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Coordinated actions to improve wolf-human coexistence at the alpine population level

“EFFICACY OF PREVENTION SYSTEMS IN THE ALPS IN THE FRAMEWORK OF THE LIFE PROJECTS”

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Introduction

Outdoor livestock husbandry is the economic activity on which wolf presence causes the greatest negative impact. Most damages occur in areas of recent wolf recolonization where over time livestock management has evolved in the absence of large predators and hence does not include any prevention measures or defence strategies from wolf attacks. The economic loss and the psychological and social hardship experienced by farmers leads to local conflicts, resulting in one of the biggest threats to wolf conservation in the Alps.

Different projects have been developed in Europe to improve wolf-human coexistence, most, if not all, working to decrease the impact of wolves on livestock husbandry by implementing effective preventive approaches. Here we provide details on these initiatives.

LIFE SloWolf (2010-2013)

The SloWolf project represents a crucial first step towards the coexistence with wolves in Slovenia. The project started in a period, when damages caused by wolves were at their historical peak in the country, meaning that the need for finding solutions was very high. Within the project, a network of 10 farmers who suffered significant damages from wolves and bears were involved in a collaboration to test high electric fences (160 cm). Within this best practice demonstration activities 10 sets of high electric fences and 12 livestock guarding dogs were donated to collaborating farmers.

The results quickly became apparent in a substantial (up to 95%) decrease of damages experienced by these farmers and the compensation for wolf attacks paid to these farmers were nearly 100.000 €/yearly smaller than the amounts before the implementation of damage prevention measures. The intensive collaboration with livestock breeders brought to light two key elements for every damage prevention system. First, all the equipment has to be used in a correct and consistent way, and second, the use of the equipment has to be controlled and supervised with field inspections to assure correct use and maintenance of the distributed equipment.

LIFE WolfAlps (2013-2018)

An extensive survey was carried out during the initial phase of the Life WolfAlps project to quantify wolf depredation on livestock and understand vulnerability of Italian Alpine pastures to effectively implemented preventive methods (Ramanzin et al., 2015). Considering that the Alps are characterised by a wide variability of conditions, be it in terms of wolf presence (which varies from stable with numerous packs to sporadic), livestock species (categories grazed and management systems) or the use or non-use of prevention systems (electric fencing, livestock guarding dogs, etc.), the survey led to several useful analyses, results and considerations. It highlighted local criticalities, common trends and shared recommendations as applied to different contexts. In this way, it was possible to identify and plan subsequent activities aimed at preventing attacks in areas of major wolf conflict, adapting them to local needs: different approaches have been used in areas of stable wolf presence (Western Alps), where the predator's decades-long presence has led to widespread use of prevention systems among sheep and goat farmers, but where it was necessary to implement protection for cattle, and in areas of recent wolf return where preventive measures were rarely in use (Central and Eastern Alps in particular). In the Italian Western Alps we developed new protection measures for cattle and we concentrated the prevention activities in case of chronic attacks on sheep and goats, defining case-by-case specific interventions. As a result of the assistance and distribution of the preventive tools by the project, we observed a reduction in

wolf attacks of 96% (Menzano et al., 2018). The experience gained and consolidated in the Western Alps has been transferred to the other Alpine areas. This happened not only through the installation of electric fences and the assignment of livestock guarding dogs (LGDs) to flocks, but also thanks to several meetings we organised where breeders residing in recently recolonized areas exchanged experiences with those from areas of stable wolf presence (Dalmasso et al., 2018). Encouraging results were also obtained in Veneto where a first pack settled in 2014 and after a very challenging time at the beginning of the project, due to political and strong local oppositions; a reduction in depredation was observed following the delivery of electrified fences for livestock protection. In particular, the analysis of the farmers' opinions on the efficacy of the prevention systems indicated that those who are not familiar with preventive systems had a rather low level of trust in them, which is not justified by the results obtained in areas of longer use (Dalmasso et al., 2018; Menzano et al., 2018; Colombo et al., 2018).

LIFE Dinalp Bear (2014-2019)

The project was primarily targeting conflicts with brown bears, but the contents regarding damage prevention systems are the same as for wolves, especially in Slovenia, where the two species inhabit almost the same areas.

Within the project, in Slovenia 18 sets of high electric fences and 20 livestock guarding dogs were distributed to livestock breeders to protect their herds from large carnivores. An important step forward towards a coordinated controlling system was made during the project by involving Slovenia Forest Service damage officials into performing controls of the use of the distributed equipment in the field. In Italy, the Autonomous province of Trento provided 51 pups to 30 breeders and Veneto region distributed 120 sets of electric fences to protect sheep and cattle.

On the basis of successful implementation of SloWolf and LIFE DINALP Bear project activities, in 2015 the Slovenian Agency for Environment and later the Ministry for Environment and Spatial Planning started to co-finance high electric fences to farmers who have already suffered damages from large carnivores. The co-financing is always available and enables farmers to purchase equipment at 80% of co-financing share. Since 2015, more than 60 sets were co-financed to livestock breeders to prevent damages from wolves and bears.

