

CDP Carnivore Damage Prevention news



Issue 11

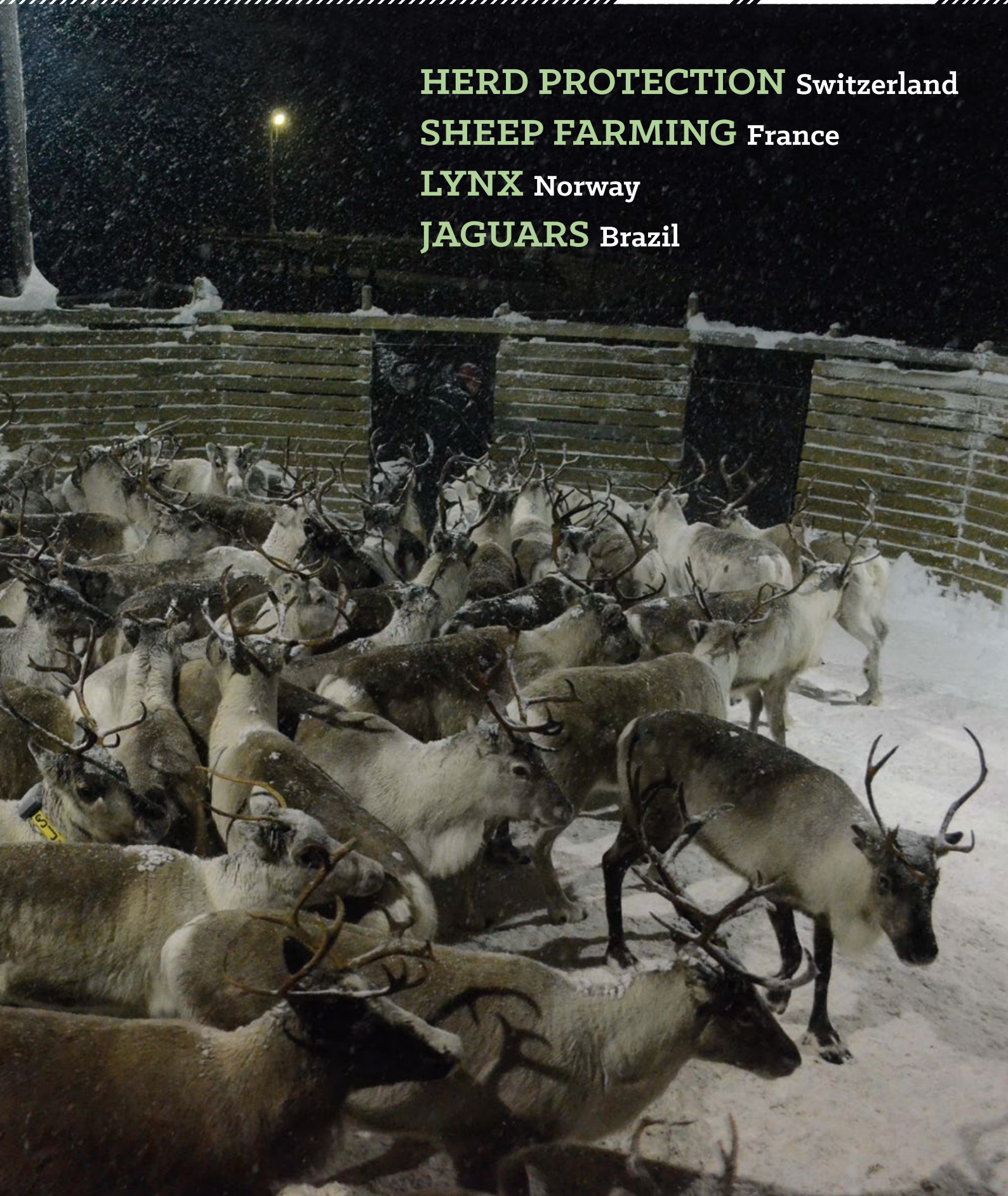
WINTER 2015

HERD PROTECTION Switzerland

SHEEP FARMING France

LYNX Norway

JAGUARS Brazil



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EDITORIAL

Dear Readers,

The restart of CDPNews last April was received by a wide public with large interest and the positive feedback all over Europe is encouraging us to go on with our philosophy of knowledge-transfer about the prevention and the management of large carnivore conflicts. We decided to focus in every issue on one main subject to facilitate the comparison of the countries and to dig deeper into the complexity of large carnivore conflicts and their management. At the same time we try to put some “light news” as short communications without scientific background, but in order to illustrate more political, social or cultural aspects around the topic. As a third type of communication we will promote some actual literature, events or national or international platforms.

In the public discussions around large carnivores, where emotions and funny or bloody stories are more important than well founded arguments, especially in the urbanized “global village” of internet-based information, the rural daily life in the peripheries is often perceived with a lack of knowledge and ignorance of the subjects’ complexity leading to misunderstandings and simplification of the reality by “clichés”.

This is one reason why we like to focus in this issue on extensive grazing systems that we find all over Europe in the rural areas which are often located somehow at the edges of our modern society. Large scale grazing systems are much more than large expanses of seminatural vegetation. They are complex structures emerging from the interaction of the human way of utilization and natural resources. Man-made and nature laws are intertwined in systems of grassland management that harbour a significant part of European natural values, but are also places where a small part of the rural population strives to make a living under harsh environmental and social conditions. Most of the European countries do face some common threats reaching from intensification in the lowlands to abandonment in the remote and less favoured grazing grounds.

The evolution of large carnivore populations represents somehow a mirror of the change of landscape and the rural development, where the topographical conditions are not compatible with a global setting of economic pressure anymore. In many cases the conservation policies of large carnivores play a small but important symbolic role beside the more important drivers of change as harsh working conditions, social fragility, lack of assurance of family business turnover, and poor economic performance. Despite the difficult economic and political setting in marginalized regions where society is still deeply rooted in agricultural activities, there are ways to maintain the heritage of large scale grazing systems and the presence of large carnivores: zu lang! The diversity of husbandry systems in France or the small herding with LGD’s in the prealpine regions of Switzerland, and other examples in this issue; all these articles show us a part of the European horizon of large scale, extensive grazing. Furthermore they illustrate, that, however differentiated, detailed diagnosis of the constraints and the alternative management practices at the regional level are required to maintain sensible grazing management as a cultural practise, a basic condition for biodiversity as well as sustainable, decentralized farming.

We wish you an interesting and critical lecture of this newsletter and are grateful for every kind of feedback or commentary, be it to us or to the authors. Only with your feedback we can improve our common effort for a well-connected international platform.

The Editors

Short Communication

DIALOGUE TO REDUCE CONFLICTS

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The recovery of populations of wolves, bears, lynx and wolverines is one of the great success stories of European conservation legislation. However, it has come at the price of increasing conflicts. Many years of research all across Europe have been instrumental in developing a mature understanding of how diverse these conflicts can be. This research has been important in helping the European Commission to design more effective policies, including the launching of a stakeholder dialogue platform by the Commissioner for Environment, Janez Potocnik, on 10th June 2014.

By the mid 20th century populations of wolves, bears, Eurasian lynx and wolverines were at all time lows across Europe. The introduction of favourable legislation at national and European levels from the 1970’s and onwards created a favourable situation for their recovery. Wolves have shown the most spectacular comeback – naturally recolonizing Scandinavia, Germany, and the Alps and expanding their range in most countries. Bears, lynx and wolverines have also reoccupied many areas from which they had been exterminated, through both natural expansion and reintroduction. Although there are still some populations that remain at critically small sizes and others that are declining, the overall picture is positive. In a world where the conservation news is often dominated by doom and gloom this offers an example of hope.

Unfortunately, while this recovery is clearly a success for wildlife conservation, it has come at the cost of increased conflicts. These conflicts have prompted a massive amount of applied research across Europe. The most obvious face of these conflicts concerns

depredation on domestic livestock, especially sheep (and semi-domestic reindeer in the Nordic countries). Hardly a week passes without some media coverage featuring pictures of dead livestock. In response, researchers have been funded to explore these issues. They have used a diversity of approaches involving both extensive fieldwork and analysis of data to elucidate the factors influencing carnivore predation on livestock. Likewise a massive effort has been used to test potential mitigation measures to reduce these conflicts and to develop the basis for compensation systems. There is now a generally good understanding of the nature of these conflicts and of the potential for different approaches to address them, although the extent to which this new knowledge has been integrated into policy varies greatly across Europe.

However, the extent of conflict as expressed by public opinion and the temperature of political debates are not well directly related to the number of livestock killed. It is here that the research conducted using social science methods have been most useful in revealing the full complexities of these conflicts. Their insights have shown that it is often the symbolism of the carnivores, rather than the carnivores themselves, which is most important in driving the conflict. While the conservationist may view the return of the wolf as a positive symbol of an attempt by society to develop a new relationship with nature, many people in rural communities view it as a highly negative symbol of unwanted change. There is no doubt that Europe’s rural areas are facing many challenges associated with the wider structural changes influencing society in general,

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and agriculture in particular. Issues such as rural-urban migration, the negative trend facing extensive livestock production, the abandonment of marginal agricultural areas and associated forest encroachment and changes in political power structures with a greater influence of external and large-scale processes are all highly disturbing for many rural people. The role of large carnivores in driving these changes are often secondary, but they add one additional layer of difficulty, and have become focal symbols for all these issues, and in many cases have been heavily instrumentalized in wider political debates. The situation is worst in areas where wolves return after long periods of absence and where people have lost their adaptations to living with these species as neighbours.

The result of this research has been to draw attention to the social and cultural aspects of conflicts, in addition to the more widely understood material and economic aspects. This implies that many different approaches beyond the introduction of practical changes to livestock husbandry are needed to address these aspects of conflict. Recognising the intrinsic political nature of the issue implies that the solutions must also be political in nature. One of the central elements of the conflict concerns a perception of powerlessness among rural stakeholders. In response, several regions and countries have created forums where different stakeholders can interact with decision makers and scientists and discuss issues of concern. However,

until recently many stakeholders have felt powerless with respect to the important decisions made at European level. In response, the European Commission has invested considerable resources in engaging with stakeholders during the last 2-3 years. This process has included commissioning summaries of the status of large carnivores, overviews of their management, reviews of conflicts and a scoping of potential methods to reduce conflicts. Building on this knowledge platform and on the feedback presented by stakeholders (and an earlier process that was conducted within the frames of the Bird Directive), the Commission has recently taken steps to develop a stakeholder platform that is intended to serve as a structured forum for discussion of large carnivore issues between different stakeholders. The pan-European platform was launched in Brussels on June 10th, 2014, with representatives of eight major stakeholders. These included European level representatives of nature conservation, hunting, agricultural and landowner organizations (Fig. 1). The signatories have agreed to use the platform as a forum for constructive discussion and the exchange of experience. The work plan is currently being developed, but funds are in place to keep it running for the first two years.

Such forums can have great potential in allowing a diversity of voices to be heard and building better relationships between stakeholders. While it is unlikely that such forums will unify the diverse goals

that the different stakeholders groups have, it should improve the interactions between them and hopefully identify areas of common ground for collaborative work. Our earlier work with these stakeholders has identified many areas of common interest that are often forgotten due to the focus on areas of conflict associated with large carnivores. Conflicts

over these species are not going to go away anytime soon because they touch on many fundamental issues concerning values and lifestyle. However, what we can hope for is that we can shape the way these conflicts are played out, reducing the temperature of the debate and building a more constructive dialogue around them.



Fig. 1. The signatories of the agreement at the ceremony on June 10th 2014 are:
 CIC – The International Council for Game and Wildlife Conservation (Bernard Lozé, president) <http://www.cic-wildlife.org/>;
 Joint representative of Finnish and Swedish Reindeer Herders (Anne Ollila, director);
 COPA-COGECA European Farmers and European Agri-cooperatives (Pekka Pesonen, secretary general) <http://www.copa-cogeca.be/Menu.aspx>;
 ELO – European Landowners’ Organization (Christoph Büren, president) <http://www.europeanlandowners.org/>;
 FACE – The European Federation of Associations of Hunting and Conservation (Gilbert de Turkheim, president) <http://www.face.eu/>;
 EUROPARC Federation (Thomas Hansson, president) <http://www.europarc.org/home/>;
 IUCN – The International Union for Conservation of Nature, European Union Representative Office (Luc Bas, director) <http://www.iucn.org/about/union/secretariat/offices/europe/>;
 WWF – World Wide Fund for Nature, European Policy Office (Tony Long, director) <http://www.wwf.eu/>.

Further Information: <http://ec.europa.eu/environment/nature/conservation/species/carnivores/>

Short Communication

ARE WOLVERINES DOOMED TO LIVE IN ETERNAL CONFLICT?

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In the high alpine areas and deep boreal forest of northern Europe roams an animal virtually unknown to most Europeans. Various names are used: glouton, jerv, järv, geatki, ahma, ernis, pocomaxa, rosomach, ghiotone or wolverine. Related to martens and badgers, wolverines are incredibly tough animals with a lot of attitude that eke out a living under harsh conditions.

There is much talk in Europe about large carnivores. Most Europeans will be able to identify wolves and brown bears, and many will recognize a picture of a lynx. However, the fourth European large carnivore – the wolverine – is totally unknown to the majority of Europeans. It is also a species about which there is comparatively little scientific knowledge. Wolverines are the largest mustelids, weighing between 15 and 20 kg. They live solitary lives, occupy large home ranges (100 to 500 km²), maintain a territorial social organization, and live in habitats ranging from alpine tundra to boreal forest. Although capable of killing prey as large as reindeer, they obtain a large part of their diet from scavenging carrion and are famous for their ability to cache carcasses rapidly for later use.

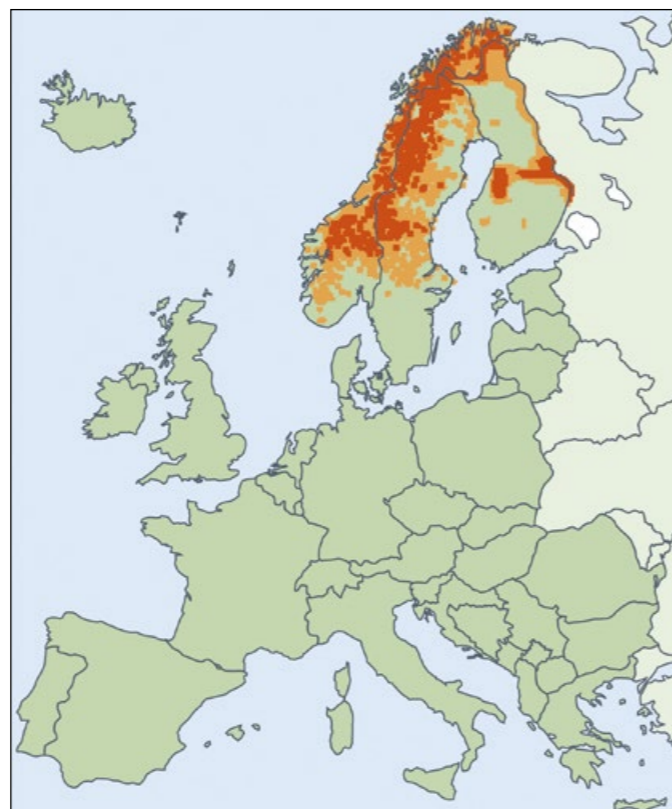


Fig. 1. Distribution of wolverines in Fennoscandia during 2006-2011 (dark cells with permanent/reproducing presence; light areas with occasional presence; Kaczensky et al., 2013).

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During the last two years, the European Commission has funded a project to conduct a European wide review of the status of large carnivores. The process involved contributions from independent experts from all European countries, and covered wolves, brown bears, lynx and wolverines. The report summarises the status of wolverines in the period 2008-2011 (Kaczensky et al., 2013).

Wolverines are only found in four European countries – Norway, Sweden, Finland and Russia (Fig. 1). There were clear differences in the quality of information available concerning wolverine status. The best data is available from Norway, where there is a nationwide monitoring program for wolverines that produces annual counts of natal dens and an annual population estimate based on analysis of DNA from faeces. Each year, over 100,000 km of surveys are driven using snowmobiles to collect scats and look for dens. Wolverines are also hunted within an annual quota hunt. In addition, state game wardens also conduct wolverine control operations, including shooting from helicopter and killing breeding animals at dens. The overall objective is to maintain the wolverine population at a level that has been determined by parliament. The lat-

est estimates are for around 350 wolverines in Norway – distributed from the Barents Sea coast in the north of Finnmark down to the latitude of Lillehammer in southern Norway (www.rovdata.no).

