned to feed on the carcass, while the LGD retreated sniffing the ground. On two PUs, wolves and LGDs were seen in proximity of each other (less than 100 meters apart) near the shepherd's hut (less than 100 meters away), without interacting.

Responses of LGDs towards other wildlife ranged from no reaction (especially towards hares, including *Lepus timidus* and *Lepus europaeus*), to barking with a short approach (<100 m) (*Lepus ssp*, red deer), and chasing (chamois and red fox), although always shorter than in the case of wolves. The LGDs' responses to stray dogs included chasing and social interactions (a neighbouring LGD male managed to enter the flock to reach a receptive female despite the presence of three other male LGDs).

Barking by LGDs did not prevent a wolf from attacking the flock during the first videotaped attack. During the second attack, on the following night, the wolf stopped the attack after LGDs barked; but LGDs were closer than the previous night.

4. Discussion

Thanks to the infrared binoculars, we were able to collect a remarkable set of images of interactions among LGDs and wildlife near flocks of sheep on summer pastures. We observed wildlife and especially wolves during all sessions. Wolves were observed passing by the flock, feeding on freshly killed sheep or attempting to attack sheep, despite the presence of LGDs. Wolves were apparently unafraid of LGDs. Although wolves were chased by LGDs or had agonistic encounters, these experiences did not prevent them from returning the same or following nights. Moreover, we recorded several occurrences in which a single LGD faced a wolf and exaggerated its behaviours instead of attacking, allowing enough time for the wolf to escape. Thus, the LGDs observed (either naive or experienced with wolf encounters) seemed

to be very cautious around wolves. These results, which corroborate those of the previous study (Landry, 2013), strongly suggest that LGDs (or at least the dogs we observed) may be considered as a primary repellent (Shivik et al., 2003), namely they disrupt a predator's behaviour (Coppinger et al., 1988), but do not permanently modify their behaviour as a secondary repellent could do, through associative learning. Therefore, it is likely that wolves become habituated to LGDs, suggesting that no long-term avoidance learning occurs (Landry, 2013). It also seems that both LGDs and wolves evaluate the risk of an escalating confrontation. If LGDs play only the role of a primary repellent, the risk (i.e. to be wounded) for the wolves remains low. Therefore, the protection of the flock depends primarily on the physical ability of the LGD to consistently disrupt predatory behaviour night after night or to win a fight. This ability (to win an all-out contest) was called resource holding potential (RHP) by Parker (1974) to distinguish physical fighting ability from the motivation to persist in a fight. Therefore, the probability to win a fight depends not only on physical components, but also on motivational aspects (Parker, 1974), which depend on the value of the resource as well as the perceived prowess and motivation of the opponent (Barlow et al., 1986). Daring (which equals aggressiveness to Hurd, 2006) was proposed as a third variable, which plays an important role in determining fight outcome (Barlow et al., 1986). Daring (or aggressiveness) is the readiness to risk an encounter, to enter, or to dare to escalate an aggressive interaction (Barlow et al., 1986; Hurd, 2006). These factors (RHP, motivation and aggressiveness), which were first applied to fish, might be useful on other species like guarding dogs, to be employed as a toll to improve protection abilities. Based on behavioural models, these factors affect the choice of whether and when to escalate a confrontation (Hurd, 2006). Animals with higher RHP may escalate more as they have less to fear in a physical fight (Hurd, 2006). Individuals with higher subjective resource values may define winning as very important and more readily escalate an aggressive interaction (Hurd, 2006). Yet, it is difficult to know how valuable this resource (flock, sheep) is for a LGD and if it is correlated to the strength of the social bond to it (which is thought to be the first step of the protection success, Coppinger et al., 1988). LGDs traditionally used in Eurasia are taller than wolves, giving them theoretically higher RHP. Aggressiveness may be more important than the RHP and motivation to win a fight, at least in some species (Hurd, 2006). Therefore, the LGDs' aggressiveness may be a selective criterion as already pointed out by Green and Woodruff (1990) and rarely used in western countries. Daring (aggressiveness) appears to be an inherent property (Liinamo et al., 2007) and is a component of the temperament (or personality) of an individual (Barlow et al., 1986). Therefore, temperament may play a major role in flock protection, which corroborates the findings of McGrew and Blakesley (1982), who observed that LGDs with a clumsy or shy temperament were more often challenged by coyotes in contrast to aggressive/bold individuals. Moreover, aggressiveness is independent of the effect of RHP and resource value (Hurd, 2006). Thus, selecting aggression among LGDs may be beneficial for the protection of the herd. Yet, in touristic areas like the Alps, it will be essential to ensure aggressiveness is maximal towards predators while it is minimal regarding humans. Selecting aggressiveness against predators may also increase aggression towards companion or hunting dogs, which will lead inevitably to conflicts with hikers and hunters. The level of LGD aggressiveness towards predators varies among breeds and bloodlines suggesting an input of artificial selection. For example, eastern LGDs, like the Karakachan from Bulgaria, are known to be more aggressive (and territorial?) towards intruders (Sedefchev, 2005). According to Sedefchev (2005), the success of the LGD is its readiness to confront and fight, which seems not to be the case with GP. Compared to other breed, GPs are known to be less aggressive towards humans and dogs (Green and Woodruff, 1988) and therefore were recommended for touristic areas (Andelt, 1992; Hansen and Bakken, 1999; Landry, 2004). It was assumed that wolves would avoid LGDs, because the first instinct of a predator is not to feed, but to avoid hazard (e.g. Coppinger and Coppinger, 1993), and that their presence would interrupt their predatory sequences (e.g. Coppinger and Schneider, 1995). Thus, the lack of readiness to escalate might indicate that the LGD is not a real obstacle and that the wolf's success is just a question of time (the balance of costs and benefits is in its favour). In areas where LGD traditions were lost, the developmental environment in the sheep culture might not be similar enough to the ancestral one to

elicit the proper behaviour from the dogs – if indeed they have any of those genes left because of selective breeding during recent years (Coppinger and Coppinger, 2005).

Our preliminary results and those of Landry (2013) demonstrate that LGD barks alone often do not modify wolves' on-going behaviours (60% of the cases in Landry, 2013), which corroborate the findings of Linhart et al. (1979) and McGrew and Blakesley (1982) on coyotes, and the ideas of Sedefchev (2005) regarding wolves. Because barking is easy to pinpoint (Coppinger and Feinstein, 1991), they might give valuable information to the wolves about the LGDs' location, the number of individuals, their distance and maybe even temperament (McGrew and Blakesley, 1982). Nevertheless, LGDs' barks can attract other LGDs even if they are not able to observe the scene (Landry, 2013). These observations suggest that LGDs vocalisations might transmit information. Indeed, the length of the barks and their frequency vary according to the context (e.g. type of intruder and threat), which suggests a function of communication (Yin, 2002; Yin and McCowan, 2004; Maros et al., 2008). Therefore, the effect of LGDs vocalisation on both LGDs and wolves will be studied in our project.

Fig. 5. During day-time, flocks scatter on large areas, which makes them difficult to protect. Photo: CanOvis/NPM.

We have regularly observed LGDs leaving the flock in the early morning to defecate and urinate before returning. LGDs and wolves can also defecate on the same spot. In our PUs, these scent "markings" did not prevent wolves from passing by or from attacking the flock, which supports the findings of Linhart et al. (1979) and McGrew and Blakesley (1982) on coyotes. Moreover, a recent study using a "biofence" made of non-native wolves faeces, urine and scratch marks showed ambiguous results as wolves regularly crossed the "forbidden" invisible line (Ausband, 2010). Therefore, LGDs markings should not be considered effective in preventing attacks as it is sometimes claimed.

MacNulty and colleagues (2009) demonstrated adult wolf predatory performance declines with age and that an increasing proportion of senescent individuals in the wolf population depresses the rate of prey offtake. Moreover, the performance weakening is correlated to the physical condition (Gurven et al., 2006). As an analogy to these results, the same may happen with the LGDs protecting a flock of sheep. Thus, the maintenance of the LGD, its age (which are RHP components), and the age structure of the LGDs' group are also key factors in protecting skills. But the latter will be ineffective if the females' heats are out of control. The energy to protect the flock is wasted on courting females and fighting males. In our case, a strange male LGD managed to reach a female in heat in the middle of the flock despite the presence of three males, probably because they were wounded during a fight at the beginning of the evening.