All the distributed equipment, both from project and at national level, are being regularly controlled by Slovenia Forest Service damage officials. In this way, a consistent and correct use of promoted measures is assured, resulting in a up to 90% reduction of damage events caused by large carnivores to the farmers who apply those measures.

LIFE WolfAlps EU (2019-2024)

An International Alpine Report describing damages caused by large carnivores and focusing on prevention practices adopted and currently evolving in each Alpine Country has been produced by the LIFE WolfAlps EU project in collaboration with the WISO platform of the Alpine Convention (Berce et al., 2022). The main objectives of the report were to present an overview of the systems used for livestock protection against damages by large carnivores and sources of financing, to highlight examples of good practices and to prepare general recommendations. Best practices tried and tested through the intensive effort of many experts throughout Europe have proven that **a variety of solutions are available to reduce the occurrence of damages caused by large carnivores on livestock**. Throughout different countries, technical solutions

were tested and adjusted to fit specific landscape features and other environmental factors in the Alpine region.

Experience from other projects such as Progetto Lupo Piemonte¹, LIFE DINALP BEAR² and LIFE SloWolf³ has shown that the presence of project staff to assist breeders and shepherds in using prevention systems and taking prompt action in case of attacks is fundamental so that breeders do not feel abandoned. Within the LIFE WolfAlps EU project, we created a new effective 'first aid' approach to facilitate direct and immediate contact with breeders in areas of wolf presence. Multidisciplinary qualified staff of Wolf Prevention Intervention Units (WPIU), composed of trained operators with different backgrounds and qualifications, give farmers case-by-case advice and support to improve prevention strategies based on successful experiences and best practices, administrative assistance, information on how to access compensation and subsidies, indication on the correct use of LGDs and mediation through active listening (Menzano et al., 2020). Beginning in 2021, WPIUs have been established in each alpine country of the project (Italy, Slovenia, Austria and France) and there are now around 400 operators in 42 units in the Alps and beyond. During their first year they intervened more than 600 times. Those in Italy and Slovenia immediately provide preventive systems such as electric fences, visual and acoustic devices. All teams operate on the basis of a shared protocol which constitutes the best practices to be followed over the Alps and ensure uniformity of approach, coordination and to solve problems. The main WPIU goals are to effectively assist breeders in the case of depredations, to prevent damages and to evaluate the efficacy of the prevention strategies adopted, while improving them by proposing *ad hoc* solutions. WPIUs are highly appreciated by farmers who now have concrete answers in situations of immediate need. A report on the results and effectiveness of WPIU and on the success of prevention strategies adopted is being produced.

¹ <https://www.centrograndicarnivori.it/progetti/progetto-lupo-piemonte>

² <https://dinalpbear.eu/en/>

³ <https://www.volkovi.si/?lang=en>

In particular, Life WolfAlps EU implemented activities in the four alpine countries of the project:

France

Most breeders in the French Alps willing to use prevention measures to protect livestock from wolf depredation were already doing so by the time the two French WPIU were established. The majority of breeders in the region is said to use some form of protection against depredation because compensation from losses due to wolves in the country is conditional - although there are exceptions - to the use of at least 2 out of 3 prevention methods: enclosure of livestock in electrified fences at night, use of livestock guarding dogs, and presence of a shepherd. Given the resulting widespread use of prevention methods in the French Alps, the French WPIU have focussed on trying to evaluate their efficacy in the field and to suggest improvements based most notably on observations of flock, dogs and wolf behaviour at night via thermal infrared imagery and GPS collars on sheep and dogs. Since the summer of 2021, the WPIU of the Office Français de la Biodiversité (OFB), composed of two full-time agents dedicated exclusively to this action, has performed 50 interventions in the field, each lasting between 3 to 5 days, and provided advice to 116 breeders on how to adjust their prevention systems. When possible, this has been achieved by showing images of how wolves actually behave when in proximity to the flock, leading to immediate, highly tailored advice that is then unlikely to be ignored. The initiative has been unanimously praised by the breeders who agreed to collaborate with the OFB WPIU, as well as by local authorities.

The breeders from Mercantour National Park (PNM) were the first in France to implement protective measures to protect their flock from depredation since the return of the wolf 30 years ago. All of them use at least 2 out of 3 prevention methods, as elsewhere in the French Alps, and most often all 3. The PNM WPIU used the same methodology as the OFB, but PNM has chosen to focus their action on the most attacked breeders in the national park, supporting them regularly throughout the pasture season. This approach has allowed us to evaluate the efficacy of the protective measures, to appreciate the difficulties specific to each grazing area and, according to our observations, to suggest recommendations to improve the preventive system in place. The breeders were then free to implement our recommendations. Our work highlights the need to work case by case, because the weak point of the preventive system can differ depending on pasture location, practices in use or experience of the breeder/shepherd. For one flock, failure to prevent an attack from wolves may be due to weakness in the composition and functioning of the pack of livestock guarding dogs, for another the enclosure might have been poorly electrified, and for yet another, a combination of several such factors might have been at work. However, no breeder has considered dispensing with preventive measures. All were satisfied with the assistance they received.