In Sweden, population monitoring is mainly based on surveying known natal denning sites, with some additional use of DNA from faeces and even camera-traps in the forested areas. Current estimates are around 680 wolverines in Sweden. Monitoring between Norway and Sweden is becoming increasingly standardized. Finland has a different monitoring system, based mainly on track counts, and current estimates are for around 70-80 wolverines in the north which are regarded as being part of the same population (termed the “Scandinavian” population) as those in Sweden and Norway. In addition, come another 80-90 wolverines in the central forest areas that have some connection to wolverines in Russian Karelia. This is termed the “Karelian” population. Wolverines are not hunted to any large extent in Sweden or Finland. There is currently very poor data from the Russian side, but the most recent estimates are for 150-170 in Russian Karelia. There are also an estimated 350 wolverines on the Kola peninsula – but it is not known to what extent these connect to



either the Scandinavian or the Karelian populations, and all of these Russian estimates are little better than educated guesses.

The total of around 1,200 wolverines in the three Nordic countries makes wolverines by far the rarest of the four large carnivore species in Europe. However, most of their distribution overlaps with the reindeer husbandry areas in the Nordic countries, and the conflict caused by depredation on reindeer is common to all countries. Reindeer herding is mainly conducted by members of the Sami people, to whom reindeer are a central element in their cultural heritage. The reindeer herding districts cover very large parts of all the Nordic countries, covering over 40% of the land area of Norway and Sweden for exam-



ple. Although wolverines also occur in the mountains of central and southern Norway outside the reindeer herding areas, they are also associated with

significant conflicts with free-ranging sheep in these areas. Presently between 7,000 and 10,000 sheep are compensated as wolverine kills each year in Norway. As a result there are virtually no areas in Norway where wolverines can exist without overlapping either domestic sheep or semi-domestic reindeer. It is only in the forested habitats of south central Sweden and central Finland that wolverines occur in areas with limited depredation conflicts.

Depredation represents a great challenge for management as it is clear that the Nordic countries have a special responsibility in a European context for the

wolverine, yet their distribution is almost entirely in areas where they conflict with some form of livestock. In fact, in most of these areas wolverines depend on domestic reindeer as their primary food source (no other wild ungulates exist in these areas, and small game species like hares are a poor substitute), which implies that their conservation requires that they have a certain access to reindeer. In such situations it is not clear if adopting livestock mitigation strategies is actually the best strategy for dealing with the conflict as is normally recommended for carnivore-livestock conflict. It is unclear as to what mitigation measures actually exist for semi-domestic reindeer. The wide-ranging movements of the herds, combined with their shy nature and their year-round exposure to depredation make it difficult to implement any effective protection.

Paying a fair level of compensation for losses may be the only successful strategy. However, this depends on being able to determine just how many reindeer are actually killed by wolverines. While there is no doubt that wolverines can, and do, kill adult semi-domestic reindeer and adult sheep, there is much uncertainty about how many. Wolverine are primarily known as scavengers and in areas where other predators, such as Eurasian lynx, exist at high densities, they can primarily live off the remains of kills that these predators leave behind. Furthermore, there are severe problems of poor body condition in many reindeer herding districts caused by an over-abundance of reindeer, which results in many animals dying of other causes, also providing plenty of carrion. In addition, poor body condition in reindeer may predispose them to wolverine predation.



It is therefore an important research priority to determine exactly what impact wolverine depredation is actually having on reindeer, and how this relates to the other factors influencing their production. A key question here concerns the extent to which wolverine depredation is additive or compensatory for other mortality, which will depend on the overall condition of the livestock and the presence of other mortality factors. It is only then that it will be possible to set fair compensation levels that avoid perverse subsidies with undesired side-effects.

The situation for the 2 million domestic sheep that free graze every summer in Norway and wolverines is more complicated as there is far less probability that their depredation is compensatory for other causes because sheep are kept indoors or at the farm for 7-8 months a year making them less exposed to environmental conditions. Furthermore, there is less scope for wolverines to scavenge on other carnivore's kills in the areas with highest sheep densities as lynx are not present in these areas. Although there are more potential mitigation measures for sheep than reindeer, implementing them in practice in the low productivity, rugged and remote alpine tundra ecosystems where they graze is logistically challenging. The only measure which offers some scope to minimize depredation is to bring the sheep in from the mountain pastures earlier

than normal (August instead of September) as for reasons that are not fully understood depredation tends to peak late in the season. However, this shortens the period when sheep can free graze and requires farmers to provide extra fodder on the home fields.

The wolverine case raises many interesting questions. Firstly, it represents an example where the conservation of a regionally endangered species virtually depends on the maintenance of some level of conflict. Secondly, it occurs with animal production systems where the opportunities for protection measures are limited and the production has very strong cultural value to an ethnic minority. In cases like this, the central questions are (1) what level of conflict is tolerable, and (2) how to provide a compensation system that is fair, efficient, and transparent? The present day systems in Norway and Finland depend on documenting losses, which is virtually impossible with these extensive grazing systems. The Swedish system in the reindeer herding areas, based on paying for wolverine presence, seems to offer many advantages if it can be further refined. It is also important that any such system should avoid providing a perverse subsidy for undesired side-effects (it has been shown that the present compensation system in Norway stimulates unsustainable herding practices) and should positively incentivize for desired practices and outputs. It is therefore important to adopt a holistic view of both the factors influencing the whole animal production system (see next article) and the whole set of economic measures that are in place to support the system. Finally, it underlines the importance of fostering wolverine expansion into the forested areas outside the reindeer husbandry districts.

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Kaczynsky P, Chapron G, Von Arx M, Huber D, Andrén H, Linnell J (2013) Status, management and distribution of large carnivores - bear, lynx, wolf and wolverine - in Europe. Istituto di Ecologia Applicata, Rome, Italy.

Further Information

www.lcie.org

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

www.rovdata.no

This animation shows the development of the Scandinavian wolverine population from 1996 to 2010:

www.youtube.com/watch?v=0geRd8iXKHg

This short video (in Norwegian) shows how DNA technology is used to monitor wolverines in Norway:

www.youtube.com/watch?v=OcjdeAr5C5Y



Short Communication

HOW CAN AN INEXPERIENCED PERSON PERFORMING CIVILIAN SERVICE SUPPORT FARMERS TO PROTECT LIVESTOCK AGAINST CARNIVORE ATTACKS ON ALPINE PASTURES?

Riccarda Lüthi*

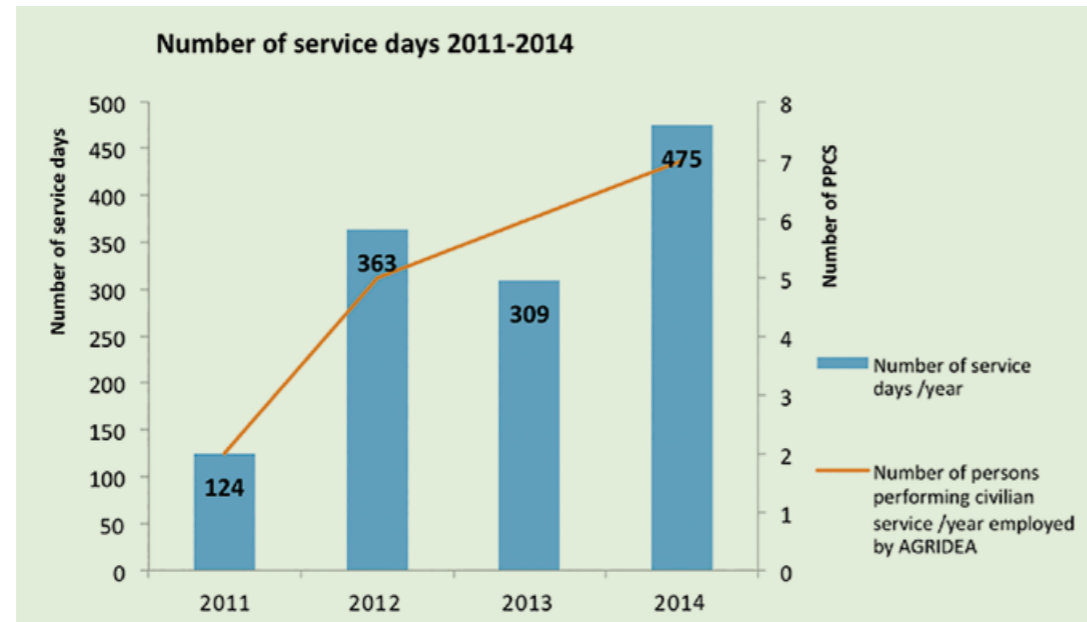
AGRIDEA, Avenue des Jordils 1, 1006 Lausanne, Switzerland. National Coordination for Livestock Protection

Being aware of the increased workload for farmers who implement livestock protection measures on a daily basis on their alpine summer pastures, AGRIDEA was looking for a possibility to offer practical support. The support was intended to be short-to-medium-term, flexible, with no administrative and little financial load for the farmers. Under the special Swiss policy, article 59 of the federal law, young men have

the possibility to substitute their military service with "alternative civilian service". Starting in 2010 with one person performing civilian service employed by AGRIDEA to support farmers/herders who practice livestock protection measures, the number has been continuously increased up to 7 persons in 2014 due to very positive experiences and thus an increasing demand from the alpine pasture managers (Fig. 1).

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Fig. 1. Development of the number of persons performing civilian service within the scope of livestock protection and the number of service days carried out.



Civilian service is an alternative service for persons qualified to perform military service, but unable to do so on grounds of conscience objections. The aim of the civilian service is “to contribute to a sustainable development and preservation of cultural heritage, to facilitate social coherence and nonviolent conflict resolution” and must be for a public benefit. Once the request of a young man for civilian service instead of military service is granted, he then has a choice of approved employers/ enterprises where he can apply for a post as “person performing civilian service”. Since 2010, AGRIDEA has become such an approved enterprise able to offer employment for “persons performing civilian service” (in the subsequent text referred to as PPCS) within the scope of its livestock protection project. During his service for the livestock protection project, the employed PPCS first attends a compulsory, three-day introductory course treating theoretical as well as practical subjects of livestock husbandry in the Alps. Then he will work for one week at a sheep farm of a Swiss livestock guarding dog breeder to become familiar with working dogs and livestock. Afterwards he is sent to work on different pastures all over Switzerland, with an intervention lasting from several days up to several weeks – the average duration in 2013 being 11.5 days, the longest 44 days. The main tasks are to help with the erection, maintenance and dismantling of fences, material transportation, surveillance of the animals, feeding the livestock guarding dogs and helping the

shepherd to treat sick or injured animals. The preconditions for working as a PPCS in the Alps are a strong motivation, good physical condition and endurance, flexibility respective to working hours, places and weather conditions, ability to work independently as well as in a team. On the other side the preconditions for a pasture manager to ask for the support of a PPCS are the presence of large carnivores and the associated use of livestock protection measures, plus the facilities to board and lodge PPCS. In return AGRIDEA takes care of administrative matters and wages.

Although AGRIDEA puts the focus of a practical support by PPCS on work directly related to livestock protection measures, other situations may be considered as well, like in the summer of 2014, when sheep farmers in the upper Valais came under pressure from wolf attacks. Because of the general preconditions on those alpine pastures (small and often heterogeneous flocks of 30-200 animals, no shepherd, no fences, lack of infrastructure) no protection measures could be taken at short term. Nevertheless, after an agreement between AGRIDEA and the sheep farmers, and the understanding that the presence of a PPCS may possibly influence the attack behaviour of the wolf but would not represent an effective protection measure, a PPCS was sent to that area in order to maintain a daily surveillance of the animals including morning and evening hours and report any kind of irregularity or new attacks. Also in this case, the sheep farmers highly appreciated the presence and reliability of PPCS,

giving them the possibility to invest in haymaking in the lowlands and at the same time being daily informed about the situation on the pastures.

In 2013 AGRIDEA launched a survey among the 16 alpine pasture managers who did benefit from the PPCS project about their satisfaction regarding the work carried out by PPCS. Of the 16 questionnaires sent out, 8 have been filled out and returned. Since the persons performing civilian service are not professionals in the field of agriculture or livestock husbandry, it was especially important to find out how far the quality of their work corresponded to the expectations of the farmers/shepherds. The results show, with few exceptions, a positive feedback: 94.3% reported that the PPCS was “always” or “most often”:

- a help;
- not physically or psychologically overstrained;
- sufficiently equipped;
- communicating clearly;
- motivated, flexible, punctual and trustworthy.

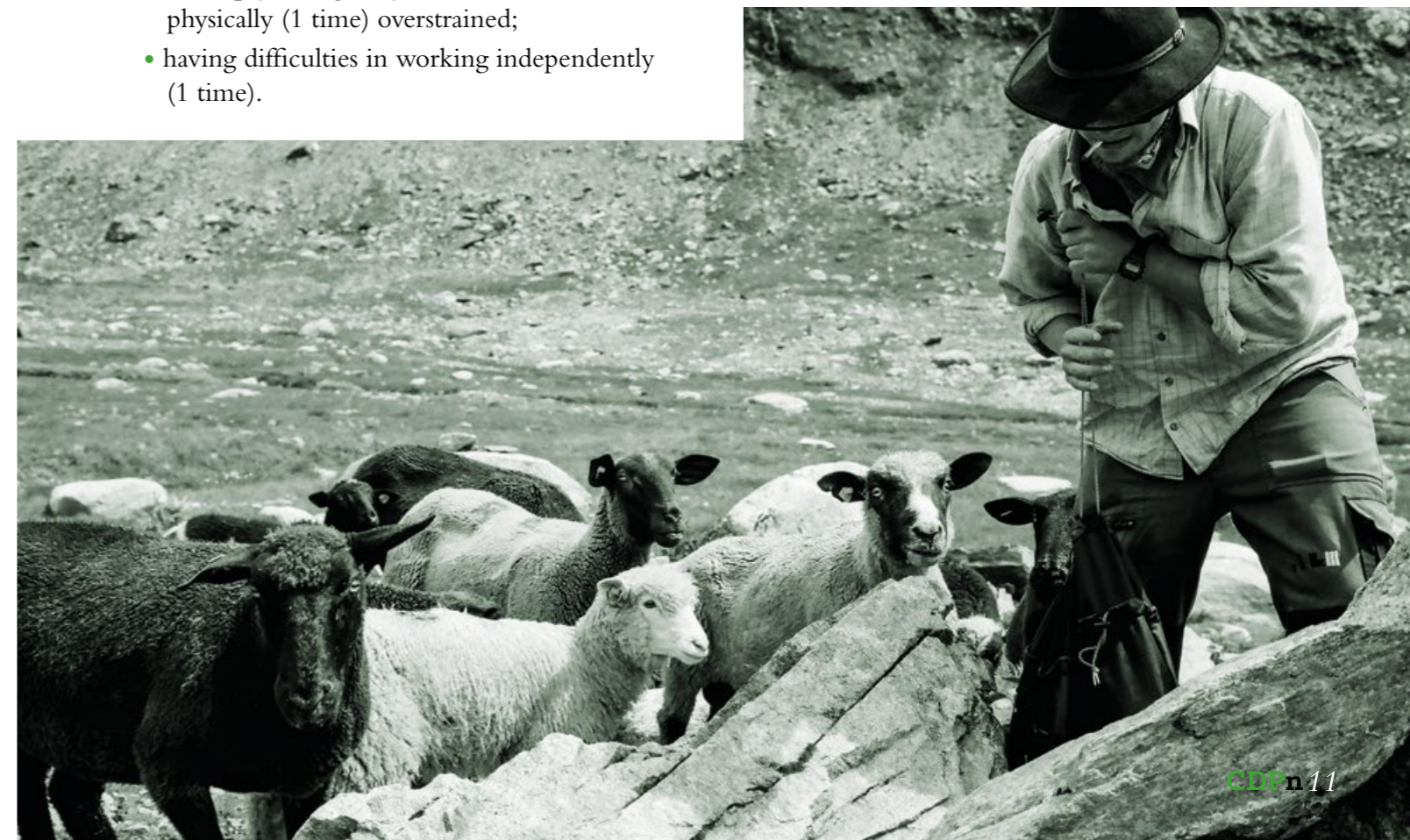
Only 5 times one of the questions was answered in a negative way, reporting that PPCS were:

- either psychologically (3 times) and/or physically (1 time) overstrained;
- having difficulties in working independently (1 time).

Over the period from 2011 to 2014, only one PPCS terminated his assignment altogether because he could not cope with the situation in the field.

Nevertheless it must be considered that the return of filled-out questionnaires was only 50% and no subsequent interrogations on the reasons of the low return rate have been carried out. Thus, it cannot be excluded that the alpine managers who did not send back the questionnaires were at the same time the less satisfied ones. To get better founded conclusions it should be considered to repeat the same survey every year or every second year at the end of the season.