We videotaped particular wolves staying nearby flocks (roaming, marking), attempting attacks (without being successful), and interacting with LGDs. Based on behaviours and phenotypes of such wolves, we speculate they could be young wolves learning how to hunt and testing LGDs. Consequently, if these first encounters are not associated with negative consequences, we hypothesize they will learn that LGDs and shepherds are not a danger and will perceive sheep as an available resource. This knowledge may then be passed to the next generation through associative learning. Thus, more aggressive LGDs may be necessary to teach young wolves that encounters with LGDs have severe consequences.

To date, observations suggest that shepherds are not perceived as a threat for wolves. For example, during

encounters shepherds can only yell or throw stones with minimal observed effects. Even if they could get the permission to use a gun (MEDDE and MAAF, 2013), the majority of them do not ask for such a permit or leave the gun in the hut. Wolf flight distance when approached by a shepherd is typically less than 100 m to as little as 30 m (J-M Landry, unpub. data). Recently, shepherds reported being challenged by a wolf while trying to recuperate a recently wounded lamb. Such emerging testimonies might be correlated to an increase in day-time attacks (which reached 52% of all attacks in 2013 in the Alpes Maritime Department, P Merlot, DDTM 06, pers. comm.).

A shepherd's daily job is to lead, care for, gather the flock for night-time bedding and feed the LGDs, as well as to monitor and adapt to available forage on summer pastures. Some shepherds continually follow the flock, while others observe from a distance to have a better overview. A herd of 1,500-2,000 head of sheep can easily scatter and occupy a large area (Fig. 5). Oftentimes, the topography is rough and heavily vegetated, leaving the flock out of view and more vulnerable to wolf predation.

5. Conclusions

The efficacy of LGDs protecting a flock depends on several internal and external factors. The way of managing the group of LGDs (e.g. neutering selected individuals) is the first step and can be easily applied if clear rules are ascertained (e.g. to respect an "age pyramid" of experience within the LGDs' group, which experienced dogs are the most representative, to take into account agonistic interactions between dogs) But it is not always obvious for sheep owners or shepherds, especially for those who have little experience with LGDs. The selection of inborn abilities like protecting a flock, RHP, motivation and aggressiveness (or "daring" temperament) may be serious criteria to consider, as would be their capacity to learn from external events (e.g. social learning) and internal experiences (e.g. own experiences). The population of the main "breed" (GP) used in France went through a severe bottleneck due to the disappearance of large predators. Since then, selection was based on phenotypic criteria and even docility rather than on protective behaviours. Currently, unreliable LGD selection is implemented on the new alpine LGD populations (nearly 1,400 dogs).

As wolves are able to develop strategies to approach a flock without being detected (Boitani, 1982) or to attract LGDs to one side, while others attack on the other side (Coppinger and Coppinger, 1978), the success of the LGDs depends not only on internal factors (RHP, motivation and aggressiveness), but also on external factors (e.g. size of the flock, topography, weather). Therefore to make a selection, we need solid criteria independent of these external factors (e.g. predator density and age structure, wild prey availability, PU topography) or subjectivity, which may bias the results. The only way to discover these criteria is to study LGDs protection skills by observing how they react to wolves and how the latter counter-respond. Because wolf attacks occurred mainly during night, the use of a set of thermal (night-vision) binoculars is obligatory to study interactions between LGDs and wolves, which is one of the main objectives of the on-going CanOvis project.

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References

Andelt WF (1992) Effectiveness of livestock guarding dogs for reducing predation on domestic sheep. Wildl. Soc. Bull. 20, 55-62.

Barlow GW, Rogers W, Fraley N (1986) Do Midas cichlids win through prowess or daring? It depends. Behav. Ecol. Sociobiol. 19, 1–8.

Ausband D (2010) Pilot study report for using a biofence to manipulate wolf pack movements in central Idaho. Montana Cooperative Wildlife research unit. Wolf project. 14 p.

Boitani L (1982) Wolf management in intensively used areas of Italy. In: Harrington FH, Paquet PC, editors. Wolves of the World: Perspectives of behavior, ecology, and conservation. Noyes Publications, Park Ridge, New Jersey, USA, pp. 158-172.

Coppinger R, Coppinger L (1978) Livestock guarding dogs. Hampshire college, Amherst Ma, USA.

Coppinger R, Coppinger L (2005) Livestock Guarding Dogs: from the Transhumance to Pre-Zygotic Selection. Carnivore Damage Prevention News 8, 2-9.

Coppinger R, Coppinger L, Langeloh G, Gettler L, Lorenz J (1988) A decade of use of livestock guarding dogs. In: Crabb AC, Marsh RE, editors. 13th Proceedings of the Vertebrate Pest Conference. University of California, Davis, USA, pp. 209-214.

Coppinger L, Coppinger R (1982) Livestock-guarding dogs that wear sheep's clothing. Smithsonian 1, 65-73.

Coppinger R, Lorenz J, Glendinning J, Pinardi P (1983) Attentiveness of guarding dogs for reducing predation on domestic sheep. Journal of Range Management 36, 275-279.

Coppinger R, Coppinger L, Langeloh G, Gettler L, Lorenz J (1988) A decade of use of livestock guarding dogs. In: Crabb AC, Marsh RE, editors. 13th proceedings of the Vertebrate Pest Conference. University of California, Davis, USA, pp. 209-214.

Espuno N (2004). Impact du loup (Canis lupus) sur les ongulés sauvages et les ongulés domestiques dans le massif du Mercantour. Thèse de doctorat, Université Montpellier II, 221 p.

Gehring TM, VerCauteren KC, Landry J-M (2010) Livestock protection dogs in the 21st century: is an ancient tool relevant to modern conservation challenges? BioScience 60, 299–308.

Green JS, Woodruff RA (1983) The use of three breeds of dogs to protect rangeland sheep from predators. Applied Animal Ethology 11, 141-161.

Hansen I, Bakken M (1999) Livestock-guarding dogs in Norway: Part I. Interactions. J. Range Manage. 52, 2-6.

Hurd PL (2006) Resource holding potential, subjective resource value, and game theoretical models of aggressiveness signalling. Journal of Theoretical Biology 241, 639–648.

Landry J-M (2013) Analyses comportementales des interactions entre des chiens de protection et des loups dans le parc national du Mercantour. Rapport pour le Ministère de l'Agriculture et de l'Agroalimentaire et de la pêche, 60 p.

Linhart SB, Sterner RT, Carrigan TC, Henne DR (1979) Komondor guard dogs reduce sheep losses to coyotes: a preliminary evaluation. Journal of Range Management 32, 238-241.

Maros K, Pongrácz P, Bárdos G, Molnár C, Faragó T, Miklósi Á (2008) Dogs can discriminate barks from different situations. Applied Animal Behaviour Science 114, 159-167.

McGrew JS, Blackesley CS (1982) How Komondor dogs reduce sheep losses to coyotes. Journal of Range Management 35, 693-696.

Muséum National d'Histoire Naturelle (Ed.) (2003–2013) Inventaire national du Patrimoine naturelle. Available: http://inpn.mnhn.fr.

Parker GA (1974) Assessment strategy and the evolution of animal conflicts. Journal of theoretical Biology 47, 223-243.

Ministère de l'Ecologie, du Développement Durable et de l'Energie, Ministère de l'Agriculture, de l'Agroalimentaire et de la Fôret (MEDDE, MAAF) (Eds.) (2013) Plan d'action national loup 2013-2017. 68 p.

Sedefchev S (2005) The Karakachan Dog: Continuation of an Old Bulgarian Tradition. Carnivore Damage Prevention News 8, 14-19.

Yin S (2002) A new perspective on barking in dogs (Canis familiaris). Journal of Comparative Psychology 116, 189-193.

Yin S, McCowan B (2004) Barking in domestic dogs: context specificity and individual identification. Animal Behaviour 68, 343 – 365.

Article

LIVESTOCK GUARDING DOGS IN EUROPE:

PAYING ATTENTION TO THE CONTEXT IS IMPORTANT WHEN MANAGING COMPLEX HUMAN - WOLF - DOG RELATIONSHIPS

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1. Introduction

In the European continent, the impacts of social and ecological changes during recent decades has led to a general trend for the "lowlands" to see an intensification of agriculture and increase in human populations and the "highlands" (and other marginal areas) to see a reduction in extensive agriculture and a decrease in human population (Meeus et al., 1990; MacDonald et al., 2000). The reduced human pressure on habitats has led to the reforestation of the landscape and the recovery of wildlife species – including highly symbolic species like wolves and bears (Linnell et al., 2008). These changes are also creating a wide range of challenges for rural populations, and what is often perceived as environmental "benefits" (mostly among the urban public) such as the recovery of wolf populations becomes the most contested symbols of "negative" change (mostly among the rural public).

There has been widespread resistance among rural people against accepting the presence of nature protection activities in general, notably the recovery of large carnivores, and adopting the technical measures that accompany nature protection actions [e.g. introduction of Livestock Guarding Dogs (LGDs), electric fences, night-time enclosure of sheep]. This shows that there has been a failure to recognise and understand the importance of the socio-cultural aspects of human-wildlife conflicts. Indeed, while the ecological, economic and technical aspects of these conflicts have been widely studied across Europe, the social science toolkits have only been recently deployed. This is despite widespread recognition of the importance of non-economic social issues such as loss of identity and tradition in the face of change, the recognition of local knowledge and way of life, as well as the specific link between livestock breeders and domestic animals at work (Ingold, 2000; Höchtl et al., 2005; Porcher, 2006; Martin et al., 2013).

Environmental anthropology can potentially make a very important contribution to this topic and to understand the complex system in which people's perceptions, knowledge and practices are embedded. By shedding light on the overall context, anthropology can explore the way people perceive their place in nature, the overall relationship between nature and

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culture, and especially the fundamental relationship between wild and domestic that lies at the heart of the modern conflicts in rural areas. In order to make a direct link to both anthropological conceptual models (nature vs. culture, domestic vs. wild) and concrete attempts to address material aspects of the conflict (adoption of protection measures) we have recently completed an ethnographic field study to understand how the domestic dog can modulate the human – wolf relationships.

We set out to explore the role of the dog in modulating the relationships between humans and wolves (Lescureux and Linnell, 2014) in three countries: the Republic of Macedonia, Poland, and Bulgaria. These countries have different practices in terms of hunting and sheep breeding, allowing us to compare different types of human – wolf relationships according to the way that hunting dogs and LGDs are used. Our main conclusions concern 1) the potential impact of LGDs on landscape in a context of rural abandonment, 2) the contrasting uses of LGDs in traditional and modern contexts, and 3) the surprising potential negative effect of LGDs in a context of shared landscape between livestock breeders and hunters. These conclusions allow us to draw some practical recommendations in terms of mitigation measures in carnivore conservation actions. We observed differences in sheep breeding practices and also differences in the way local people are using LGDs between Macedonia, Bulgaria and Eastern part of Polish Carpathians.

These differences are mainly due to the fact that while livestock breeding traditions, including the use of LGDs, have been kept in Macedonia, few traditional livestock breeders remain in the Polish East Carpathians. Most of our Polish informants were new livestock breeders also working with other agricultural and non-agricultural activities in parallel. The situation in the Pirin mountains of Bulgaria is somehow intermediate. Some livestock owners are breeding sheep as their main activity. They own a flock and have been traditionally keeping LGDs. Others just own a few sheep and flocks from several owners are cooperatively herded. These herders have only started to use LGDs in the last decade thanks to the combined actions of environmental and rural development NGOs (cf. Sedefchev, 2005).

2. LGDs and landscape in a context of rural abandonment

The differences between countries allowed us to observe the impact LGDs can have on livestock breeders' use of their landscape. Indeed, most Macedonian livestock breeders from the Sharr Mountains are still transhumant and migrate to alpine pastures during summer, grazing their sheep in open landscapes with the help of shepherds and LGDs. In a context of rural abandonment and shrub encroachment on alpine pastures, LGDs allow the maintenance of sheep grazing in places where it would be dangerous (from the point of view of depredation risk) to graze without dogs, i.e. in shrub covered places or even in the forest when temperatures are too hot for the flock to be in the open during the day. Dogs are constantly scanning the area when the flock is moving and especially emboldened by the shepherds when coming close to dangerous areas.

In the eastern Polish Carpathians, only a few of the livestock breeders we met were still transhumant. Many sheep breeders kept their sheep close to the village, inside fenced fields or fenced meadows with one or two livestock guarding dogs inside (cf. also Śmietana, 2005). There were no shepherds staying with the sheep, and they freely grazed inside their enclosures. In this context, LGDs do not help the flock graze in bushy places or in the forest. However, most of these fenced meadows are surrounded by forest and are potentially highly exposed to wolf attacks. Electric fences are only being used to protect sheep during the night in Poland. Therefore, in this situation the use of LGDs prevents the wolf from coming into the non-electrified enclosures, and allows livestock breeders to keep sheep without attending shepherds in meadows surrounded by forest and wolves.

Our investigations clearly show that LGDs have a potential (indirect) impact on the landscape, since they permit shepherds to avail of grazing sites close to and even inside the forest. Moreover, in a context of rural abandonment and bush encroachment like in the Balkans, LGDs can potentially slow down the vicious cycle of land abandonment leading to loss of grazing pastures and increased difficulties to maintain livestock breeding activities. Our results also show contrasting approaches to landscape and wolf presence in contrasting situations that we can analyse following

the ancient Roman classification of landscape. In the Balkans wolves have always been present and shepherds kept their traditional husbandry methods to protect the flock. They "fight" against the wolf which is conceptually viewed as crossing the perceived border between silva (forest) and saltus (grazing area) or ager (cultivated fields) (Lescureux and Linnell, 2010). Thus, LGDs are used to maintain borders (between the "domestic" flock – and the "wild" wolf) and also to cross it in the other direction, allowing herders to go into the forest (silva) with the sheep.

In the eastern Polish Carpathians, wolves have always been present too, and it is rather livestock breeding which is coming back and having to adapt to a difficult situation (meadows surrounded by forest). Breeders are adopting some of the traditional husbandry methods which are still in use in the Tatra Mountains (a mountain range in the western Carpathians on the Polish/Slovakian border), but are also adapting them to the context of village meadows close to the forest, not using shepherds but combining LGDs and electric fences. Thus, they can maintain the presence of saltus enclaves inside the silva landscape.

3. The importance of the shepherd – dog team in the traditional use of LGDs

During our investigations, we had the opportunity to meet three types of LGDs users:

1. Livestock breeders (LB) who are traditionally using LGDs;
2. LB who were using dogs other than LGD breeds, but had started to use LGDs for the first time;
3. LB who started this activity without familial traditions and started to use LGDs for the first time.

In the Balkans, where traditional use of LGDs has been retained, sheep are always grazed on unfenced pastures by one or several shepherds accompanied by several LGDs whereas in the eastern Polish Carpathians we met many people who left the sheep alone with one or two LGDs in an enclosure, but without an attendant shepherd. Even though LGDs are always considered as relatively independent animals,

Sheep flock with shepherd and livestock guarding dogs in open landscape in Macedonia. Photo: Nicolas Lescureux.

In Bieszczady area, many small flocks are kept on forest meadows, protected by a fence and one or two dogs, in the absence of shepherds (eastern Polish Carpathians). Photo: Nicolas Lescureux.

Hunting dog "Balkanec" from Macedonia. These dogs are used to hunt wild boars, hares, and foxes but can sometimes be killed or injured by wolves and in some areas it happens they are killed by livestock guarding dogs (Republic of Macedonia). Photo: Nicolas Lescureux.