Overall, the possibility to offer practical support through persons performing civilian service on Alpine pastures that are confronted with additional work due to the presence of large carnivores is a very positive experience and will certainly be continued in the years to come. To ensure a good quality also in the future, a careful selection must be made each year to employ PPCS candidates who conform best with the job's demands. The question may arise, whether it makes sense to invest even more in the initial training of PPCS to enable them, for example, to work with a sheepdog, in order to be even a more significant help for the shepherd/pasture manager.



HERD PROTECTION IN THE NORTHWESTERN SWISS PREALPS 2009-2013

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The wolf and small livestock husbandry in Switzerland

The return of the wolf to the Swiss Alps often leads to conflicts with the resident human population. Especially owners of small livestock are affected, as they summer their animals in the habitat of wolves. Experience shows that wolves can cause considerable losses among unprotected herds. To make the coexistence of wolves and small livestock possible, herd protection by means of livestock guarding dogs becomes of primary importance in the Alpine region. In Switzerland, scepticism and lack of understanding are often prevailing regarding the implementation and efficiency of herd protection. Therefore, the scientific evaluation of herd protection measures is crucial. In a recent study, corresponding analyses were for the first time conducted for a region with continuing wolf presence over five years in Switzerland. The insights gained from the study are summarized in this article.

Traditional small livestock husbandry and herd protection

Today, small livestock in Switzerland are mainly kept as a part-time job or as a leisure-time activity. Only a minority of farmers pursues small livestock husbandry as a full-time job. The summered herds with an average of 100 to 450 animals are relatively small (Waeber, 2003). After the eradication of large carnivores, the protection of small livestock herds in Switzerland was not important until the end of the 20th century (Mettler, 2005). With the return of the

wolf and the associated losses to unprotected livestock herds the situation has suddenly changed. Therefore, over the last few years the effort to protect sheep and goat herds from large carnivores has increasingly gained importance in Switzerland (Landry et al., 2004; Lüthi and Mettler, 2005).

Nonetheless, the establishment of suitable herd protection measures has only been taking place very slowly. Thus, in many areas protection measures have only recently been implemented. Although there are multiple reasons for the slow implementation process, an argument often put forward by small livestock owners contributing to the present situation is that an effective protection is not feasible in Switzerland. As a consequence, the willingness of small livestock owners to establish herd protection measures on their summering pastures has in the past remained very low.

Missing information on applicability and preventive effects of herd protection

Unfortunately, evidence that locally adapted herd protection – i.e. by the use of livestock guarding dogs – can effectively prevent small livestock herds from wolf attacks in Switzerland has until recently been missing. This lack was mainly due to the fact that appropriate situations necessary for a scientific evaluation of the adopted herd protection measures did not exist for a long time. In order to investigate if herd protection can reduce or prevent wolf attacks in the medium-to-long-term the continuing presence of wolves in areas with protected herds is required.

Quantitative evaluation of herd protection – ecological setting

In Switzerland the first opportunity to scientifically evaluate the development and efficiency of herd protection measures arose in 2009 with the arrival of a female wolf (identified as F05) in the north-western Prealps (i.e. the Ganttrisch-Schwarzsee region of the cantons Bern and Fribourg, Fig. 1). During the summering period of 2009, the wolf caused considerable damage to some of the numerous unprotected small livestock herds in the region (see below). As a reaction, responsible authorities enforced the implementation of locally adapted herd protection in the concerned area. Together, the continuing presence of the wolf during

the subsequent years and the systematic protection of small livestock herds, both contributed to the ecological setting that was needed to perform a quantitative investigation of the applied herd protection measures in a whole region in Switzerland. In 2013, an analysis has, finally, been conducted on behalf of the Association for Livestock Guarding Dogs Switzerland (HSH-CH) and the Federal Office for the Environment (FOEN) (Willisch et al., 2013). The following questions have been addressed in the mentioned study: First, do persons in charge of small livestock implement herd protection measures on their pastures? And second to what extent are wolf attacks and the number of killed animals depending on the applied protection measures?

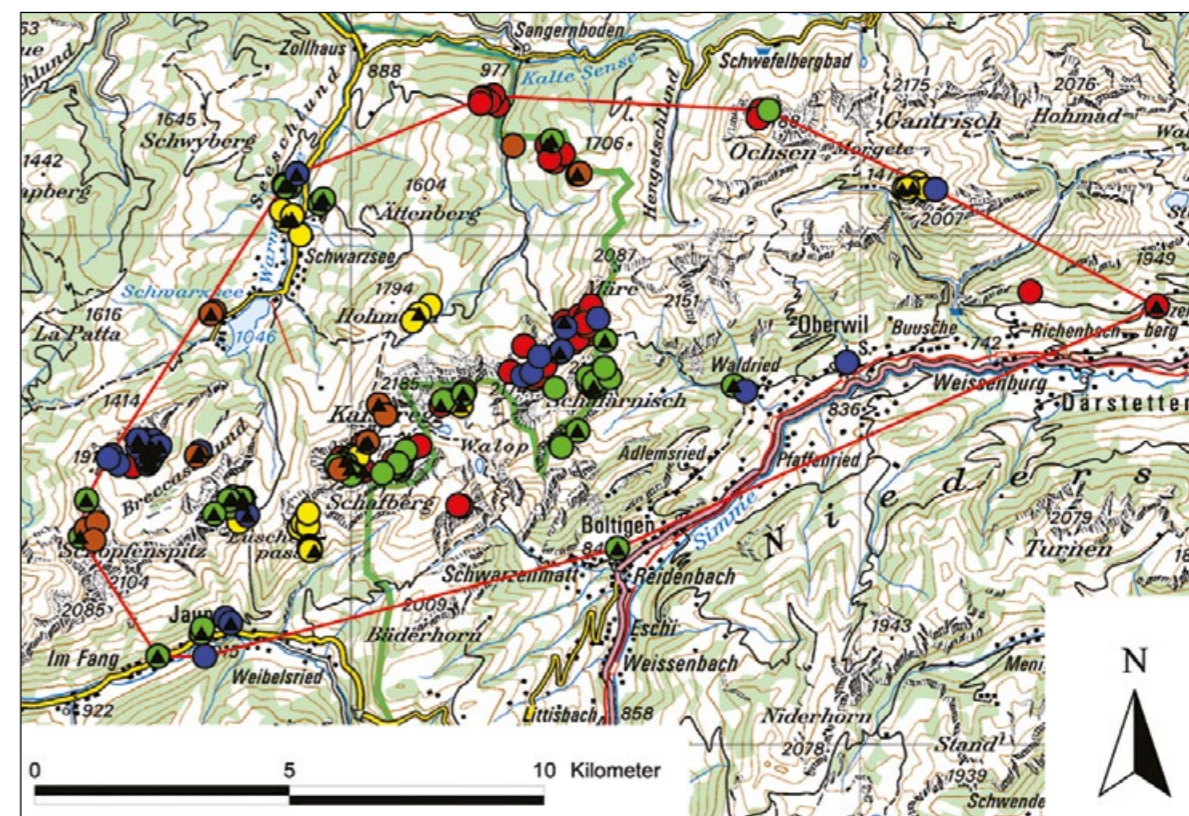


Fig. 1. Confirmed wolf attacks (2009: red; 2010: yellow; 2011: green; 2012: blue; 2013: brown) and estimated territory (red polygon) of the female wolf F05 between 2009 and 2013. The black triangles represent wolf attacks where the wolf F05 was genetically identified. Data: KORA 2013; Map: PK200, Swisstopo.

Characteristics of traditional small livestock husbandry

In the Ganttrisch-Schwarzsee region each year between May and September/October about 4,000–4,300 small livestock (95% sheep, 5% goats) are summered on alpine pastures. The pastures in the region typically

consist of open alpine meadows above the timberline. However, the terrain along the west-to-east running mountain ridge may be rugged with cliffs and extended scree fields. Herd sizes in the area normally vary between 20 and 450 animals (Pfister, 2010). An exception is a single large herd of approximately 1,200 ani-

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mals that replaced some smaller herds on six neighbouring pastures in the years 2012–2013. Small livestock in the region are either held on permanent pastures where animals are allowed to roam freely without any range restrictions, or on so called rotational grazing pastures. In the latter case, the pastures are subdivided by fences into several subunits and the animals are held alternately in the different compartments (Boggia and Schneider, 2012). Before the arrival of the wolf no permanent shepherding was conducted in the study area, although owners checked their herds on a more or less regular basis.



Locally adapted herd protection

In the study area, herd protection gained rapid importance in 2009 when the first attacks by the newly arrived wolf occurred. As a consequence, the implementation of herd protection measures was intensified during the subsequent years based on the cantonal management plans for wolves. With the aim of having the protection measures accepted by the small livestock owners, pre-existing, local summering structures were maintained as much as possible, and only the absolutely essential changes were made. For the protection of herds, livestock guarding dogs of the breeds Maremma and Abruzzes Shepdog or Pyrenean Mountain Dog were used. Electric fencing was not applied. Where possible, up to four livestock guarding dogs were integrated into the herds. In order to enable the livestock guarding dogs to efficiently protect the herds in some cases structural support measures were taken. Accord-

ingly, changes in the grazing systems or the permanent surveillance by shepherds were both considered support measures. Adaptation of the grazing system occurred on one pasture. Here, the permanent pasture system, where the livestock were free to roam, was changed to a rotational grazing system, where animals are summered alternately in different fenced subunits. In two cases, the permanent pasture system was maintained, while the remaining pastures were already managed as rotational grazing systems. Ultimately, permanent surveillance by a professional shepherd was established during the run of the study in one case only (i.e. the herd of 1,200 animals; see above).

Small livestock summering is adapting

Between 2009 and 2013 for each pasture in the area, the regional protection experts defined the most suitable herd protection measures (i.e. number of livestock guarding dogs) and the required structural support measures (i.e. adaptation of grazing system, fusion of small herds, permanent presence of shepherd) in order to prevent the herds from further wolf attacks. Livestock owners were free to adopt the proposed protection measures on their pastures. The data show that as a result of this systematic protection effort between 2009 and 2013 the number of protected herds increased from initially 1 to finally 10. At the same time the number of unprotected herds decreased from 17 to 8 herds (Fig. 2). It is noteworthy that despite the continuing pres-

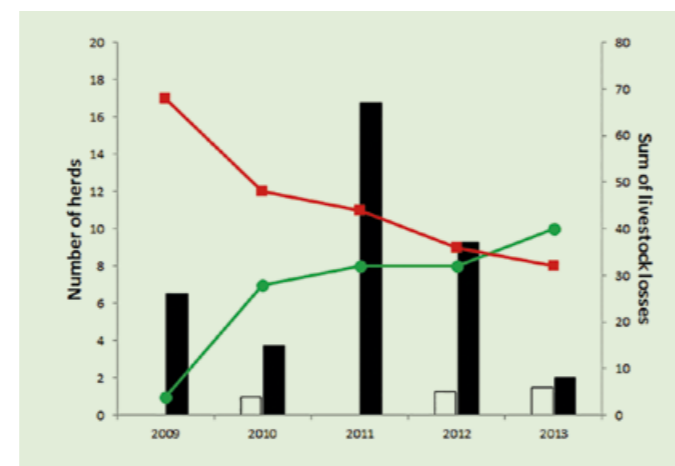


Fig. 2. Development of the number of protected (green circles) and unprotected herds (red squares) between 2009 and 2013 and the cumulated number of livestock losses in each year within these herds (white bars: losses in protected herds; black bars: losses in unprotected herds).

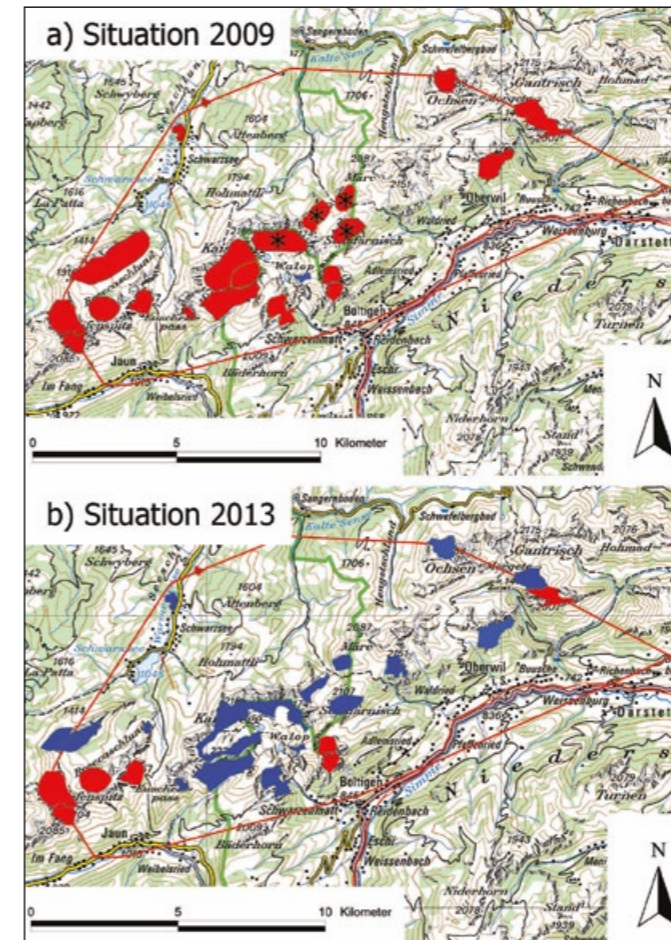


Fig. 3. Mapping of herd protection within the projects' perimeter in the years 2009 and 2013 (red: unprotected pastures; blue: protected pastures; *: pastures temporarily abandoned or where the summering was aborted from 2009 to 2011). Data: PK200, Swisstopo

ence of the wolf and the on-going attacks in the area none of the managed pastures had to be completely abandoned. Only on a few pastures with unprotected herds was the summering of small livestock terminated temporarily due to losses (Fig. 3). Overall, the area of protected pastures in the region increased between 2009 and 2013 from initially only 0.1 km² to 10.0 km² while the area of unprotected pastures declined from 15.5 km² to 4.2 km².

The efficiency of herd protection

Considering the number of herds which did not change their protection status during the summer, a total of 18 cases could be identified between 2009 and 2013 in which the wolf had caused losses to unprotected herds. In contrast, herds with herd protection only

suffered losses in five cases. Regarding the total amount of killed livestock, 153 animals were killed by wolves in unprotected herds in comparison to 15 killed animals in protected herds. The numbers of killed animals per summering period and pasture amounts to 1–5 animals (mean = 0.6, SD = 1.2) in protected herds, while in unprotected herds livestock losses of 1–35 animals (mean = 3.4, SD = 6.4) were registered. Particularly, the high numbers of losses in unprotected herds were due to multiple surplus killing events. Overall, these numbers show that unprotected herds can suffer very large losses caused by wolves. In comparison, by using suitable prevention measures protected herds suffer only moderate losses, if any.

Factors affecting wolf attacks and killed livestock

Statistical analyses showed that successful wolf attacks as well as the number of killed livestock during the summering are directly related to the number of livestock guarding dogs in use and the size of the herds. Accordingly, the more livestock guarding dogs were present to protect the herds, the smaller were the numbers of successful wolf attacks and the smaller were the total numbers of killed livestock per herd and season (Fig. 4). On the other hand, the risk of successful wolf attacks and the total amount of killed animals were both increasing with increasing herd sizes. In addition, the analyses revealed that the numbers of successful wolf attacks and livestock losses did not depend on the type of grazing pasture system or the presence of a permanent shepherd. Therefore, it can be concluded that these structural support measures do by themselves not provide any protective effect from wolf attacks. As a consequence, it can further be assumed that successful protection of livestock is not only possible in herds with a rotational grazing system

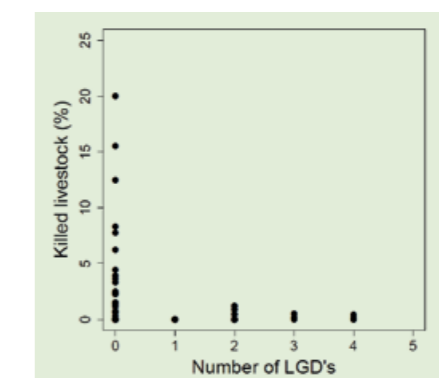


Fig. 4. Percentage of livestock killed per season and herd in relation to the number of livestock guarding dogs in the respective herds for the study area between 2009 and 2013.

or a permanent shepherd, but, if local conditions permit, also in herds on permanent pastures that are not surveyed by a shepherd.