Rural abandonment is highly visible in mountain villages from north western Macedonia. Photo: Nicolas Lescureux.

it appeared quite obvious that when shepherds are present on the Balkan pasture, dogs and shepherds acted as partners. Both shepherds and dogs observed each other looking for cues to know how to react. If dogs smelt something, shepherds would notice it and encourage them to search and eventually to attack the intruder if it was dangerous for the flock.

This partnership between LGDs and shepherds appears to be characteristic of their traditional use and has to be kept in mind in the different projects trying to reintroduce the use of LGDs in places where they have disappeared (e.g. the Alps), or have never been used (e.g. the Nordic countries). The danger is that dogs can show unwanted behaviour (e.g. chasing wildlife, attacking sheep, attacking hikers and pet dogs) and will not be corrected if used in the absence of a shepherd. The use of dogs without permanent shepherding can be a common feature where LGDs are being reintroduced in western Europe. Indeed, due to low agricultural income in sheep breeding, high labour cost and the lack of appropriate infrastructures (such as cabins), many livestock owners can't afford to hire shepherds. Using LGDs without shepherds may require a selection for very different traits (i.e. less aggression) than previously which may possibly reduce their effectiveness against large carnivores.

4. LGDs: a mitigation measure raising unexpected conflicts

In the Balkans, hunters traditionally hunt in groups, especially for wild boar, and use several free-ranging dogs which are released in the forest in order to drive the wild boar towards the hunters. The coexistence of this hunting method with wolf presence generates two types of conflicts. Firstly, there is a direct conflict between hunters and wolves since hunting dogs are sometimes killed by wolves. Almost all hunters we met in Macedonia reported they had experienced having dogs injured or killed by wolves. A second conflict occurs when dogs are lost for several days. Looking for food, they go out of the forest and end-up in the mountain pastures. Even if they do not attack the flocks, they can be killed by LGDs who are protecting the sheep against intruders. Therefore, some conflicts emerged between hunters and livestock breeders and there have been cases when hunters have killed LGDs in retaliation. Such conflicts didn't appear to exist in the eastern Polish Carpathians since the hunts are operated in a different way and hunting dogs are rarely lost in the forest, and also rarely killed by wolves. No conflicts appeared to exist there between hunters and livestock breeders about LGDs killing hunting dogs.

The first interesting conclusion that can be drawn from these conflicts is that behind an apparently homogenous rural response to an agent like the wolf, there can be internal divisions and conflicts between different traditional practices related to wolf management occurring in the same landscape. The second conclusion is that some conservation actions aiming at mitigating conflict, like the introduction of LGDs in places they were absent or from where they disappeared can cause unexpected new conflicts. Similar unexpected conflicts have also been reported from western Europe with LGDs threatening or attacking hikers and their pet dogs. Therefore it is important to pay attention to the social and ecological context in places where LGDs are still in use and to facilitate a trans-European transfer of knowledge between traditional and new users of LGDs in order to properly implement their introduction, in accordance with the other existing practices in the landscape like hunting or tourism.

5. Conclusions

Human – wolf – dog relationships are very complex and can vary according to social, ecological, and even individual context (Savalois et al., 2013; Gompper, 2014). In the face of expanding wolf populations, LGDs have been presented as a very efficient tool to mitigate conflicts between livestock breeding activities and the presence of large carnivores. As we have shown, on the one hand LGDs can certainly play a role in maintaining livestock breeding activities, and thereby grazing dependent cultural landscapes that are rich in biodiversity. On the other hand, they can also generate conflicts with other landscape users like hunters. It is important to keep in mind that LGDs have been used from centuries, have proven to be efficient, but were originally part of a complex pastoral system implying the constant presence of numerous shepherds. Therefore their direct transfer to modern multi-use landscape in Western Europe will not automatically be efficient or without problems. There is a strong need for a better understanding of the traditional use of LGDs as well as the different way to adapt them to modern contexts.

References

Gompper ME (2014) The dog-human-wildlife interface: assessing the scope of the problem. In: Gompper, ME, editor. Free-Ranging Dogs and Wildlife Conservation. Oxford University Press, Oxford, pp. 9-54.

Höchtl F, Lehringer S, Konold W (2005) "Wilderness": what it means when it becomes reality - a case study from the southwestern Alps. Landscape and Urban Planning 70, 85-95.

Ingold T (2000) From trust to domination. An alternative history of human-animal relations. In: Ingold T, editor. The perception of environment. Essays on livelihood, dwelling and skill, Routledge, London and New York, pp. 61-76.

Lescureux N, Linnell JDC (2010) Knowledge and Perceptions of Macedonian Hunters and Herders: The Influence of Species Specific Ecology of Bears, Wolves, and Lynx. Human Ecology 38, 389-399.

Lescureux N, Linnell JDC (2014) Warring brothers: The complex interactions between wolves (*Canis lupus*) and dogs (*Canis familiaris*) in a conservation context. Biological Conservation 171, 232-245.

Linnell JDC, Salvatori V, Boitani L (2008) Guidelines for population level management plans for large carnivores in Europe. A Large Carnivore Initiative for Europe report prepared for the European Commission (contract 070501/2005/424162/MAR/B2).

MacDonald D, Crabtree JR, Wiesinger G, Dax T, Stamou N, Fleury P, Guttierez Lazpita J, Gibon A (2000) Agricultural abandonment in mountain areas of Europe: Environmental consequences and policy response. Journal of Environmental Management 59, 47-69.

Martin A, McGuire S, Sullivan S (2013) Global environmental justice and biodiversity conservation. The Geographical Journal 179, 122-131.

Meeus JHA, Wijermans MP, Vroom MJ (1990) Agricultural landscape in Europe and their transformation. Landscape and Urban Planning 18, 289-352.

Porcher J (2006). Well-being and suffering in livestock farming: living conditions at work for people and animals. Sociologie du Travail 48, Supplement 1, e56-e70.

Savalois N, Lescureux N, Brunois F (2013) Teaching the Dog and Learning from the Dog: Interactivity in Herding Dog Training and Use. Anthrozoös 26, 77-91.

Sedefchev S (2005) The Karakachan Dog - Continuation of an old Bulgarian Tradition. Carnivore Damage Prevention News 9, 14-19.

Śmietana W (2005) Use of Tatra Mountains Shepherd Dog in the Bieszczady Mountains and the Bieszczady Foothills, Poland. Carnivore Damage Prevention News 8, 10-12.

Article

AN INNOVATIVE APPROACH

TO MITIGATE THE CONFLICT BETWEEN LARGE CARNIVORE CONSERVATION AND LOCAL COMMUNITIES

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LIFE EX-TRA – Improving the coexistence of large carnivores and agriculture in southern Europe

www.lifextra.it

1. Introduction

The LIFE EX-TRA project took place between January 2009 and March 2013 in three Italian national parks [Gran Sasso and Monti della Laga National Park (PNGSML), Monti Sibillini National Park (PNMS) and Appennino Tosco-Emiliano National Park (PNATE)] and in different areas in Romania, Bulgaria and Greece. Based on the knowledge acquired in the previous LIFE project "Improving the coexistence of large carnivores and agriculture in southern Europe" (LIFE04NAT/IT/000144-COEX), of which the PNGSML was a partner, the LIFE EX-TRA project offered the opportunity to transfer skills and good practices concerning the management of large carnivores to other areas.

One of the lessons learned from the LIFE COEX Project has been that, although many technical, legal and economic measures can be used to try to mitigate the conflicts between large carnivores and local communities, these tools cannot reduce the emotional impact that depredation of livestock has on its owners. The effects of these negative feelings are that the local communities strongly fight against the presence of the wild predators. This can be seen by several cases of wolves and bears being killed in the past years, and also by the simple constant lobbying against the presence of these animals in the area.

Conflicts between carnivore conservation and local communities are characterized by a plurality of actors, interests, motivations, all with different ways of communicating. Often the negative feelings of local communities towards wolves and bears are an indirect symptom of other problems associated with issues such as land use restrictions in protected areas, inadequate working conditions for livestock raisers, insufficient appreciation of local products, and the general feeling of being abandoned by the local authorities. In fact, many discussions with local interest groups have revealed that the conflicts with wolves and bears were mainly a way to attract the attention of local authorities onto other, more fundamental issues.

The new element that was introduced in the LIFE EX-TRA project was the attempt to gain a full understanding of all the affected stakeholders and, in a second step, to start a negotiation process between the local authorities in charge of nature management and the most affected parties, in order to allow the start of dialogue.

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In the project's first year (2009) a detailed stakeholder analysis was conducted, based on the consultancy of national experts in the four project countries, and under the coordination of an international steering group.

After the first pre-assessment, while sharing the same theoretical basis, we understood how the methodological approach to the management of environmental governance would be different in the four individual partner countries. The socioeconomic, legal, ecological and geographical conditions were so different among areas that it became immediately clear that in each country a common approach had to be adapted to meet diverse local needs. The support of specialists in each country has helped to adequately point out specific problems to be faced in the consultation process.

In the present article the methodology and activities developed in the three above-mentioned Italian National Parks are presented.

2. Methods

The preliminary stakeholder assessment phase was followed by the application of a methodology that aimed at the management of conflicts through negotiation with local stakeholders and participatory planning.

Two sets of negotiation meetings were conducted: the first set aimed at identifying, some urgent themes and, consequently, some concrete priority actions. The second set of meetings was directed at verifying the results of the previous agreements and at stipulating new ones. Thanks to the mediation of facilitators, these meetings resulted in the common agreement on management approaches, which were followed by concrete interventions on the ground.

2.1. General approach

Despite the diversity of the different geographical areas and the social, political and economic parties engaged, the starting point in the project required all involved partners to understand that "environmental governance[1]", is composed by the analysis and comprehension of the power dynamics between stakeholders.

We referred to a particular type of governance, related to the coordination methods of local actions, in which a plurality of actors operate on a given area, each one having decision-making power (Lewis et al., 2003, Turco, 2009a). These powers are far from being well-defined, but are often intertwined. Furthermore, they are not solely based on legislation, but also on cultural heritage and informal social arrangements. In this perspective the spatially defined approach that was applied gives a significant contribution to environmental conflict prevention and management (Woch & Emel, 1998; Philo & Wilbert, 2000; Faggi & Turco, 2001) since it involves shared planning in a bottom-up negotiation approach.

Fig. 1. Classification of actors identified in the stakeholder analysis carried out in the three involved National Parks in Italy in the LIFE EX-TRA Project, 2009.

2.2. Stakeholder analysis

In the first year of the project a detailed stakeholder analysis was developed in cooperation with the staff of the Department of Human Sciences of the University of L'Aquila. This process began with the construction of a "Map of Actors" (Fig. 1) (Turco, 2009b), a tool that identifies three typologies of persons and bodies that are at various levels affected (positively or negatively) by the presence of large carnivores:

> ***Institutional actors:*** institutions and functional agencies empowered by law, with specific profiles and tasks;
>
> ***Stakeholders:*** private and public bearers of interests. Their point of view can contribute to large carnivore conservation and to create consensus around the undertaken actions. This groups includes livestock raisers, hunters, veterinarians, foresters, persons involved in local tourism et cetera. Stakeholders are selected on the basis of their representation (boards and institutions, associations), their effective presence on the ground, and the fact that they have something to say about the addressed issue (Bobbio, 2004);
>
> ***Stockholders:*** a special category of stakeholders, who are interested in investing in specific tasks of a project or issue, in order to make a profit (tourist operators, farmers, construction companies), or for image strategies (biotechnological industries, green business). They can have direct interests (investors) or indirect ones (sponsors).

A second dimension was then included in the map when the actors were divided according to the level of their involvement in the targeted issue (in our case co-existence with large carnivores) (Faggi & Turco, 2001):

> ***The first circle*** (core actors) included all the institutional actors as well as the stakeholders and stockholders who were closely and directly affected by the presence of large carnivores in the area;

1 Governance is the framework of social and economic systems and legal and political structures through which humanity manages itself" World Humanity Action Trust (WHAT), 2000.

The second circle included interest groups that were less strongly affected by the presence of wolves and bears, benefitting from their presence only to a certain degree.

The third circle included only those actors who were indirectly affected by the presence of large carnivores (e.g. residents, tourists).

Each of the identified actors is characterized by different profiles, issues and strategies and, as can be seen in the figure, the representatives of both the stakeholder and the stockholders can be involved at different levels in the conservation issue that is targeted.

The construction of this map of actors has been a first important step in order to identify all people and groups to be involved more or less intensively in the following steps.

2.3. Interviews

A questionnaire was developed in three steps: 1) production of a preliminary brief version of the questionnaire, 2) testing of the questionnaire on a restricted group of persons and, 3) after evaluation of the results of this test, development of the definitive questionnaire.

The "hermeneutical" interview technique, which was applied in the present analysis, is a type of semi-structured qualitative interview that includes oriented questions and open replies (Montesperelli, 1998; Dalehite, 2008; Della Porta, 2010). The purpose of this was to give the interviewees the biggest possible freedom to express their opinions and suggestions, in order to most effectively obtain a full-range diagnosis of all the factors involved in the conflicts: actors, issues, conflict setting, level of conflict. It is important to point out that the interviews did not focus specifically on large carnivores but on all issues concerning the life of the local communities in the Park areas. The aim was to detect issues and opinions that are only indirectly related to the presence of wolves and bears.

2.4. Data analysis – The 3-stage model

The analysis of the interviews lead to the classification of the existing conflicts based onto a 3-stage methodology (Turco, 2009a), in which the conflict dynamics were divided into three stages with an upward dynamic, each of which requires specific management interventions. In all three stages, interventions and specific behaviour can cause a decrease of the conflict level or an increase. If the conflict level strongly increases it develops into the next step.

1st Stage: An initial disagreement develops into a permanent tension stage. This happens when diverging positions among current actors emerge, regarding more or less well-identified issues or interests, but do not cause open disputes and severe negative attitudes.

2nd Stage: If the causes, effects, dynamics and time frame of tensions are not properly identified, and if they are not appropriately managed, they can evolve into a real conflict stage. In this stage diverging positions are well defined and are expressed in severe negative feelings and attitudes and in clear and open disputes. This stage requires an accurate diagnosis in order to put in place proper mitigation and management strategies.

3rd Stage: If adequate mitigation measures are not applied the arising disputes might spread or connect to other previously existing issues of any kind, developing into the conflict network stage. At this stage controversies grow, developing new conflicts, spreading into new areas, involving new actors and dynamics. This event can exacerbate the negative feelings, creating a climate of suspicion and hostility.

2.5. Participatory meetings

Following the stakeholder analysis a series of 16 workshops and 24 individual meetings were carried out in the three involved National Parks between November 2009 and December 2011. These mee tings aimed to neutralize the upward dynamic of the 3-stage model, to manage the identified conflicts and tensions in order to prevent them from developing into a more severe stage. Fifteen of the workshops were developed with the "World Cafè" method and one with the "Open Space Technology".

The World Café method (www.theworldcafe.com) involves the subdivision of the participants in small groups and a series of twenty-minute rounds of conversation for each group. Each round aims at discussing one specific question, designed for the context and desired purpose of the session. After the small group rounds the participants are invited to share insights or other results from their conversations with the rest of the large group.

The Open Space Technology (OST) (Owen 1998) can be used in meetings with very variable numbers of people. The approach is most distinctive for its initial lack of structure, in which the group of participants then creates the working agenda, as individuals post their issues in bulletin board style. The issues are then organized in sets of topics, which are addressed in dedicated discussion rounds. These resulting notes are compiled into a proceedings document that is distributed physically or electronically to all participants.

In addition, specific issues emerging from consensus workshops were discussed more in depth with the involved stakeholders, in opportunistically organized and unstructured personal meetings.

It must be pointed out that it is not possible to precisely plan the number, timing and structure of such meetings in advance, due to the fact that the topics and techniques involved in each single meeting result from the previous ones' outcomes, and these factors are each time influenced by many factors such as: 1) main issues raised in the previous meetings; 2) attitudes of the involved stakeholders; 3) availability of key stakeholders to participate. Therefore the whole process is subject to a case-by-case evaluation of the single steps by the experts and a consequent adaptation of locations, timing and involved techniques.