Significance for herd protection

The presented study is the first one evaluating quantitatively for a whole region in Switzerland the implementation and efficiency of herd protection measures against wolves. As scepticism and lack of understanding for herd protection is widespread among small livestock owners, sound information is of pivotal importance. In this respect the scientific analysis of protection measures and wolf attacks, in regions where a) herd protection is practiced and b) wolf presence is confirmed over multiple years, is invaluable for the future implementation of herd protection. In addition, the systematic evaluation of the applied protection measures provides, of course, detailed insights into the functional relationships between protection measures and wolf attacks. There is no question that this kind of information is important to successfully adapt herd protection to local conditions. For the

Gantrisch-Schwarzsee region, for instance, the exemplary analyses have shown that a successful protection, against a single female wolf, via the use of a sufficient number of livestock guarding dogs can also be achieved with permanent or rotational grazing systems without the need of permanent shepherds – if certain conditions are fulfilled (e.g. sufficient herd cohesion, open habitat). Night-time corralling, as suggested by Espuno et al. (2004) for the successful protection of small livestock in France, is, therefore, not a mandatory measure to reduce wolf attacks to a level tolerable for livestock owners in Switzerland.

No doubt, the protection of small livestock herds in Switzerland against large carnivores is, when compared with other countries, such as Italy or France, still at an early stage. The question if the presented herd protection measures will hold in the long-term, in situations where wolves are building packs, remains open. Similar quantitative assessments of the adopted protection measures will be required in order to ensure an effective herd protection under various, local conditions in the different regions of Switzerland.

Acknowledgements

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Research Article

SHEEP FARMING IN FRANCE: FACING THE RETURN OF THE WOLF

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Introduction

In order to evaluate how farmers in France can protect their livestock from wolf attacks, it is necessary to understand and take into account how sheep and goat farming is organized in the regions where wolves are returning. This work is supported by a large number of studies conducted in various regions

of France about the vulnerability of the flocks and adaptability of animal husbandry systems towards the wolf's presence. We will review historical sheep farming systems that were in use when wolves were still common, although in the process of being eradicated, in the second half of the 19th century, and subsequent developments in animal husbandry systems, freed

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A Mediterranean steppic pasture.
Photo: Jean-Pierre Legeard/CERPAM.





A collective flock on summer mountain pasture.
Photo: Laurent Garde/CER.PAM.

from the wolf constraint during the past 150 years. The recent forced «cohabitation» of sheep farming with fully protected wolves cannot, in any way, reproduce past social organisations, but it is useful to try to understand how the wolf's presence was integrated in production choices and flock management modes. Indeed, flock protection cannot be reduced to a list of different methods farmers used for this purpose.

During the second half of the 19th century in France, most of the country had been cleared of wolves, although wolf populations remained until the 1930s in the Northeast and the West-Central part of the French territory (de Beaufort, 1987). Since the 1990s, a new wolf population from the Italian strain started to settle in the French Alps and to spread significantly to other regions in the 2010s (Kaczensky et al., 2013). Small ruminant farming practises have been therefore developed for more than a century without

the presence of large predators. Meanwhile, farming underwent very deep changes due to major economic and social changes. We will try to briefly describe these upheavals.

Developments in sheep farming in Southern France over the past 150 years

Until the years 1870s wethers (castrated males) were bred for their wool, which had a high economic value, and for their manure, then the only fertilizing resource for agriculture (Lacroix, 1988). In Provence, as in Languedoc, flocks were often very large, like nowadays. Records show that some owners possessed 500 to 2,000 head (Archiloque, 2003; de Beaufort, 1988). But very small-size flocks were also frequent, owned by farmers operating within a subsistence farming system associating sheep farming with the production of various crops. In this case, these were usually taken care of by a family member, often a child. During summer, flocks are herded to the alpine

pastures (transhumance). Smaller flocks were brought together to form larger herds, as they can be found now (Gourdon and Gourdon, 2014). These large flocks, and only these ones, allowed for the implementation of efficient protection systems to protect the sheep against predators. A group of professional shepherds was in charge of the herd by managing the grazing of the animals, penning them at night and ensuring their protection by sleeping nearby the herd in small mobile wooden chests (Gourdon and Gourdon, 2000), similar to those still used in Romania (Garde, 1996). But at the time, gathering the sheep at night had an economical purpose: the retrieval of manure (de Reparaz, 1978). This made protection easier, as this was integrated into the production system. The

same applied, and still applies, to the dairy sheep farming from regions enjoying a more favourable climate and more abundant grass. This last point is important: in an arid mountain area, only hardy animals with low needs, such as castrated males or dry sheep, can bear the constraints of night gathering, as gathering the sheep at night means they have less time to graze and have to travel more every day. Also, the sheep were accompanied by a traditional livestock guarding dog, with its spiked collar, the Provençal dogou (Laurent, 1962). Moreover, the traditional herd protection was also possible, or maybe mainly possible, because of a strong pressure of destruction on wolf populations (Rigaud, 1997; Viala, 2007).

At the end of the 19th century several major changes occurred simultaneously: the collapse of the wool trade due to the competition of new countries (free trade treaty of 1860); rural migration from the mountains to cities, releasing subsistence cultures for fodder production; wolf eradication. Sheep farming then underwent major changes: farmers turned to the production of meat lambs to cover a new commercial outlet, the newly expanding city populations. Ewes needed better nutritional conditions compared to wethers. Instead of being gathered at night, they were free to graze for a longer period during the day and to settle at their chosen bedding site, a new practice



A rebuilt hut for two shepherds on a collective summer pasture.
Photo: Dominique Baron/CER.PAM.

that geographers of the time considered beneficial to the land (Briot, 1907). Gradually, small mountain farmers increased the size of their flocks taking into account however the availability of the surrounding fodder for hay harvest for wintering. At the same time, labour, that was formerly abundant and cheap, became rare and expensive, subject to an increasingly demanding labour legislation. However, the traditional practice of shepherding on summer pastures was maintained. As night penning and manure collecting were abandoned, a single shepherd was sufficient to take care of the flock. Guard dogs were no longer used. These farming practices, which had to adapt to economic deep organizational changes during 100 or 150 years, are now suddenly confronted with wolves' packs on their grazing lands.

How is sheep farming organized nowadays? Sheep farming organization is very diverse and adapted to different local environments (terroir) and marketing opportunities. This organizational diversity is directly linked to landscape biodiversity (Lécrivain et al., 2001; Poux and Romain, 2009), and it might be said that public policies, which tend to produce standard practices, should be more supportive of the diversity of livestock systems and grazing practices by maintaining open landscapes and forests by grazing and hay production.

The following sections will describe livestock farming systems in relation with their vulnerability or resistance to the wolf constraint. The method used for this purpose is the ‘vulnerability diagnosis’, resulting from a series of interregional surveys, which describes the physical and human factors influencing the organization of production for a single farmer or a group of farmers. The vulnerability diagnosis aims at identifying vulnerability factors facilitating wolf access to the flock depending on the daily herding circuits and the way the flock is managed by day or at night. It evaluates existing protection measures and studies the feasibility of implementing a protection plan relying on mobile fences, livestock guarding dogs, various equipment devices and the associated labour. This method has been described by Dodier and Gouty (2007) and CERPAM et al. (2008). The complete study methodology can be found in Garde et al. (2012). Until now, 250 farms were studied in the last ten years in different French areas: Provence, the Northern and Southern Alps, the Massif Central, the Jura and the Vosges mountains. Each survey takes from 2 to 5 days to be completed.

Sheep farming in Mediterranean regions and in the Alps

In the Alps and on the Mediterranean coast, one can find a diversity of sheep farming systems, which can roughly be divided into three or four major types, each having different levels of vulnerability to wolves’ predation. The challenge was to protect, in the past twenty years, nearly 4,000 farms and 1 million ewes and lambs.

Mediterranean lowlands and Crau steppe

In the Mediterranean lowlands, and on the Crau steppe, sheep farming can benefit from large grassland areas, allowing the production of suckling lambs. The number of animals kept can vary significantly, but an important part of this production mode consists of large flocks, from just over a thousand sheep to 2,000 to 4,000 sheep. Often, these flocks graze during a limited period in hilly rangelands (*parcours*) in addition to their natural grasslands. One or several shepherds are hired to take care of different flocks and for the lambing season. In summer time, flocks are driven to the high mountain pastures (*transhumance*). The most common



sheep breed used is the highly gregarious Mérinos d’Arles, particularly well adapted to herding such large and dense collective flocks. This type of sheep farming is undoubtedly the least vulnerable to wolf attacks, because large flocks are easier to watch and protect especially in large high mountain pastures with generally good visibility, low predation risk, watering spots, and enough shepherds’ cabins. To face predation on alpine summer pastures, the Ministry of Agriculture finances an assistant shepherd who handles the additional work, the purchase of electric fences for night penning, and the costs of three to five livestock guarding dogs per flock (mainly Pyrenean Mountain Dogs).

Mediterranean hills and southern Prealps

In Mediterranean hills and the southern Prealps, two other different types of sheep farming can be found: sheep are either kept on fenced pastures, or permanently herded by shepherds. This region, where half of all packs in France settled (ONCFS, 2014), is the most affected by wolf attacks, registering two-thirds of all recorded losses in France (Fig. 1); it is also the

region where the sheep farming system is by far the most vulnerable and the most difficult to protect.

The first of these systems relies on the production of suckling lambs and the extensive use of rangelands in the form of fenced pastures. Flocks are medium-sized, ranging from 300 to 800 head. Farms also include hay fields, making them self-sufficient for fodder; sheep spend a short period (two to four months) during winter in the barn. Therefore, meadows are also grazed in autumn in order to ensure good and safe ewe conditions for the autumn lambing. The other lambing period occurs in spring. Two or three batches of ewes are taken to pastures during spring and autumn, but since they remain small (adapted to the feeding requirements), it is impossible to employ two or three shepherds. In summer, ewes either go to the mountain pastures (*transhumance*), in the same conditions of the previous case, or stay in local summer pastures. In the later, herd protection is difficult due to the small number of head, since it does not pay off to hire a shepherd, and the wooded or shrubby cover facilitates wolf attacks. Non-electric wire netting fences, less than 0.8

m high, commonly used to control ewe movements, are not effective against wolf intrusion. If reinforced and electrified, they can be an effective protection, provided that livestock guarding dogs are also used; but adaptations of such enclosures, ranging from one hundred to five hundred hectares in size and divided in five to ten paddocks, could be very expensive



A Prealp pasture on autumn season. Photo: Benedicte Beylier/CERPAM.

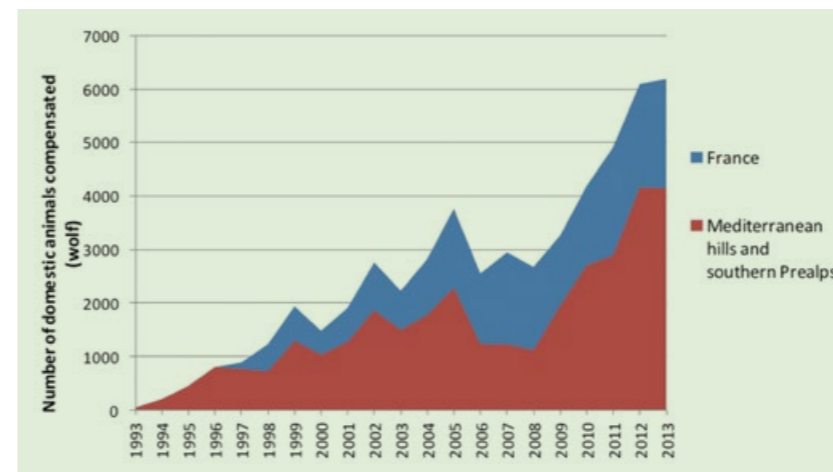


Fig. 1. Wolf damage on livestock in France and the Mediterranean hills and Southern Prealps. Data: DREAL Rhône-Alpes.

(more than 100,000 € per farm) (Gaborit, 2012). Furthermore, Natural Parks and hunters are reluctant to accept this type of equipment because they create a barrier to wildlife movements.

In the second system, the winter period in the barn is very limited or inexistent. Sheep are herded in highly extensive systems (about one animal per hectare), since grazing areas have low vegetation productivity (usually wooded or shrubby). Lambing occurs in late winter or early spring. The number of ewes per flock reaches 500 to 1,000 or more. During all the grazing season, the number of head (ewe and lamb) can double. In such conditions herd protection is quite difficult and wolf damages are high. We should bear in mind that this farming practise was developed in a period without wolf presence, being well adapted to the breed of sheep and climate, and very interesting economically. The range provides 80% of the flocks' feed (Fig. 2).

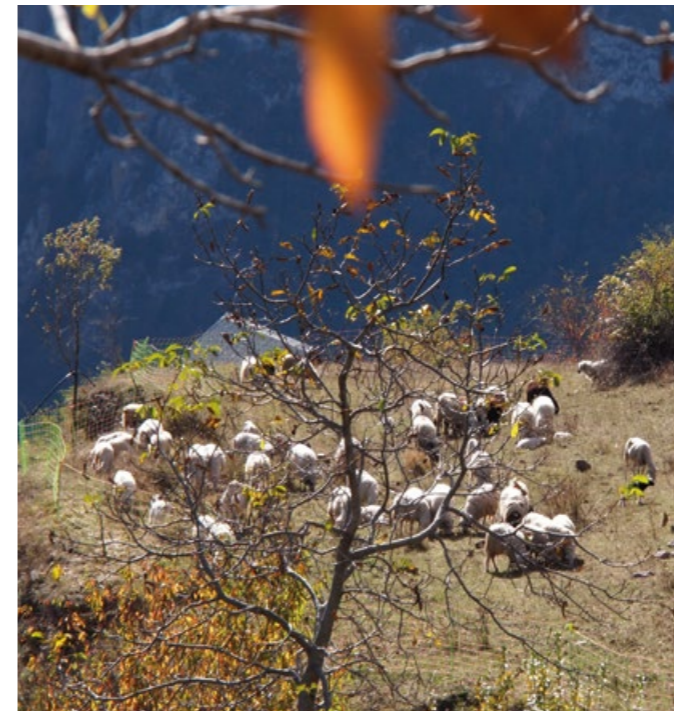
The most commonly used breed is a local sheep subject to conservation measures, the Mourreros. To take into account their nutritional needs, linked to lactation and growth, the sheep are widely spread on pastures, so each animal can feed well (Favier, 2014). In fact, it is also a very interesting agro-ecological system to preserve landscape, vegetation and the local sheep breed. Unfortunately, in such a system, vulnerability to wolves is very high. It is harder to protect a flock in typical Mediterranean landscape, wooded and shrubby, than on alpine pastures.

This system is mainly present in the South-East of the Provence-Alpes-Côte d'Azur region. In this area,

where about fifteen wolf packs are present (ONCFS, 2014), farmers have all implemented protection measures. The increase of wolf damages in this area strongly suggests that preventive measures become less and less effective because wolves seem to adapt to them. We are facing the disarray of farmers who suffer repeated attacks and do not know what else to do. Their conviction that sheep farming is doomed has become widespread; this idea seems widely shared by the institutions responsible for wolf conservation: for example, the government proposed granting aids to facilitate the termination of sheep farming in significant wolf predation areas, during the meeting of the 'Groupe National Loup' in Paris in January 10th, 2014, provoking a strong reaction from farmers associations.

Mountain sheep farming

In higher mountain valleys, sheep farming is much less vulnerable to wolves because of the shorter period of exposure of the flock and less vulnerable grazing areas. Since the winter season lasts from five to six months (which is otherwise a major economic constraint due to the cost of fodder) the flock is kept safely indoors. In summer, sheep are gathered in large flocks, allowing the use of the same methods of protection used in the large transhumant flocks during four months (Fig. 3). Nevertheless, in some summer pastures, where small flocks graze freely, sheep are extremely vulnerable. Apart from summer pastures and the period in the barn, sheep remain in more vulnerable areas during



A batch of ewes and lambs on autumn season in Mercantour. Photo: Laurent Garde/CERPAM.

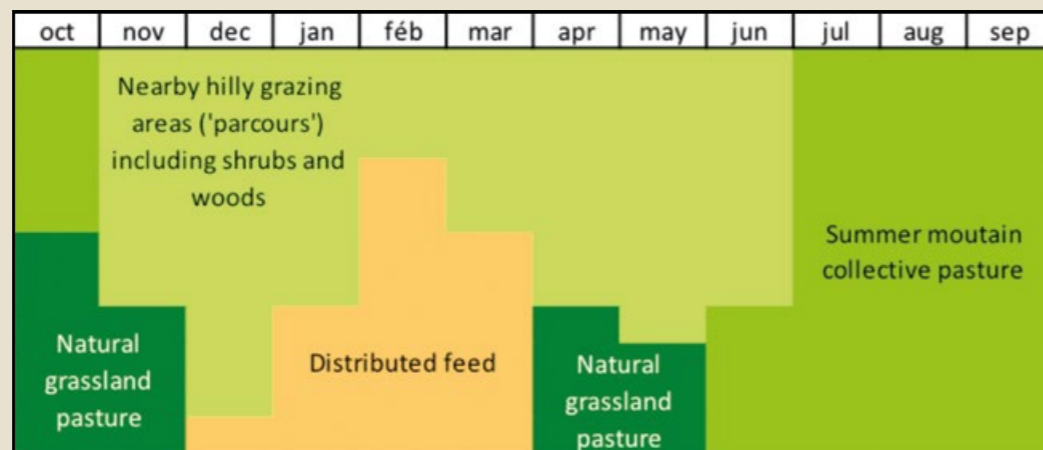
two to three months, i.e. in spring on hillsides and in autumn on meadow regrowth, after hay harvesting, down in the valley. Flocks are usually managed with mobile electric fences. Attacks may occur but are occasional events, not a permanent structural constraint. Due to the length of winter, flocks contain fewer animals (200 to 500 ewes). Lambing traditionally takes place in spring but tends to spread over a larger period to meet the demands of the consumers and of the "red label" (a national quality seal). But this trend, aiming to make lamb production more profitable (better price market), can be challenged by the need to protect at the same time batches of sheep and lambs down in the valley and in the mountain pasture.

The arrival of wolves in some other regions of France

Wolves, first confined to the Alps, are now beginning to affect animal husbandry in many other mountainous and lowlands regions, in the Northeast, Central and Southwest of France. Shepherding as described above is typical to the Alps range, although it can be found in some sites in the Cevennes and the Pyrenees. Therefore flock protection in newly wolf recolonized areas outside the Alps is a huge challenge for sheep production, considering that improving the effectiveness of existing enclosures could be very costly (see above).

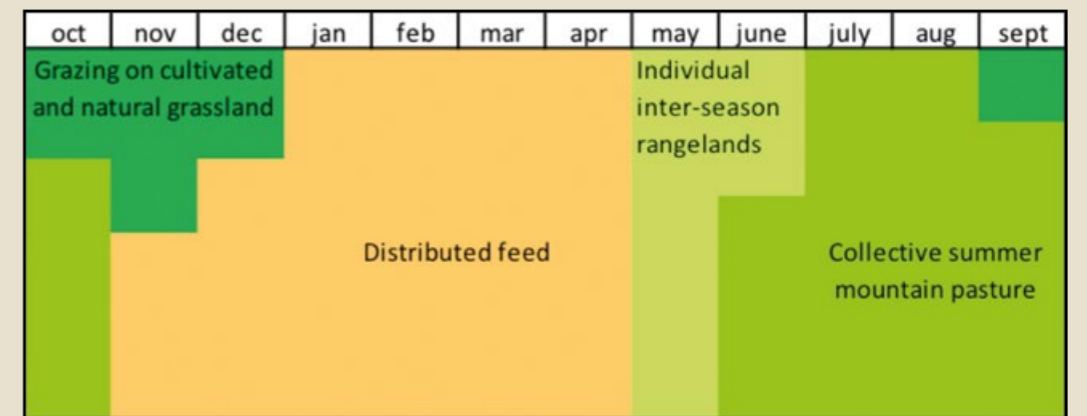
The Massif Central region is a very good example of the impact of the arrival of wolves. There are nearly two and a half million ewes in this area, i.e. three times more than in the Alps or the Pyrenees. Flocks are usually managed individually all year round. During the whole grazing period, roughly from April to November, meat sheep farmers divided their flock (few hundred ewes), to ensure at least two lambing seasons. Preventive measures have therefore to be multiplied to be able to protect all batches. Every farmer would have to be provided with a sufficient number of dogs in order to simultaneously protect several batches of grazing animals, which, with two dogs per batch, means a large number of dogs. Moreover, fences have to be reinforced and electrified: to associate dogs and effective fences is the only way to protect these systems, if human presence is not possible (Garde et al., 2012; Ministère de l'Agriculture, 2014); such a solution would not be welcomed by the

Fig. 2. Example of a feeding system for a transhumant flock of sheep in the southern Prealps with collective summer pasture (based on typical Breeding Network types, adapted) (Garde et al., 2014).



500 ewes - 575 ha AAU (20 ha natural and cultivated grassland, 550 ha rangeland + collective mountain pasture) - Pastoral index = 80% - Stocking rate = 0.13 LU/ha (excluding mountain pasture)

Fig. 3. Example of a feeding system for a mountain sheep farming with collective summer pastures (based on typical Breeding Network types, adapted) (Garde et al., 2014).



360 ewes - 82 ha AAU (25 ha natural and cultivated grassland, 7 ha cultivated cereals, 50 ha rangeland + collective summer mountain pasture) - Pastoral index = 50% - Stocking rate = 0.65 UGB/ha (excluding mountain pasture)

funding institutions, due to the high cost of securing grazing parks, or by the entities in charge of the management of the land, because it would imply a lot of partitioning. Additionally, the mosaic landscapes of the Massif Central, a patchwork of meadows, moors and woods, often used for grazing, favour wolves' approach and increases the vulnerability of flocks.

Dairy farming is a different case. Nearly one million dairy sheep are present in the Roquefort cheese production area. These flocks are much less vulnerable since they are managed in one group and return to the farm in the evening for milking. They are currently kept in grazing parks, but the animals could be managed by a shepherd, hired for the eight months of grazing – which would be a prohibitive expense for farms, typically two-person operations, or very costly in terms of public subsidies. There are in total 2,244 dairy sheep farms in this area; if wolf packs settle, protection policies should aim at a full coverage of the territory as opposed to targeting a limited number of farms serving as showcases. Furthermore, some necessary practices would have to be discontinued: for example night grazing after the milking, during hot-

ter periods, would no longer be an option. But an important aspect should not be forgotten: although flocks that are brought back in the evening for milking and managed as a single batch can certainly be protected more easily, dairy livestock – sheep and goats alike – are much more sensitive to attacks than meat-producing flocks: firstly, the individual value of an animal is higher, and secondly once the animals have suffered from stress, milk production is likely to be affected, which means a heavy loss for the dairy farmer. In other words, the risk of having an attack is lower, but the economic consequences of an attack are more severe (Bernon, 2008; Gaborit, 2012).

In the mountains of north-eastern France – Jura, Vosges – farms operate in a very similar way, but sheep farmers are much less numerous. One of the issues raised in the Vosges is the large number of tourists using the hiking trails going through enclosed parks. Leaving in these parks unattended guarding dogs with no human supervision involves unacceptable risks, and modifying the layout of fenced pastures or of trails would represent a considerable amount of work, an option that local authorities are not prepared to accept (Candau, 2012). And finally, the arrival of wolves in the plains of Lorraine and Champagne, where sheep farming is associated with cereal production, raises new questions. Studies must be conducted to identify specific risks and consider flock protection options.

Efforts towards a better income or a higher value

In all regions of France, a certain number of farmers try to be less dependent on public subsidies (which can reach 50% of the total income) and strive to obtain a higher income, either by taking to a complementary activity or by increasing the return on their products. Some farmers turn to diversification (multi-activity model): chestnut and berries production, production of animals other than sheep (e.g. cattle, poultry, or accommodation for tourists). In all cases, diversification means decreasing the number of sheep (usually 100 to 300 sheep) and it means also that less time is available for taking care of the sheep. Surveys show that these farms are very sensitive to the extra work that is necessary to protect the flock (Bonin, 2007). In case of repeated attacks, farmers might switch completely to the complementary activity. Some of them already abandoned sheep production after repeated wolf attacks.



Sheep grazing on a wooded pasture with guard dogs.
Photo: Mario Massucci.

Sheep farming in the context of small multi-activity units seems to be the most vulnerable to wolf attacks, due to the lack of flexibility in the use of labour and the fact that the option to switch to the other activities is present.

In a similar way, for those farmers who are striving to get a better value for their products through on-site processing, direct retail sale and short marketing channels, the consequences of the arrival of wolves are also heavy. On-site processing, just as on-site retail sale, causes a considerable amount of extra work. As a consequence, farmers keep fewer sheep – usually 200 to 400 ewes in a farm specialized in meat production using short marketing channels. In order to ensure lamb production over a longer period and for cash flow management reasons, there are more batches, with a small number of animals per batch. A survey conducted on a highly-performance farm using short marketing channels (selling directly to butchers) showed that it operated with 10 batches grazing at the same time, each with less than 50 animals. To protect this livestock, the farmer would need ten to twenty dogs, and would have either to employ 10 shepherds for six months or to equip the entire grazing area with secured enclo-

tures. The option of having a simplified animal husbandry system (i.e. with a reduced number of batches) has been studied; it would result in a loss of income of 12,000 € for the farmer and he would, in addition, feel demotivated, which means that this production would be abandoned (Aguer and Garde, 2011). These specialized systems do not have the necessary margins to be able to organize a form of shepherding or face the extra work entailed by the protection of the flock. They have no alternative and, should wolf attacks happen regularly, would probably be unable to go on with their economic activity. The protection is easier for dairy sheep farming using on-site processing and direct retail sale, with flocks of 100 to 250 animals managed in a single group, making the use of shepherds easier.

The farmers' concerns about the wolf situation

In France, we now have twenty years of experience of small ruminant farming in the presence of wolves. The results are diverse, but the conclusions of the animal husbandry technical services reflect the pessimistic views of sheep farmers. All, farmers and technical ser-



A protection fence on a wooded pasture.
Photo: Mario Massucci.

vices alike, have done their best, implementing the protection measures suggested and striving to improve them. It can be concluded that these means are reasonably effective in the case of larger flocks which are managed and grouped together under the supervision of a shepherd in summer pastures (alpages) and in more easily manageable landscape and vegetation patterns. Flock protection may also be attempted on the larger flocks among shepherded flocks kept on well-cleared grassland areas, used for milk ewes or suckling lambs. Finally, flocks grazing in summer pastures, which are indoors during a long winter period, and grouped in collective flocks for only about four months in summer, could also, it seems, be protected for the short duration of the offseason at spring and fall.

But in all other situations, where you have small flocks, batching, wooded or shrubby grazing land, grazing lambs, attempts to get more value from the products, a multi-activity economic model, or animals grazing freely in the mountain, the sheep farming community feels there is no solution. And it should be kept in mind that these situations represent

the vast majority of sheep farming areas where wolves are present or arriving. Either attempt to protect the flocks are failures, in situations where wolves have been already settled for a while, or the prospect of seeing the arrival of wolves is seen as creating hopeless problems. Twenty years after their first experience of wolves, farmers are both discouraged and farther from accepting wolves than they ever were. All of them, whether they belong to major trade unions or to alternatives ones, whether they have turned to short marketing channels or to organic production, increasingly fear for the survival of their activity in the event of a permanent settling of wolf packs on their grazing territory. Given this situation, technical services are helpless. Apart from giving technical advice for the introduction of livestock guarding dogs or providing special equipment to improve protection, they cannot offer a real solution to the problem: how wolf-induced constraints can be dealt with in an existing economic model that is in its present form fully integrates commercial, human and environmental factors.

A shrubby Mediterranean *parcours*.
Photo: Sabine Debit/CERPAM.

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EURASIAN LYNX DEPREDATION ON SHEEP IN NORWAY: SUMMARIZING 20 YEARS OF RESEARCH



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Large carnivores were effectively exterminated from much of Norway during the early to mid-20th century. In their absence, a form of sheep husbandry developed which involved releasing up to 2 million sheep into forest and tundra grazing areas throughout the country without fencing or protection. Supervision is limited to the occasional patrolling of the grazing area that has no protective effect. The sheep do not flock and disperse over large areas. Sheep are normally free-grazed from June to September, spending autumn and early spring on fenced fields close to the farm and winter in barns. The system requires low labour inputs and many sheep farmers have alternative employment outside the farm.

Since the 1980's populations of Eurasian lynx, wolverine, brown bear and wolf have been recovering in Norway. There are currently between 300 and 400 lynx in Norway, spread thinly across most of the country. The population is maintained at this level through

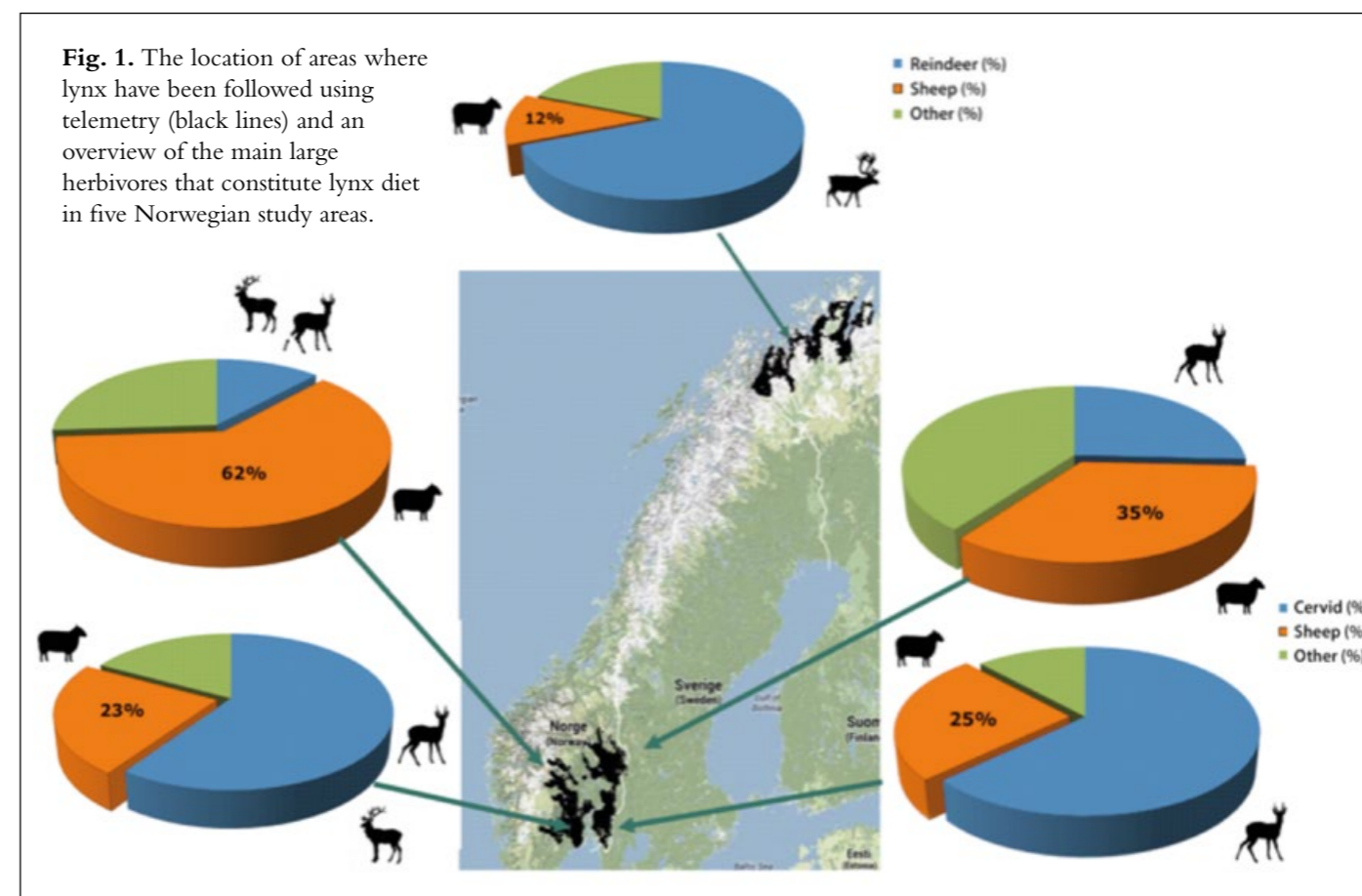
the use of an annual quota regulated harvest. Parallel with this recovery has been an increase in the mortality of sheep while free grazing in summer. There has been considerable uncertainty about the causes of this mortality because the extensive nature of the grazing system, the complex terrain in which the sheep graze, and the low level of supervision do not facilitate the timely discovery of carcasses in a state that permits necropsy. A series of early studies using radio-telemetry of sheep documented that large carnivores were killing substantial numbers. As a result a practice evolved where compensation was paid for most missing sheep above a level that was regarded as a pre-carnivore recovery "normal" loss. This has reached the stage where currently less than 10% of paid compensation is based on a carcass that has been subject to field inspection. The rest is based on a somewhat subjective evaluation by administrators in the various county environmental affairs departments.

What is actually happening to the sheep?

Eurasian lynx are the most widespread of the large carnivores in Norway, and their entire distribution overlaps with sheep farming areas. Although there is plenty of evidence that lynx depredate on free-grazing sheep from necropsy of carcasses, there is considerable uncertainty about how many are killed. Lynx killed sheep are particularly hard to detect, because they tend to kill single sheep, and often consume and/or bury the carcass. In recent years, almost 10,000 sheep have been compensated as lynx kills annually in Norway.