3. Results and discussion

3.1. Results of the stakeholder analysis (Turco, 2010)

Following to the construction of the map of actors, during the stakeholder analysis 462 persons were interviewed, most of which were institutional actors and stakeholders (Fig. 2).

The interest groups mostly involved in all the conflict stages were livestock raisers, farmers and local communities in general, but also other specific categories have been involved especially at the tension level: veterinarians, foresters and hunters.

Regarding wolves and bears, the most concerned groups were livestock raisers/farmers as well as institutional actors (municipalities and other local land management authorities) (Fig. 3).

However, it is interesting to see that only a small share of causes of conflict was connected to the presence of large carnivores in the area (Fig. 5). In fact, in PNGSLM and in PNMS in only 14% of the instances large carnivores were mentioned as an issue during the stakeholder analysis and in PNATE only in 10,5% of the cases. Also, issues directly connected to the presence of wolves and bears have mainly been categorized in the "tensions" stage (Table 1), whereas they only very marginally appeared in the other stages.

In contrast, the analysis has revealed a large number of issues besides the presence of large carnivores that are causes or components of the different stages of conflicts (as defined in the 3-stage model) (Fig. 4; Tables 1 & 2).

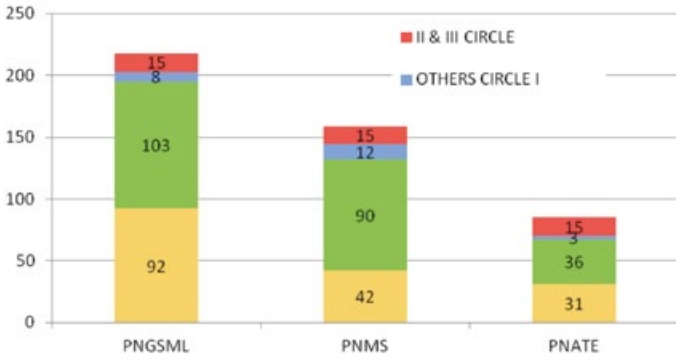

Fig. 2. Numbers of persons of different stakeholder groups interviewed during the stakeholder analysis carried out in Italy in the frame of the LIFE EX-TRA Project, 2009. The Circles mentioned in the legend (I, II and III) refer to the circles in Fig. 1 (PNGSML: Gran Sasso; PNMS: Monti Sibillini; PNATE: Appennino tosco-emiliano).

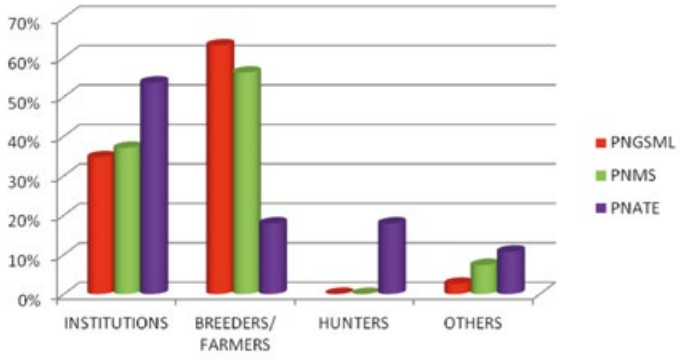

Fig. 3. Types of actors mostly concerned with the presence of large carnivores as revealed by the stakeholder analysis carried out in Italy in the frame of the LIFE EX-TRA Project, 2009. "Others" are categories such as persons involved in tourism, foresters, veterinarians, park rangers (PNGSML: Gran Sasso; PNMS: Monti Sibillini; PNATE: Appennino tosco-emiliano).

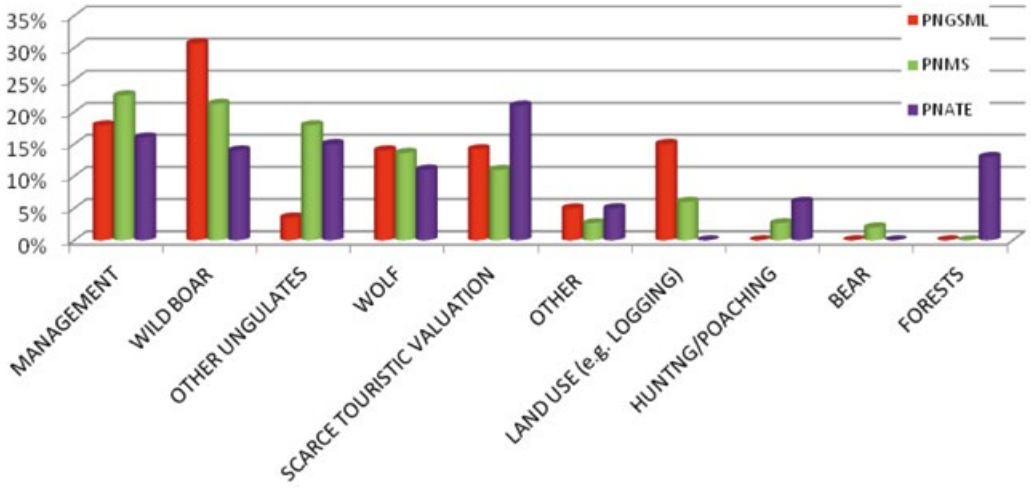

Fig. 4. Types of issues identified as causes of conflicts as revealed by the stakeholder analysis carried out in the frame of the LIFE EX-TRA Project, 2009 (PNGSML: Gran Sasso; PNMS: Monti Sibillini; PNATE: Appennino tosco-emiliano).

In fact, the most severe conflict levels registered concerned the following two types of issues:

Institutional conflicts between the local communities and the Park administration, mainly because of disagreements over the general park management;

Conflicts caused by the presence of overabundant wild boar populations. In Italy, this species is present in large numbers and causes severe damage on agriculture. Due to the restrictions on hunting in protected areas this issue causes many different levels of disagreements and disputes between different interest groups.

The analysis has, however, also revealed some level of consensus for the presence of the Parks, mainly regarding issues linked to socioeconomic assistance to farmers and livestock raisers and in terms of improvement of the conditions for the tourism sector.

Table 1. Stakeholder categories and issues involved in the "tensions" stage of the 3-stage model applied in the stakeholders analysis carried out in 2009 in three National Parks in Italy in the frame of the LIFE EX-TRA Project (for complete tables refer to report at www.lifextra.it).

Involved categories	Description of issue
Tensions regarding wolves and bears	
Farmers/livestock raisers	Need to set up a trust relationship between farmers/livestock raisers and park staff; Difficult dialogue between farmers/livestock raisers and park staff; Insufficient damage compensation measures; Few possibilities for appreciation of professional skills.
Public veterinary services	The presence of park veterinarians during damage assessment is not appreciated because they seem to represent only the parks' interests.
Foresters	Problems to participate in damage assessments due to time concerns.
Hunters	Wolves kill too many wild boars.
Other tensions	
Farmers/livestock raisers	Insufficient economic returns for local traditional products Disputes about the usage rights of common lands (e.g. assignment of pastures).
General Park inhabitants	General disagreements on the management of the protected territories; The interventions for rural and socioeconomic development implemented by the Park administrations are mainly carried out in the core areas, therefore the communities in the peripheral areas only suffer from restrictions and do not enjoy any benefits.

Table 2. Stakeholder categories and issues involved in the "conflicts" and "conflict network" stage of the 3-stage model applied in the stakeholders analysis carried out in 2009 in three National Parks in Italy in the frame of the LIFE EX-TRA Project.

Involved categories	Description of issue
Conflict stage	
General Park inhabitants	Lack of political and legal representative of the Park and of clear figures with whom to interact (PNGSL); Request of some communities to leave the Park.
Conflict network stage	
Local institutions, associations, scientists and farmers	Conflicts about wild boar management: i) Political and ideological conflicts – the local authorities use the presence of wild boars as an excuse to attack the Park; ii) Scientific conflicts – contrasts between different opinions about population size and management methods; iii) Legal and economic conflicts – claims, economic damage – the wild boar is a "symptom" of other conflicts.