In order to shed light onto the actual extent of lynx depredation the Scandlynx project began studying livestock depredation among radio-collared lynx in 1995. Since then we have been studying depre-

dation in both southern and northern Norway. Although the development of technology (from VHF to GPS collars) has changed our way of working, the essential work involves following individual lynx to quantify their kill rates (number of animals killed per unit time) on wild and domestic prey under different environmental conditions. The major difference between southern and northern Norway lies in the availability of alternative prey. In the south roe deer, followed by red deer, are the most common wild prey. In the north there are no wild herbivores of a size that lynx can readily kill, so domestic reindeer represent their most common prey (Fig. 1). A total of 78 individual lynx with access to free-ranging sheep during summer have been studied so far.



Who kills sheep and where?

Our most intensive study area in the area west of Oslo (Østafjells) provided good insight into the factors explaining variation in the probability of lynx killed sheep (Table 1). Roe deer and red deer were the main winter prey for all lynx. In summer, solitary female

lynx killed comparatively few sheep, whereas females with dependent young and adult males were four and five times more likely to kill a sheep. When looking at individual variation it was clear that both the density of roe deer and sheep influenced patterns of prey selection. Males were always more likely to kill sheep

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Table 1. Seasonal composition of the prey species killed by solitary females, females with kittens, and male lynx in Buskerud, Telemark, and Oppland counties, southern Norway, 2006–2011. Numbers in parentheses indicate the total number of kills for a given lynx category and season.

Prey type	Solitary Females (%)		Females with kittens (%)		Males (%)	
	Summer (16)	Winter (64)	Summer (73)	Winter (87)	Summer (188)	Winter (64)
Beaver (<i>Castor fiber</i>)	0	0	0	0	0	0.5
Goat (<i>Capra aegragus</i>)	0	0	0	0	0.5	0
Hare (<i>Lepus timidus</i>)	10.5	12.5	13.7	16.5	12.9	4.3
Moose (<i>Alces alces</i>)	0	0	0	0	0	1.2
Red deer (<i>Cervus elaphus</i>)	5.4	7.8	2.7	6.2	1.1	22.6
Red fox (<i>Vulpes vulpes</i>)	0	1.5	0	0	0	1.8
Reindeer (<i>Rangifer tarandus</i>)	0	0	0	0	0.5	0.6
Roe deer (<i>Capreolus capreolus</i>)	52.6	67.2	24.7	67.0	23.1	56.7
Sheep (<i>Ovis aries</i>)	10.5	0	45.2	3.1	55.4	12.3
Squirrel (<i>Sciurus vulgaris</i>)	0	0	0	1.0	0	0
Tetraonids	10.5	9.4	12.3	6.2	3.8	0
Other birds	10.5	1.6	1.4	0	2.7	0

than females, and kill rates on sheep were highest in areas with more sheep and fewer roe deer, and lowest in areas with more roe deer and fewer sheep (Fig. 2). When looking at the occurrence of sheep in lynx diet across the range of study sites, the main finding was that sheep were rarely the major part of the diet, apart from areas with few roe deer and with very high sheep densities.

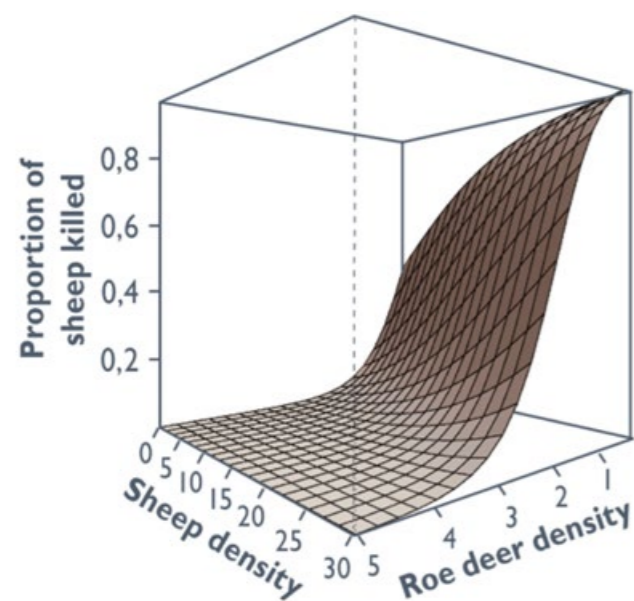


Fig. 2. Relationship between lynx prey selection for sheep and densities of roe deer and sheep.



How often do lynx kill sheep?

During our studies we found that most of the collared lynx killed sheep at one time or another (75% of males and 33% of females) during the weeks that we followed them. This finding led us to quickly reject the idea that there were just a few sheep-specialist problem-individuals in the lynx population. However, there was considerable variation in the rates at which lynx killed sheep. The main difference was between males

Table 2. Seasonal composition of the prey species killed by solitary females, females with kittens, and male lynx in Buskerud, Telemark, and Oppland counties, southern Norway, 2006–2011. Numbers in parentheses indicate the total number of kills for a given lynx category and season.

Area	Sex	Lynx*season	Proportion (%) of lynx involved in depredation (n)	Average lambs per km ²	Average roe deer per km ²	Sheep killed per 30 days
Region 5	M	9	83% (6)	1.3 (±2.6)	0.2 (±0.2)	7.9 (±8.6)
	F	14	8% (12)	1.0 (±1.1)	1.1 (±1.3)	0.2 (±0.7)
Region 4	M	5	25% (4)	1.8 (±2.5)	3.5 (±1.8)	0.4 (±1.8)
	F	3	33% (3)	1.9 (±2.4)	2.2 (±1.1)	0.8 (±1.4)
Region 2 - north	M	8	100% (8)	3.2 (±1.8)	0.6 (±0.4)	5.9 (±3.1)
	F	7	83% (6)	5.2 (±3.0)	0.4 (±0.3)	2.4 (±1.8)
Region 2 - south	M	6	67% (6)	1.1 (±0.7)	3.2 (±1.4)	1.9 (±1.6)
	F	3	33% (3)	1.5 (±0.9)	2.7 (±2.1)	0.9 (±1.6)
Region 8	M	16	50% (6)	8.5 (±3.8)	12.3 (±5.4)	0.9 (±0.4)
	F	23	55% (11)	8.1 (±5.7)	11.1 (±4.6)	1.5 (±0.4)

and females (Table 2). In most study areas males killed sheep far more frequently than females. In addition, males were responsible for all cases of multiple killing. Kill rates for all lynx classes varied from 0.2 to 8 sheep per month. An overall analysis revealed that kill rates on sheep decreased with increasing roe deer density and that the relative kill rates were lower at lower sheep density (Fig. 3).

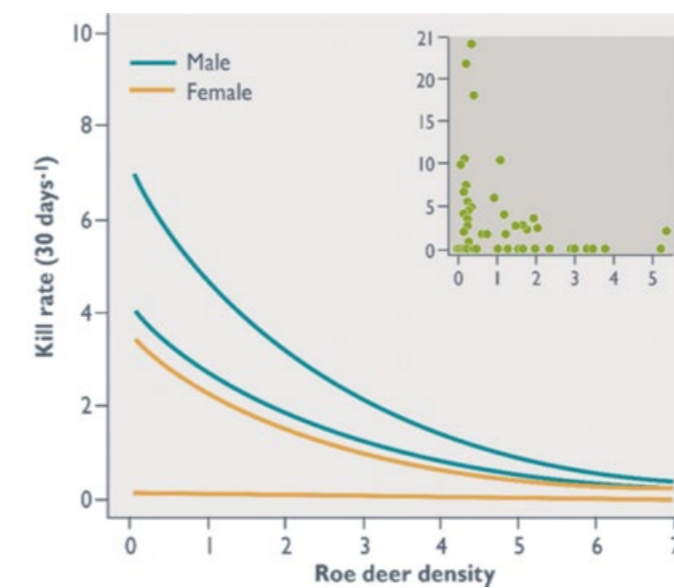


Fig. 3. The impact of roe deer density and sex of lynx on sheep kill rate at high (upper lines) and low (lower lines) sheep density.

Based on these analyses we believe that sheep killing behavior by lynx is mainly a result of encounter rates between lynx and sheep. In areas with high sheep densities there are more encounters between lynx and sheep, leading to more sheep kills. However, this may well be modified by the availability of alternative prey, seeing as the chances of killing a sheep was also higher in the areas with extremely low roe deer density. In support of the encounter rate model is the observation that of 15 lynx in southeastern Norway who had access to sheep grazed on fenced (mainly simple sheep fencing) pastures – there was not a single case of depredation documented.

Are too many sheep being compensated?

Given a per capita estimate of kill rate and combining it with the annual population census that estimates the size of the lynx population it is possible to estimate the number of sheep killed by lynx each year. We performed the calculation for four of the carnivore management regions where we had collected field data on lynx. For three of the management regions we estimated that on average over the last 18 years managers had paid out compensation for an average of between 2 and 5 times more lynx than we estimated even when using maximum kill rate estimates. In some years the



payments were up to 8 times higher than what we estimated as being likely. Only one region appeared to have been making realistic payments. Clearly, lynx have in general been blamed for more depredations than they are responsible for. So, if the sheep are not being killed by lynx, what is killing them? The simple answer is that nobody really knows. In some areas, it could be other large carnivores like wolverines or bears, although this can be excluded in at least one of the regions. The problem is that the original estimates of “normal” loss come from 30 to 40 years ago and much has changed in that period. Red foxes have returned to Norwegian nature after being decimated during the 1980’s during a scabies epidemic. The climate is changing, leading to an expansion of tick distribution. A variety of diseases (e.g. Anaplasmosis), poisoning (photosensitivity caused by eating certain plants), and accidents can also kill significant numbers of sheep. If lynx are not killing so many sheep as thought, there is a real need to find out what is happening to free-grazing sheep from both animal welfare and economic points of view. In Norway every summer approximately 130,000 sheep disappear while summer grazing. Even with the large numbers (30,000) being compensated as carnivore kills each year there are still 100,000 deaths that need to be accounted for. The main problem in assigning cause of death is that most dead sheep simply disappear as the husbandry system does not permit the rapid finding and necropsy of animals.

How to limit lynx depredation?

Although our study indicates that lynx depredation is over-estimated there are still substantial numbers (thousands) of sheep being killed by lynx. The current strategy to deal with this has involved using sports hunting to regulate the size of the lynx population. This strategy has succeeded to the point that it has prevented the lynx population from growing and has kept a limit on the numbers of sheep killed, but it has done nothing to reduce the per capita depredation rates (Fig. 4) which is by all estimates unacceptably high.

Any reduction in per capita impact implies that either the sheep will need to be better protected (fencing is the only realistic option in Norway given high labor costs that exclude shepherding) or else there will need

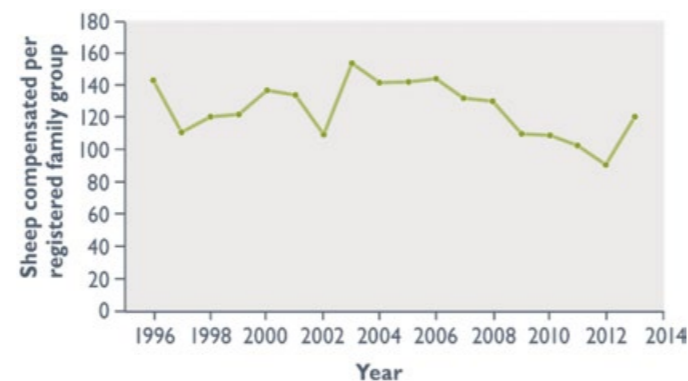


Fig. 4. Annual numbers of sheep for which compensation has been paid relative to the size of the lynx population as measured by number of annual reproductions (family groups).

to be more effective zoning to separate sheep and lynx. Zoning is already used in Norway as a central management strategy. On one level it works as it has been used to exclude lynx from the southwestern counties with the highest sheep densities. However, on a finer scale it has not worked because regional managers have not been able to adapt policy to the massive home ranges of Norwegian lynx (from 300 to 2,000 km²) and have tried to create a too fine scaled mosaic of zones.

A final measure that is needed is to restructure the compensation system. The fact that despite current efforts it is impossible to confirm the cause of death for 90% of the missing sheep indicates that any such ex-post facto compensation system can never produce results with any degree of confidence. Rather than trying to refine the present system we believe that it would be better to move to an incentive based system that removes all requirement to document losses and simply pays an amount scaled to a level that corresponds to

what the lynx population in a given area is believed to be responsible for killing. In such a system, the herder who manages to adapt his husbandry and minimize losses will gain a double payment, from both the sale of more lambs to slaughter and from the incentive



payment. The present system does not provide any economic incentive to change the form of husbandry.

All of these measures will require a willingness to change on the part of sheep farmers and massive amounts of economic, logistical and technical assistance from the state. At present, there are a lot of funds available for assistance, although most of it is being used

on unsuitable measures and is tied up in compensation. However, the willingness to change appears to be absent, at least judging from media reports of statements from the agricultural organisations. However, the consequence of not doing anything is both an unacceptable rate of sheep losses and unsustainable levels of social conflict that are likely to continue indefinitely.

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This lynx has been immobilized to equip it with a GPS collar in connection with studies to document rates of depredation on livestock. Photo: Thomas Strømseth.



Research Article

PEOPLE AND JAGUARS COEXISTENCE PROJECT: UNDERSTANDING AND INCREASING TOLERANCE TO BIG CATS IN BRAZIL

Silvio Marchini*

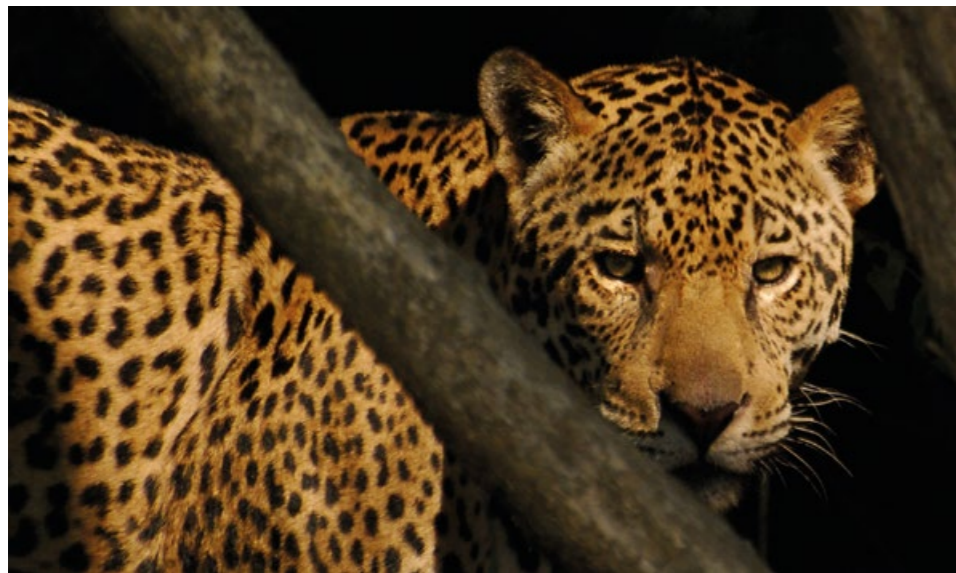
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The jaguar (*Panthera onca*) and the puma (*Puma concolor*) are the largest terrestrial predators in the Neotropics (male mean weight in kg: 104.5 and 58.9, respectively) (Macdonald et al., 2010) and some of the most widely distributed (Fig. 1) and charismatic species of conservation concern in Central and South America. Nonetheless, these big cats are not always welcome in rural areas and their presence can be intolerable to many people. The resulting persecution by humans is a major threat to jaguars and pumas in Brazil (ICMBio, 2011, 2013). It is widely assumed that intolerant behaviour toward large predators is motivated by retaliation for real and perceived losses of livelihood (Treves and Bruskotter, 2014). The People and Jaguars Coexistence Project, however, proposes a human dimensions perspective for effectively understanding and resolving conflicts between people and big cats in Brazil; an approach that goes beyond the traditional ecological and economic considerations about reciprocal negative impacts, by addressing also the complexity of the causal relationship between jaguar and puma damage and human thoughts and actions toward these animals, and the disagreements between people over wildlife values and management objectives.



Fig. 1. Distribution maps of jaguar and puma. Maps from Panthera - www.panthera.org

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Ecology and economics of the conflict

The study and mitigation of the problems involving jaguars and pumas has focused on the negative aspects of the interactions, within the framework of human-wildlife conflicts (HWC). More specifically, it has given attention to the patterns and predictors of damage caused by jaguars and pumas; the description of the damage to livestock; the monetary costs associated with such damage; the implications of the situation for the conservation of these big cats; and the prevention of damage and mitigation of monetary losses.

Livestock losses to jaguars are generally small when averaged over time and space. Average losses attributed to jaguars in Brazil range from 0.2-2.3% of livestock holdings over 12 months in the Cerrado (Palmeira et al., 2008), the Atlantic Forest (Conforti and Azevedo, 2003), southern Amazonia (Michalski et al., 2006), southern Pantanal (Azevedo and Murray, 2007; Cavalcanti and Gese, 2010), two ranches in northern Pantanal (Dalponte, 2002), and a larger portion of the northern Pantanal (Zimmermann et al., 2005). Large cattle ranches (>1,500 head of cattle) were found to endure the highest monetary costs, reaching US\$1,770.80 in a 2-year period (Michalsky et al., 2006). Sometimes, a major factor predisposing a particular herd to jaguar predation is poor husbandry (Azevedo and Murray, 2007; Michalski et al., 2006). While the risk of predation is greater among cattle left unattended close to forest cover (Azevedo and Murray, 2007), documented losses of cattle to jaguar predation are generally much fewer than those attributable to accident, snake bite, dis-

ease, parturition problems, flood (Azevedo and Murray, 2007) and even theft. In the Pantanal, for instance, Azevedo and Murray (2007) found that of 169 cattle mortality incidents, 19% were due to predation by jaguars. These authors recommend that cattle ranchers in the Pantanal region concentrate on losses due to nonpredation causes that could be more easily controlled. Furthermore, on some ranches, livestock depredation by puma may be more common than predation by jaguars, but it may

be difficult for ranchers to distinguish predation by jaguars and pumas.

As for pumas, even though they can cause great losses to livestock (e.g. maximum losses in southern Brazil were 78% for goats, 84% for sheep, and 16% for cattle; Mazzolli et al., 2002), their impact has received less attention from wildlife professionals than that of jaguars, as they prey mostly upon sheep and goats in smaller properties instead of cattle in large ranches, and as their significance has most likely been overshadowed by the exceptional prominence of their spotted cousins (Marchini, 2010). Nonetheless, pumas have recently been brought to the forefront, through exposure in the press due to the apparent increases in the frequency of their appearances in unsuspected places and of their collisions with vehicles. Once restricted mostly to remote natural or rural areas, these incidents have been happening in populated places. There is evidence of high behavioural plasticity of pumas in using highly anthropogenic habitats (Magioli et al., 2014), but population trends are unknown and the species is still listed as endangered.

Results from such studies have provided the basis for a number of recommendations of prevention measures (e.g. fencing, guard dogs) and husbandry practices that have the potential to decrease livestock losses caused by jaguars (Hoogesteijn and Hoogesteijn, 2005; Marchini and Luciano, 2009). Recommendations include night corrals, maternity pastures in areas closer to the ranch headquarters and provision of drinking water to prevent cattle from excursions to forest streams (Michal-

ski et al., 2006; Azevedo and Murray, 2007). While data on the effectiveness of these prevention measures are still scarce, Cavalcanti et al. (2012) recognize that inherent characteristics of the Pantanal (e.g. large ranches averaging 12 thousand hectares in size, where cattle are raised extensively) make it difficult to effectively control the access of predators to cattle, and as long as this is an issue, it is likely that predation will occur to a certain extent. The authors suggest that, along with curtailing losses due to rudimentary herd management and poor husbandry practices, ranchers should focus on increasing their production potential (e.g. maintaining native prey populations).

Regarding the economic incentives that have been proposed to encourage tolerance, compensation and sport hunting have shown little promise due to operational, financial, legal and cultural constraints. Jaguar-based tourism, on the other hand, has boomed in the last decade, with several tour operations in place in the Pantanal and central Amazon. In 2008, a fisherman was killed by a jaguar while sleeping in his tent on a riverbank of the Paraguay River near Taiamã Ecological Station (Neto et al., 2011), a major destination in the Northern Pantanal for jaguar sighting tours. This was the first officially documented, unprovoked, fatal attack of a jaguar on a human in Brazil. In 2010, in the same region of the Pantanal, a tourist was seriously injured when a jaguar jumped out of a ravine onto his boat, biting him on the head and right shoulder and tipping him into the water (Neto et al., 2011). These two incidents fuelled controversies involving tour operators that were accused of baiting and habituating jaguars to increase sightings. In response, the government of Mato Grosso enacted, in 2011, regulations for jaguar viewing tours in that state (e.g. attracting jaguars with food or sound is prohibited, boats must keep a safe distance from the jaguar, avoiding being in its presence for more than 20 minutes).

The human dimension of coexistence

Ecology and economics provide a wide array of tools and techniques for understanding and managing wildlife-caused damage and conservation issues. These disciplines have contributed significantly to the control of pests and the conservation of endangered species. However, in the interactions between humans and charismatic animals like jaguars and pumas, the cause-effect relationship between wildlife damage and negativity toward wildlife is seldom simple and consistent. Besides, people often disagree – based on values other than ecological and economic ones – about management goals in HWC: while some people favour the control of damage to the detriment of wildlife, others favour wildlife for its positive impacts (Marchini, 2014).

In HWC, persecution (i.e. persistent killing, chasing, or other harassment of a species) is not always a simple function of wildlife damage. There may be a discrepancy between actual and perceived damage. What ultimately drives human behaviour is not reality itself, but how reality is perceived. In conflicts with high-profile predatory animals such as big cats, the perceived damage and risk often exceed the actual evidence (Marchini and Macdonald, 2012; Treves and Bruskotter, 2014). A feedback loop between notoriety and sensationalism may be behind the distorted perceptions. For



instance, we found that jaguar attacks on people have a prominent place in story-telling in rural Brazil and the attack reports provided by respondents may have been inflated by the self-reinforcing process in which a collective belief gains more plausibility through its increasing repetition in public discourse (colloquially: “repeat something often enough and it will become fact”) (Marchini, 2010).

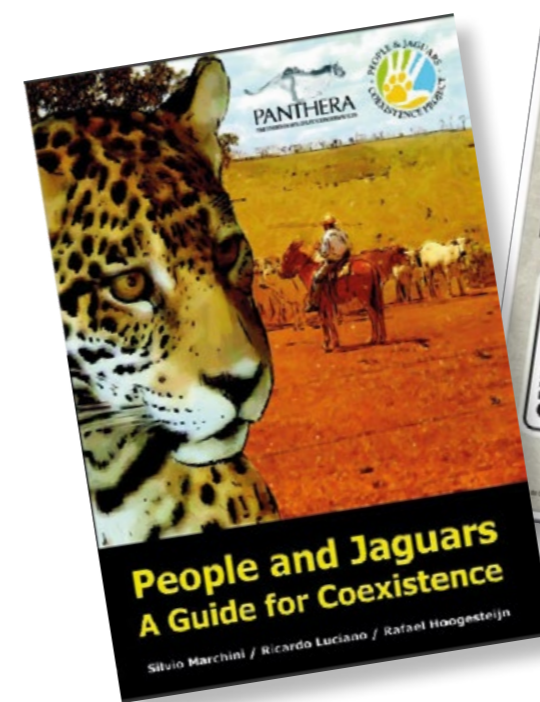
Furthermore, factors not directly related to the impacts that wildlife have on human livelihoods may also be involved in the persecution of jaguars and pumas. Large carnivores elicit strong negative emotions, particularly fear, with people who are fearful of carnivores usually being more antagonistic to them. Also, we found that social motivations are important determinants of the intention to kill jaguars in the Pantanal, where 25% of ranchers justified their approval of jaguar killing on the grounds of tradition (Marchini, 2010). These ranchers often refer, with apparent pride, to the “Pantaneiro culture” and the conviction that jaguar hunting has been passed from generation to generation as an element of that culture.

To make things worse, jaguars and pumas evoke strong, mixed opinions and feelings. Nobody opposes the extermination of mosquitos or gets offended by the non-consumptive use of birds in bird watching, but the management of iconic animals such as big cats divides opinions among broad sectors of society, which can result in social conflict. Damage alone can explain disagreements between groups of people when the impact of HWC is differentially distributed, with people more heavily affected expecting more stringent measures against wildlife than those who are not negatively affected. Social conflicts over wildlife, however, are often based on subjective factors. People can disagree over goals and management alternatives for affective, aesthetic, or ethical reasons, for example. Besides, charismatic wildlife often becomes a surrogate for deeply embedded cultural discords within and between social groups (Marchini, 2014). Ranchers and farmers are a minority group in Brazil, and their numbers are dwindling. As a result, they may associate wildlife conservation with urban values that are increasingly imposed on them and might view the continuation of wildlife killing as part of their resistance to this and their struggle to preserve their rural heritage (Marchini, 2010).

Hence, intolerance toward jaguars and pumas is not merely determined by any direct costs imposed, but is rather the product of a dynamic and complex web of individual (e.g. perception of risk and fear), societal (e.g., peer pressure and social conflict), and cultural (e.g. identity) factors (Dickman et al., 2013). The conventional approach to wildlife management and conservation, with its emphasis on animals and their habitats, is inadequate to deal with the psychological and social nature of our problems with these felids. A more promising approach is one that incorporates a “human dimensions” perspective. The emerging field of Human Dimensions of Wildlife addresses the system human-wildlife-habitat, instead of wildlife and habitat separately, with an emphasis on describing, understanding, predicting, and affecting human thought and action toward wildlife (Manfredo et al., 1996). As humans are the common thread in the highly variable realm of human-wildlife conflicts, and the course and resolution of conflict are determined by the thoughts and behaviours of the people involved, understanding the human dimensions is the most crucial prerequisite for developing effective mitigation (Manfredo and Dayer, 2004).

People and Jaguars Coexistence Project

Our project is hosted by the Laboratory of Wildlife Ecology, Management and Conservation (LEMaC) of the University of Sao Paulo, led by Prof. Katia Ferraz, and aims to understand and improve the relationship between people and wildlife in Brazil, with a focus on jaguars and pumas. A key feature of this pursuit is the articulation of a model of wildlife management that integrates human and biological dimensions in wildlife



management, conservation planning, and policy-making. We work to develop fundamental understandings of human behaviour associated with controversial wildlife and to apply concepts and empirical findings to real-world problems of conflict management.

More specifically, we have been doing: i) Research with focus on the individual level, to understand people's behaviour toward big cats and obtain clues about how to influence that behaviour for the benefit of jaguar and puma conservation, and research looking at the socio-cultural level, to understand how tolerance varies in space, the similarities and differences among human-big cats conflict situations in different regions of Brazil (including Amazonia and Pantanal) and evaluate whether interventions found successful in one context are likely to work in another; ii) Education and communication based upon the results from the above research and built upon 12 years of experience in education for conservation of the Escola da Amazônia Project¹, to increase tolerance to jaguars and pumas and decrease persecution; iii) Conservation conflict transformation, in collaboration with Prof. Alistair Bath (Memorial University in Newfoundland, Canada), by the engagement of interest groups such as farmers and parks authorities, gaining trust and building management plans through true consensus processes; iv) Incorporation of human dimensions into conservation

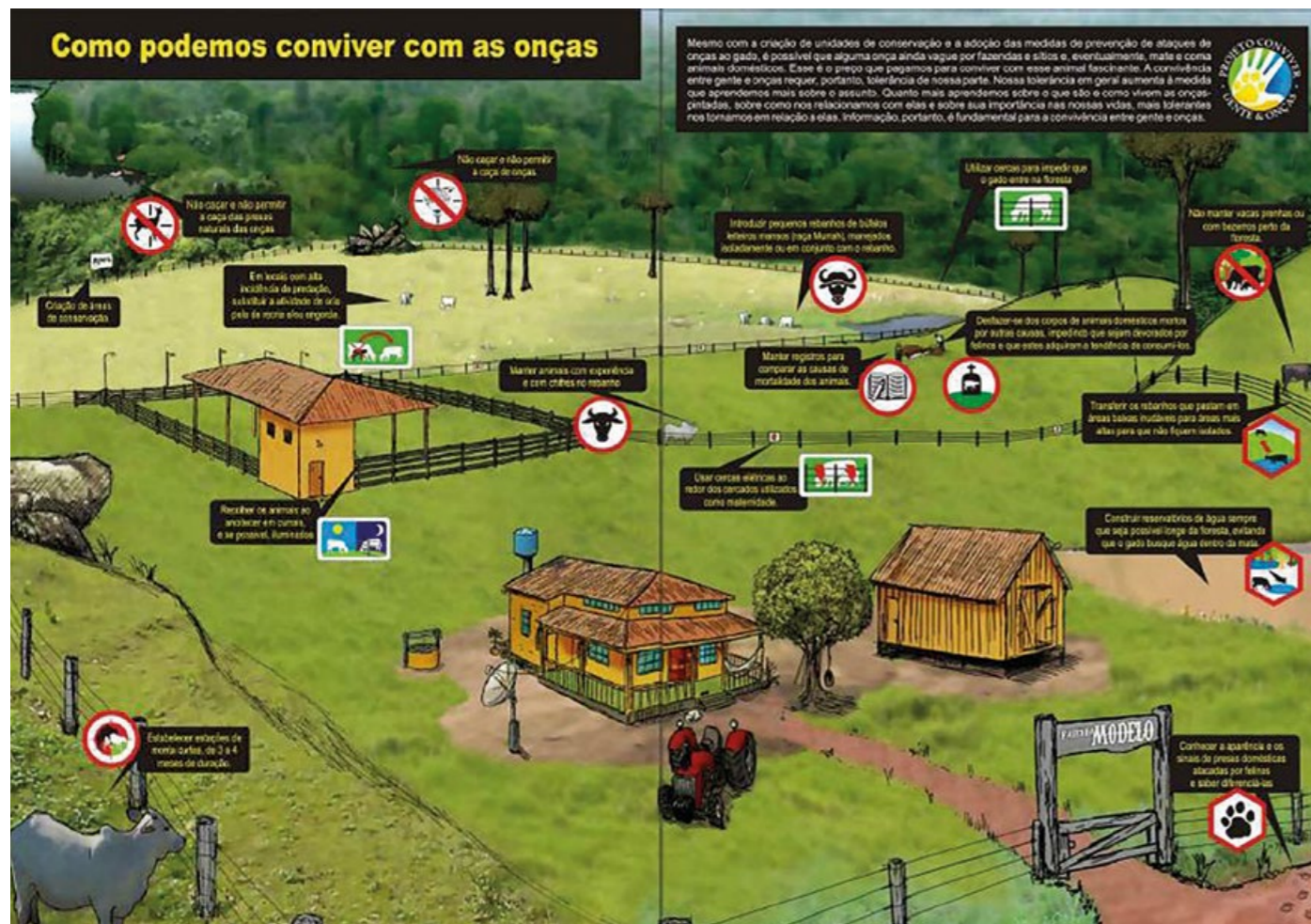
planning and public policy, more specifically through the collaborative work in the design of two National Action Plans, led by the Ministry of Environment – one for the jaguar and one for the puma; and v) Capacity building in human dimensions among wildlife professionals and graduate students.

Our results revealed that, besides the real economic loss, the subjectivity of feelings and perceptions may also be behind the killing of jaguars. Specifically among farmers on the frontier of deforestation of the Amazon, the fear of jaguars and the belief that killing them is a common practice among neighbours are main motivations for persecution (Cavalcanti et al., 2010; Marchini and Macdonald, 2012). It was with these farmers and their children that we conducted an experiment that evaluated the effectiveness of different approaches of education and communication – within and outside the classroom – to improve the feelings and perceptions of jaguars and consequently, discourage the behaviour of killing them (Marchini, 2010).

The experiment involved six rural schools and 150 students, averaging 12 years old. The students asked, with the support of an official letter from the school, that their parents review parts of the book used in the activities in the classroom and sign the homework. In addition, parents received information through “People and Jaguars: a Guide for Coexisting”² (Marchini and Luciano, 2009), an illustrated, colourful book, attractive and easy to understand even for those who

¹ More detail at <http://whiteleyaward.org/winners/education-conservation-amazon-brazil/>

² Free download at <http://www.amazonarium.com.br/docs/peopleandjaguarcomplete.pdf>



cannot read. Another group of adults, in the same rural community, received the book from the project researchers, identified as representatives of an environmental organization. The impact was greater among parents who received the book through the school, from the hands of their son or daughter: at the end of the experiment, they were less convinced that killing jaguars is as common or socially acceptable. This result suggests that parents' perceptions can be influenced not only by the information explicitly conveyed in the content of books and their children's homework, but also by the implicit message that a community institution (and therefore other community members) supports jaguar conservation more than they had realised. The use of role models, case studies, and examples of coexistence with jaguars, could conceivably enhance the power of school-based communication campaigns to create or redefine social norms concerning conservation-orientated behaviours.