3.2. Stakeholder meetings (Turco, 2011a,b)

3.2.1. Feedback meetings

Following the stakeholder analysis, from November 2010 to March 2011, a first set of "feedback meetings" was organized in order to communicate the results of the stakeholder analysis to the persons who have been interviewed. These 6 meetings were attended by a total of 163 persons.

The main issues that emerged from the feedback meetings were then discussed in the following participatory workshops. These issues were:

a. Wildlife management;

b. Regional tourism development;

c. Absence of institutional bodies: the Board of Directors – Community Park;

d. Support services in the territory;

e. Listening to citizens' concerns (the proper strategy to achieve some of these major goals).

3.2.2. Consensus workshops

After the feedback meetings two Consensus Workshops (CW) were held in each area, with the following objectives:

CW1

i) Joint identification of actions to be encouraged in relation to the needs of the stakeholders in the area, based on the principle that, given the limited human, material and financial resources, "we couldn't do everything";

ii) Joint identification of the methods and time frames to achieve the identified objectives, based on a fundamental principle of reflexivity: "we try to understand what we do when we do it, and not later, when it may be too late to correct the mistakes";

CW2

i) Assessment of the feasibility of the agreements, through specific finalized meetings, based on the principle that "the agreements have to be respected; if something did not work we have to try to understand why it didn't";

ii) Implementation of agreements to boost the participatory practice at the end of the project and let it continue in the future.

These consensus workshops did not work independently of each other; on the contrary, they were closely and explicitly related. In the second round of meetings the facilitators recalled the issues that had emerged in the first workshops, and they publicly explained which goals had been achieved, which had been partially achieved, which were subject to further assessments and which had not been achieved.

The first sets of Consensus Workshops were attended by 154 persons in 4 meetings; the second one was attended by 126 persons in 4 meetings.

Between the first and the second set of workshops, 6 thematic meetings were held, aimed at strengthening and preparing the second event, in particular with more active stakeholder groups, which presented an higher conflict level. These meetings were attended by 129 persons.

3.2.3. Main results of the participatory workshops in the three parks

The results achieved in the participatory process can be classified in four main outputs:

1. Concrete interventions in the field. These were agreements between the local authorities and the interest groups about specific activities and/or tools to be implemented in order to decrease depredation or to improve the working conditions of local livestock raisers, namely:

a. Veterinary assistance to livestock raisers for sheep and cattle;
b. Distribution of materials to about fifteen farmers to build permanent collective fences in order to protect calves born in the pasture, and to prevent damage from wolves, in PNGSL;
c. Co-funding for the installation of 16 electric fences on livestock farms in PNMS;
d. Initiation of the RECANDO Program in PNMS, which foresees the construction of a network of exchange of livestock guarding dogs between farmers;
e. Installation of a feeding site for vultures and other raptors in PNMS. This allows the shepherds to dispose of livestock carcasses without having to pay for the intervention of the public health services which causes a consistent additional cost;
f. Development of a wolf monitoring program with the participation of local stakeholder groups.

2. Legal/institutional improvements such as adaptation of regulations for the control of wild boars, update of compensation schemes, agreements with the Forest Administrations regarding the Park Regulations.

3. General increase of consensus among the local interest groups. There has been a steady increase of the participation of the representatives of local communities and authorities in the negotiation process. Moreover, the follow-up evaluation of the entire process has revealed a general consensus about the Park Administrations' efforts (LIFE EX-TRA 2012).

4. Development of best practices. Since the staff of the three involved Parks have recognized the effectiveness of the applied participatory procedure, they have further used these techniques in order to facilitate other processes beyond the objectives of the LIFE EX-TRA Project, such as the development of the new Park Regulations in PNATE, the training of facilitators in PNGSL, the inclusion of these techniques in several new participatory processes:

a. Development of grazing regulations in the frame of the LIFE PRATERIE Project "Urgent actions for the conservation of grasslands and pastures in the territory of Gran Sasso e Monti della Laga" (LIFE LIFE11NAT/IT/234);
b. The development of beach forest management procedures in the frame of the LIFE Project FAGUS "Forests of the Apennines: Good Practices to Conjugate Use and Sustainability" (LIFE11 NAT/IT/000135);
c. Regular management of the conflicts between carnivore conservation and local livestock raisers;
d. Development of the management plans of the Natura 2000 sites.

4. Conclusions

The fact that in the present stakeholder analysis wolves and bears were concretely and directly connected to disputes only at a "tension" level is certainly encouraging. However, the other causes of conflicts may not be disregarded as factors affecting carnivore conservation. The severe conflicts, whatever their causes, create disputes with the Parks' administrations and adverse feelings towards these institutions and what they represent. Since wolves and bears are major flagship species for these Parks, they are easily chosen by the local communities in order to attract the attention of the local authorities and to express their frustrations and discontent. This important assumption has been fundamental in the development of the participatory process that was carried out after the main conflicts were identified.

It can be affirmed that the key result of this process was, without any doubt, the opening of new channels of communication between formal institutions and local communities. At the same time, the applied approach has disrupted the common view according to which stakeholders have to give "blind" support to the local governance policies. This change has on its turn caused a general increase of consensus.

Another advantage of this approach is also that the local interest groups that have participated in the decision making processes will feel more responsible for the developed tools, activities and regulations, supporting their use and respect also by other actors.

Finally, the participatory process has also helped to introduce some good practices in the field of stakeholder consultation for supporting large carnivore conservation.

The results of this four-year process have been very encouraging. Following the participatory meetings there has been a general recognition by stakeholders of a process, started by the local authorities, which is on-going and not a "one-shot" initiative. This has generated a widespread improvement of relationships between stakeholders and the decision-making bodies. Also as a consequence the local authorities have recognized the importance and effectiveness of public consultation and participatory management.

5. Problems and recommendations

The main disadvantage of the presented technique is that a participatory process requires very long time. It cannot been applied as a one-shot initiative to quickly solve conflicts but it must rather been seen as an ongoing, never-ending process. In fact, in the present case the first steps into the direction of stakeholder consultation have already been done during the LIFE COEX Project (2006) this process has then been fully developed starting from 2009 and by the time of writing (spring 2014) is still ongoing in new projects. And in each step new issues arise and new conflicts are brought onto the scene. The Park administrations cannot allow to interrupt the process because this would disappoint the expectations of the local communities and generate negative feelings again. Therefore the application of a real participatory process requires an ongoing commitment by the organization starting the initiative to dedicate resources in terms of funds, staff and time.

Another risk of this technique is that, if the process is not properly managed by specialised staff, it might generate expectations that are not fulfilled and, by bringing together different, diverging groups and positions, it might increase the conflicts instead of mitigating them. Therefore it is strongly recommended to involve in such a process one or more persons specifically trained in order to adequately manage the difficult situations that always appear during the meetings.

Finally, since the assumption of a participatory process is that each party contributes with own expectations and inputs but also with own commitments, the local authorities have to make sure that they will maintain all commitments they take in terms of concrete interventions, law adaptations, financial support.

Acknowledgements

We want to thank the representatives of all the associated beneficiaries for the fruitful cooperation in the LIFE EX-TRA project, which would not have been possible without the funds of the LIFE Program of the European Commission. Thanks also to Prof. Angelo Turco for the significant scientific input in the whole Human Dimension component of the project. Last but not least, all the involved stakeholders are the key for future conservation and therefore we are hugely grateful for their trust in the project, the Parks, the partners and their staff and for having participated in the whole process.

References

Bobbio L (2004) Amministrazioni pubbliche, imprese, associazioni e cittadini nei processi decisionali inclusivi. Edizioni Scientifiche Italiane, Napoli, 152 p.

Dalehite E (2008) Determinants of performance measurement: an investigation into the decision to conduct citizen surveys. In: Public Administration Review, September.

Della Porta D (2010) L'intervista qualitativa. Laterza, Roma-Bari, 164 p.

Faggi P, Turco A (eds) (2001) Conflitti ambientali. Genesi, sviluppo, gestione. Unicopli, Milano, 372 p.

Lewis D, Bebbington AJ, Batterbury SPJ, Shah A, Olson E, Siddiqi MS, Duvall S (2003) Practice, power and meaning: frameworks for studying organizational culture on multi-agency rural development projects. Journal of International Development, 15, 1-17.

LIFE EX-TRA (2013) Final Report of Action E3 "Follow-up surveys on the perception of the stakeholder groups". Available: http://www.lifextra.it/index.php?option=com_docman&task=cat_view&gid=84&Itemid=30&lang=en.

Montesperelli P (1998) L'intervista ermeneutica. Franco Angeli, Milano, 208 p.

Owen H (1998) Expanding Our Now: The Story of Open Space Technology. Berrett-Koehler Publishers, San Francisco, 175 p.

Philo C, Wilbert C (eds) (2000) Animal spaces, beastly places: new geographies of human-animal relations. Routledge, New York, 311 p.

Turco A (2009a) Governance, cultures and development. Environmental co-operation in West Africa. Franco Angeli, Milano.

Turco A (2009b) Linee Guida per lo svolgimento degli Ateliers Partecipativi, Consultazione e coinvolgimento degli stakeholders. LIFE+EX-TRA/PNGSML and Partners, Assergi, 60 p.

Turco A (2010) Grandi carnivori tra consenso e conflitti nei Parchi Appenninici. Human dimensions Stakeholders analysis REPORT. LIFE+EX-TRA/PNGSML and Partners, Assergi, 209 p.

Turco A (2011a) Rapporto Ateliers Partecipativi. LIFE+EX-TRA/PNGSML and Partners, Assergi.

Turco A (2011b) II Rapporto Ateliers Partecipativi. LIFE+EX-TRA/PNGSML and Partners, Assergi, 57 p.

Conference Abstract

USE OF DOGS IN THE MEDIATION OF CONSERVATION CONFLICTS

Kurt VerCauteren, Mike Lavelle, Jean-Marc Landry, Laurie Marker, Tom Gehring

26th Vertebrate Pest Conference, Waikoloa, Hawaii, USA
March 3-6, 2014

Conflicts between wildlife and humans are of global importance and increasing. These conflicts may negatively impact wildlife, humans and other resources, primarily livestock. Human safety and economic well-being can be adversely impacted by depredation of livestock and perpetuation of wildlife-borne diseases in agricultural systems. Conversely, management approaches to mitigate these conflicts may employ primarily lethal control methods which can negatively impact wildlife populations of conservation importance. Dogs, principally livestock protection breeds, have been used for centuries in some cultures to protect livestock from predators. Dogs have also been used for a variety of other conservation-specific practices. In this presentation we provide an overview of a chapter we developed on this topic for a book entitled *Free-ranging Dogs and Wildlife Conservation*, recently released by Oxford University Press. We will review past and current use of dogs for mediating wildlife-human conflict and highlight future areas of research that are needed to more effectively use dogs for mediating conservation conflicts.

VerCauteren K, Lavelle M, Gehring T, Landry J-M, Marker L (2013) Dogs as mediators of conservation conflicts. In: M. Gompper, editor. Free-Ranging Dogs and Wildlife Conservation. Oxford University Press.

MEETINGS

16th Australasian Vertebrate Pest Conference
26-29 May 2014
Brisbane, Australia
http://www.avpc.net.au/

Sustainable Tourism 2014
08-10 July 2014
Opatija, Croatia
http://www.wessex.ac.uk/14-conferences/sustainable-tourism-2014.html

4th Canine Science Forum
15-17 July 2014
Lincoln, UK
http://www.csf2014.com/

International Congress for Conservation Biology
21-25 July 2013
Baltimore, Maryland, USA
http://www.conbio.org/mini-sites/iccb-2013

21st Annual Conference of The Wildlife Society
25-30 October 2014
Pittsburg, PA, USA
Includes concurrent session on wildlife damage management, and the annual meeting of the Wildlife Damage Management Working Group.
http://wildlifesociety.org/

IUCN World Parks Congress
12–19 November 2014
Sydney, Australia
http://www.worldparkscongress.org/

Publications

BOOKS

People and Wildlife, Conflict or Co-existence?

Edited by Rosie Woodroffe, Simon Thirgood and Alan Rabinowitz / **2005** / Cambridge University Press / 516 pp

"As humans continue to encroach into natural habitats, and conservation efforts restore wildlife to areas where they have been absent, contact between humans and wild animals is growing. Some species, even the endangered, can have serious impacts on human lives and livelihoods. Tigers kill people, elephants destroy crops and African wild dogs devastate sheep herds left unattended. This book presents a variety of solutions to human-wildlife conflicts, including novel and traditional farming practices, controlled hunting and tourism, as well as the development of local and national conservation policies."

Biology and Conservation of Wild Carnivores
The Canids and the Felids Two-Volume Set

Edited by David Macdonald, Andrew Loveridge and Claudio Sillero-Zubiri / **2010** / Oxford University Press / 1,248 pp

"A two-volume set made up of 'Biology and Conservation of Wild Canids' and 'Biology and Conservation of Wild Felids'. These advanced textbooks bring together a unique network of the world's most respected and knowledgeable experts to provide a review of the biology and conservation of these families, and provide detailed case-studies from species investigations worldwide."

Carnivore Ecology and Conservation: A Handbook of Techniques

Edited by Luigi Boitani and Roger A. Powell / **2012** / Oxford University Press / 506 pp

"Conflicts with human activities stimulate continual debates about the management of carnivore populations, and throughout the world people seek workable solutions for human/carnivore coexistence. This concise yet authoritative handbook describes research methods and techniques for the study and conservation of all terrestrial carnivore species. Particular attention is paid to techniques for managing the human/carnivore interface. Descriptions of the latest methodologies are supported by references to case studies, whilst dedicated boxes are used to illustrate how a technique is applied to a specific land cover type, species, or particular socio-economic context."

Human Dimensions of Wildlife Management (2nd edition)

Edited by Daniel J. Decker, Shawn J. Riley and William F. Siemer / **2012** / Johns Hopkins University Press / 304 pp

"Though the focus is wildlife, this lucid and comprehensive work on 'human dimensions' would be a handy reference for any land or natural resources manager."

Free-Ranging Dogs and Wildlife Conservation

Edited by Matthew E. Gompper / **2013** / Oxford University Press / 336 pp

"Brings together a diverse group of experts to provide a comprehensive synthesis of issues relevant to, and derived from, the interactions of free-ranging dogs and wildlife. Explores the role that dogs play in wildlife survival, harvest, management, protection, and disease outbreaks, and in how humans perceive conflicts with wildlife. In addition, the potential role of dogs as mediators of conservation conflict is assessed, including the role of dogs as livestock guardians, the potential for dogs to aid researchers in locating rare wildlife species of conservation interest, and the importance of recognizing that some populations of dogs such as dingoes have a long history of genetic isolation and are themselves important conservation concerns."

Wildlife Management and Conservation. Contemporary Principles and Practices

Edited by Paul R. Krausman and James W. Cain III / **2013** / Johns Hopkins University Press / Published in association with The Wildlife Society / 360 pp

"Presents a clear overview of the management and conservation of animals, their habitats, and how people influence both."

Wildlife Damage Management: Prevention, Problem Solving, and Conflict Resolution

By Russell F. Reidinger, Jr. & James E. Miller / **2013** / Johns Hopkins University Press / 256 pp

"A complete guide to preventing and resolving problems associated with wildlife-human interactions."

COMING TOPICS

The next issue of the CDPNews, out this summer, will focus on extensive grazing systems of all types of livestock. If you are developing a project or study dealing with this topic, send us a proposal. But contact us before writing your articles, so we can send you the authors guidelines and better coordinate the contents of the Newsletter. The winter edition will again be opened for all topics.
Thank you for your collaboration!
The editors

To be added to the mailing list or for further information, contacts us at: lifemedwolf@fc.ul.pt

You can download the Carnivore Damage Prevention News on the MedWolf website:
www.medwolf.eu

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Carnivore Damage Prevention