Our project shows that conservation efforts considered as emanating from outside the social group can be poorly accepted. Conservation educators and communicators should therefore explore the benefit of the social domino effect and find ways to make their messages appear to originate from within the community; messages that arrive through other community mem-

bers (e.g. friends, neighbours and relatives) can be more easily accepted than those that appear to come from the top down, imposed by "outside" people or institutions. We have also shown that school-based education and communication interventions can have a powerful impact on students' perceptions of jaguars, and on those of their fathers; this process could be used to positive conservation effect. The finding that students can influence their fathers' perceptions of jaguars suggests that conservationists can use rural schools to reach at once tens of students in a classroom, or hundreds on the school's soccer pitch, who will in turn transfer the conservation message to their fathers. Given the logistical challenge of visiting landowners one-by-one at home in rural Amazonia, this strategy might be relatively cost-effective. The exceptionally strong prominence of the jaguar in people's hearts and minds, combined with the relatively high rate of primary school enrolment in Brazil (97.5%) and the willingness of public school directors and teachers to cooperate with conservationists, renders school-based intergenerational learning a particularly promising approach for big cat conservation.

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Journal Article Abstract

SUBSIDIZED FENCING OF LIVESTOCK AS A MEANS OF INCREASING TOLERANCE FOR WOLVESJens Karlsson, Magnus Sjöström / *Ecology and Society* 16, 16 / 2011

Studies of how proactive measures to reduce livestock depredation by carnivores affect human tolerance toward carnivores are extremely rare. Nevertheless, substantial amounts of money are spent each year on proactive measures to facilitate large carnivore conservation. The objective of this study was to assess how subsidies for proactive measures to reduce sheep losses to wolves are associated with public attitudes toward wolves. The respondents were 445 people living inside wolf territories in Sweden. Our data set is unique because we combine wolf territory level information regarding proactive subsidies and wolf attacks on dogs and sheep with geographical information of the respondents. Consequently, the respondents can be assigned to a specific wolf territory. The number of wolf attacks on sheep and

dogs in the respective territories as well as the number of years that the wolf territory had existed did not affect human attitudes toward wolves. Subsidies for proactive measures to reduce wolf predation on sheep significantly increased positive attitudes toward wolf presence on the local scale. The magnitude of the effect of subsidies for proactive measures was comparable to the effect of other variables well known to affect human attitudes toward wolves such as age or education. Our data show that subsidies not only made the already positive more positive, but also made people with negative attitudes to wolf presence locally, less negative. Our conclusion is, therefore, that subsidies for proactive measures are an effective tool when working with “the human dimension” of conservation biology.

Journal Article Abstract

SUPPLEMENTAL FEEDING WITH CARRION IS NOT REDUCING BROWN BEAR DEPREDATIONS ON SHEEP IN SLOVENIAIrena Kavčič, Miha Adamič, Petra Kaczensky, Miha Krofel, Klemen Jerina / *Ursus* 24, 111-119 / 2013

Supplemental feeding is often believed to be a successful tool for reducing human–bear (*Ursus arctos*) conflicts, especially in Europe. However, effectiveness of this measure is poorly understood and there is growing concern for potential negative side-effects. This is particularly true for supplemental feeding using livestock carrion. Carrion feeding is considered especially effective in reducing livestock depredations by diverting bears from pastures and meeting their protein needs. In Slovenia, year-round supplementary feeding of bears with livestock carrion and corn was intensive and in some areas practiced for over 100 years. However, in 2004 the use of livestock carrion was banned in accordance with European Union regulations. This provided an opportunity to study the effects of carrion feeding on livestock depredations by bears. We used sheep as they represented 97% of all depredation events by brown bears in Slovenia. We analyzed whether bears selectively used carrion feeding stations

over corn feeding stations (i.e., indicating that carrion might be more effective in diverting bears from sheep pastures) during 1994–2011, and compared the annual frequency and seasonal distribution of sheep depredations 5 years before and after the ban on livestock carrion feeding during 1999–2009. We found no support that bears selected carrion feeding sites over feeding sites with corn. When controlled for changes in bear and sheep numbers, there was no indication that the ban on carrion feeding increased sheep depredations. Moreover, complementary data indicated that natural protein sources were considerably more important than livestock carrion and that use of carrion peaked in spring, when sheep are rarely outdoors and thus unavailable for depredation. Because of the observed lack of effectiveness, high costs, and potential negative side-effects, we discourage supplemental feeding with livestock carrion to reduce livestock depredations.

Journal Article Abstract

WHY NAMIBIAN FARMERS ARE SATISFIED WITH THE PERFORMANCE OF THEIR LIVESTOCK GUARDING DOGSGail C. Potgieter, Laurie L. Marker, Nico L. Avenant, Graham I.H. Kerley / *Human Dimensions of Wildlife* 18, 403–415 / 2013

The success of livestock guarding dogs (LGDs) in mitigating farmer–predator conflict relies on the perceptions of farmers that use them. Purebred LGDs are provided to Namibian farmers by the Cheetah Conservation Fund as a farmer–predator conflict mitigation measure. We examined the perceptions of farmers using 164 of these LGDs by analyzing data collected during face-to-face interviews from 2000–2010. Although most respondents reported reduced livestock losses since LGD introduction, satisfaction with LGD performance

was more strongly linked to their observations of LGD behavior. The most commonly reported negative behaviors were staying home (29 LGDs, 18%) and chasing wildlife (25 LGDs, 15%). On subsistence farms, care provided was negatively correlated with LGD age ($r = -.34$, $n = 35$, $p = .04$) and LGDs reportedly staying home were provided with less care than other LGDs. Overall, LGDs performed satisfactorily on commercial and subsistence farms, and thus contributed to farmer–predator conflict mitigation.

Journal Article Abstract

NO TRESPASSING: USING A BIOFENCE TO MANIPULATE WOLF MOVEMENTSDavid E. Ausband, Michael S. Mitchell, Sarah B. Bassing, Craig White / *Wildlife Research* 40, 207-216 / 2013

Conserving large carnivores can be challenging because of conflicts with human land use and competition with humans for resources. Predation on domestic stock can have negative economic impacts particularly for owners of small herds, and tools for minimizing carnivore depredation of livestock are needed. Canids use scent marking to establish territories and avoid intraspecific conflict. Exploiting scent-marking behaviour may provide a means for manipulating canid movements. We hypothesised that human-deployed scent marks (i.e. “biofence”) could be used to manipulate the movements of grey wolves (*Canis lupus*) in Idaho, USA. We deployed 65 km of biofence within three wolf-pack territories during summer 2010 and 2011 and used location data from satellite-collared wolves and sign surveys to assess the effectiveness of biofencing. Location data provided by satellite-collared wolves and sign surveys in 2010 showed little to no trespass of the biofence, even though

the excluded areas were used by the packs in previous summers. We also opportunistically deployed a biofence in between a rendezvous site of a resident pack and a nearby sheep grazing allotment; the pack was not implicated in any depredations in summer 2010, even though they had killed sheep every year since 2006. Location data provided by satellite-collared wolves in summer 2011 showed that wolves did trespass biofences. Biofencing effectively manipulated the movements of wolves in the first year of our study, but not the second. Our work suggests that biofencing may be most limited by the apparent necessity to maintain a continuous presence once the biofence is established. The inherent labour and costs associated with such efforts may limit the usefulness of biofencing. Our work can be improved on through further testing that maintains biofencing over a longer timeframe (>3 months), samples several animals per treatment pack, and uses a treatment and control design.

Journal Article Abstract

INDIRECT EFFECTS ON HEATHLAND CONSERVATION AND WOLF PERSISTENCE OF CONTRADICTIONARY POLICIES THAT THREATEN TRADITIONAL FREE-RANGING HORSE HUSBANDRYJosé Vicente López-Bao, Víctor Sazatornil, Luis Llaneza, Alejandro Rodríguez / *Conservation Letters* 6, 448–455 / 2011

Conservation agencies within the European Union promote the restoration of traditional land uses as a cost-effective way to preserve biodiversity outside reserves. Although the European Union pursues the integration of the environment into strategic decision-making, it also dictates sectoral policies that may damage farmland biodiversity. We illustrate this point by outlining the socioeconomic factors that allow the persistence of traditional free-ranging horse husbandry in Galicia, northwestern Spain. Free-ranging Galician mountain ponies provide ecological and socioeconomic services including the prevention of forest fires, the maintenance of heathlands and wolves, and the attenuation of wolf-human conflicts. This traditional livestock system may have

persisted because it entails negligible costs for farmers. Wolf predation upon Galician mountain ponies does not threaten farmer's economies and seems to be tolerated better than attacks to more valuable stock. Recently, European Union's regulations on animal welfare, carcass management, or meat production put new economic and administrative burdens on farmers, make free-ranging horse rearing economically unsustainable, and incentivize its abandonment. The aim of the European Union to integrate environmental policies may be successful to preserve farmland biodiversity only through careful anticipation of the side effects of apparently unrelated regulations on the fragile equilibrium that sustain traditional land uses.

MEETINGS OF INTEREST**16th Wildlife Damage Management Conference**1-4 March 2015 / Gatlinburg, Tennessee, USA <http://fwf.ag.utk.edu/wdmc2015/>**Science for Parks, Parks for Science: The Next Century**25-27 March 2015 / Berkeley, California, USA <http://parksforscience.berkeley.edu/>**22nd Eastern Black Bear Workshop**26-29 April 2015 / Louisville, Mississippi, USA <http://www.easternblackbearworkshop.org/>

BOOKS

The Wolf's Tooth: Keystone Predators, Trophic Cascades, and Biodiversity (2nd edition)

By Cristina Eisenberg / 2011 / Island Press / 272 pp

Animals such as wolves, sea otters, and sharks exert a disproportionate influence on their environment; dramatic ecological consequences can result when they are removed from – or returned to – an ecosystem.

In “The Wolf’s Tooth”, scientist and author Cristina Eisenberg explores the concept of “trophic cascades” and the role of top predators in regulating ecosystems. Her fascinating and wide-ranging work provides clear explanations of the science surrounding keystone predators and considers how this notion can help provide practical solutions for restoring ecosystem health and functioning.

Eisenberg examines both general concepts and specific issues, sharing accounts from her own fieldwork to illustrate and bring to life the ideas she presents. She considers how resource managers can use knowledge about trophic cascades to guide recovery efforts, including how this science can be applied to move forward the bold vision of rewilding the North American continent. In the end, the author provides her own recommendations for local and landscape-scale applications of what has been learned about interactive food webs.

Parks, Peace, and Partnership: Global Initiatives in Transboundary Conservation

Edited by Michael S. Quinn, Len Broberg, and Wayne Freimund / 2012 / University of Calgary Press / 400 pp

Today, over 3,000 protected areas around the world contribute to the protection of biodiversity, peaceful relations between neighbouring countries, and the well-being of people living in and around the protected environs. Historical and geo-political constraints are disappearing in a new spirit of collaboration to address common issues confronting ecosystems, species, and communities. Managing across boundaries is seen as the only way to ensure the long-term viability of ecological systems and sustainable communities. Current international thinking in this area is reflected in this collection of essays by park managers, biologists, scholars, scientists, and researchers. From Waterton-Glacier International Park to the European Alps, and Lake Titicaca in Peru and Bolivia, the essays provide illustrative examples of the challenges and new solutions that are emerging around the world.

Genetics and the Behavior of Domestic Animals (2nd edition)

Edited by Temple Grandin, and Mark Deesing / 2013 / Academic Press / 496 pp

Behaviour is shaped by both genetics and experience – nature and nurture. This book synthesizes research from behavioural genetics and animal and veterinary science, bridging the gap between these fields. The objective is to show that principles of behavioural genetics have practical applications to agricultural and companion animals,

The continuing domestication of animals is a complex process whose myriad impacts on animal behaviour are commonly under-appreciated. Genetic factors play a significant role in both species-specific behaviours and behavioural differences exhibited by individuals in the same species. Leading authorities explore the impact of increased intensities of selection on domestic animal behaviour. Rodents, cattle, pigs, sheep, horses, herding and guard dogs, and poultry are all included in these discussions of genetics and behaviour, making this book useful to veterinarians, livestock producers, laboratory animal researchers and technicians, animal trainers and breeders, and any researcher interested in animal behaviour.

Ecology and Conservation of the Maned Wolf: Multidisciplinary Perspectives

Edited by Adriana G. Consorte-McCrea, and Eliana Ferraz Santos / 2013 / CRC Press / 344 pp

Wolves are controversial figures worldwide and much effort has focused on how to conserve them while addressing public concerns. With its solitary habits and fruit-eating diet, the endangered maned wolf roams the South American grasslands and swamps, playing a vital part in maintaining biodiversity hotspots. Compared to the grey wolf, little is known about its relationship with local people and the environment and the reasons for its decline, making research about this unique species an urgent concern.

“Ecology and Conservation of the Maned Wolf: Multidisciplinary Perspectives” gathers the work of leading researchers from diverse disciplines and countries, covering up-to-date research on the biology, ecology, and conservation of the maned wolf. It presents innovative insights that can benefit conservation strategies and offers perspectives for the future of the species.

Keeping the Wild. Against the Domestication of Earth

Edited by George Wuerthner, Eileen Crist, and Tom Butler
2014 / Foundation for Deep Ecology and Island Press / 248 pp

Is it time to embrace the so-called “Anthropocene” – the age of human dominion – and to abandon tried-and-true conservation tools such as parks and wilderness areas? Is the future of Earth to be fully domesticated, an engineered global garden managed by technocrats to serve humanity? The schism between advocates of rewilding and those who accept and even celebrate a “post-wild” world is arguably the hottest intellectual battle in contemporary conservation. In “Keeping the Wild”, a group of prominent scientists, writers, and conservation activists responds to the Anthropocene-boosters who claim that wild nature is no more (or in any case not much worth caring about), that human-caused extinction is acceptable, and that “novel ecosystems” are an adequate replacement for natural landscapes. With rhetorical fists swinging, the book’s contributors argue that these “new environmentalists” embody the hubris of the managerial mindset and offer a conservation strategy that will fail to protect life in all its buzzing, blossoming diversity.

Large Carnivore Conservation: Integrating Science and Policy in the North American West

Edited by Susan G. Clark, and Murray B. Rutherford
2014 / The University of Chicago Press / 416 pp

Drawing on six case studies of wolf, grizzly bear, and mountain lion conservation in habitats stretching from the Yukon to Arizona, “Large Carnivore Conservation” argues that conserving and coexisting with large carnivores is as much a problem of people and governance – of reconciling diverse and sometimes conflicting values, perspectives, and organizations, and of effective decision making in the public sphere – as it is a problem of animal ecology and behaviour. By adopting an integrative approach, editors Susan G. Clark and Murray B. Rutherford seek to examine and understand the interrelated development of conservation science, law, and policy, as well as how these forces play out in courts, other public institutions, and the field.

In combining real-world examples with discussions of conservation and policy theory, “Large Carnivore Conservation” not only explains how traditional management approaches have failed to meet the needs of all parties, but also highlights examples of innovative, successful strategies and provides practical recommendations for improving future conservation efforts.

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Dog Behaviour, Evolution, and Cognition (2nd edition)

By Adam Miklosi / 2014 / Oxford University Press / 400 pp

This is the first book to collate and synthesize the recent burgeoning primary research literature on dog behaviour, evolution, and cognition. The author presents a new ecological approach to the understanding of dog behaviour, demonstrating how dogs can be the subject of rigorous and productive scientific study without the need to confine them to a laboratory environment. This second, fully updated edition of “Dog Behaviour, Evolution and Cognition” starts with an overview of the conceptual and methodological issues associated with the study of the dog, followed by a brief description of their role in human society. An evolutionary perspective is then introduced with a summary of current research into the process of domestication. The central part of the book is devoted to issues relating to the cognitive aspects of behaviour which have received particular attention in recent years from both psychologists and ethologists. The book’s final chapters introduce the reader to many novel approaches to dog behaviour, set in the context of behavioural development and genetics. This second edition recognises and discusses the fact that dogs are increasingly being used as model organisms for studying aspects of human biology, such as genetic diseases and ageing. Specific attention is also given in this edition to attachment behaviour which emerges between humans and dogs, the importance of inter-specific communication in the success of dogs in human communities and the broad aspects of social cognition and how this may contribute to human-dog cooperation.

COMING TOPICS

On the next issue of the CDPNews we would like to deepen the knowledge on the effects of culling and hunting on predator populations and damages. If you are developing a project or study dealing with this topic, send us a proposal. Other topics related with damage prevention are also welcome. Please contact us before writing your articles, so we can send you the authors’ guidelines and are able to coordinate the contents of the Newsletter.

The next issue will be out in Spring.
Thank you for your collaboration!

The Editors

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

* Texts from the books’ publishers.