Perhaps the greatest testament to the overall positive impact of the WPIU in France is that it has been identified, in the framework of the forthcoming edition of the French National Action Plan on Wolves and Stock-rearing Activities (2024-2029), as an action to be pursued and funded beyond the LIFE WolfAlps EU project.

Austria

Austria is the last of the Alpine countries to be recolonized by wolves. In 2022, the first two wolf packs were detected in the Alps. Measures to prevent damage on alpine pastures are therefore only at the beginning of their implementation. However, the general willingness of farmers to change their management of alpine pastures is low. In this context, the first WPIUs were set up under Life WolfAlps EU to help farmers affected by wolf attacks. This assistance was highly appreciated, but it was just for short-term interventions, so comprehensive plans for a damage prevention system for the respective pastures and its implementation are still missing.

In addition to these project activities, the Province of Tyrol has launched damage prevention pilot projects outside of the LIFE program on three different alpine pastures (two started in 2021, one in 2022). Various measures are being tested, in particular protection by shepherds, shepherd dogs and night enclosures with electric fences. In one project also livestock guarding dogs have been used since 2023. Since 2022, there have been no attacks by wolves, although in the meanwhile they occur everywhere in the Alps (Land Tirol, 2022; Moser and Willems, 2022a; Moser and Willems, 2022b; Moser and Willems, 2023a; Moser and Willems, 2023b; Moser and Willems, 2023c).

Italy

Almost 600 interventions occurred during 2 years of WPIU interventions, with more than 430 shepherds and breeders having been contacted in the field and helped in defining the best prevention strategies. In addition, more than 200 breeders received prevention systems provided in a timely manner by the teams. WPIU interventions were addressed not only to professional, but also to "hobbyist" breeders (i.e., part-time breeders that have another, main profession - an important reality particularly in the plains and hilly areas of recent wolf recolonization), and also to help municipal administrations in managing local cases of wolves prowling near stables and villages. A specific study to explore LGD behaviour comparing their

association with cattle and sheep has been carried out in order to support breeders in the management of livestock guarding dogs.

Slovenia

In Slovenia, 7 WPIU units with 70 damage officials as operators are involved and ready to assist farmers in the field. From the start of the project, more than 230 field interventions were performed, assisting farmers with ready-to-use interventions kits, controlling the use of distributed equipment in the field and advising farmers on how to effectively protect their herds in different situations. The most challenging area in Slovenia is represented by the alpine region of Gorenjska and Upper Soča Valley, where traditionally some of the herds are grazing freely on the mountains from May to September. In these areas, wolves appeared in 2019, forming the first three packs after a long absence. The need to find solutions is high and the terrain specifics drive the conflict in areas, where farmers are not used to the presence of a predator. The aim of the project in such areas is to form best practice examples network to facilitate the transfer of damage prevention practices to a larger number of farmers.

Within the project, 14 sets of fences and 13 livestock guarding dogs (2 adults, 11 pups) were distributed to livestock breeders. The first examples of protecting young cattle were implemented at three farms and the use of the fladry system is being tested to broaden the list of possible solutions. An important step forward is also the collaboration with agricultural advisors and the Chamber of Agriculture and Forestry of Slovenia to find suitable solutions to a variety of specific needs and challenges.

Conclusions

The experience gained from the above-mentioned projects, together with other scientific publications on this topic (Espuno et al., 2004; Dalmaso et al., 2012; Reinhardt et al., 2012; Gervasi et al. 2021; Singer et al. 2022) is encouraging and shows that **it is possible to reduce the impact of wolf depredation to economically acceptable and socially tolerable levels**, through the appropriate adaptation of breeding systems and the correct adoption of preventive measures. The evidence available indicates that it is feasible to maintain traditional economic activities in tandem with long-term wolf conservation in the Alps.

Data collected within the projects show that in most alpine mountain **pastures it is possible to adopt strategies aimed at reducing the vulnerability of herds and flocks to wolf attacks. However, it is evident that case-by-case specific solutions must be defined in the field** alongside the breeders and shepherds involved, taking into consideration the different types of mountain pasture, orography, structures and infrastructures presence, management objectives and environmental characteristics. **One-size-fits-all does not exist, as some areas will demand more effort than others** to find the local appropriate solution and to help breeders to correctly use preventive methods. Changes due to the adoption of new livestock management and the appropriate use of the preventive systems require time and effort from breeders and should be supported by the long-term availability of field advice and adequate funding.

In particular, it is important to consider:

1. that **prevention tools** are actually mitigation tools, as they do not completely eliminate depredation (zero risk does not exist), but if properly applied, they allow damage to be reduced. The main prevention tools available are electric fences, LGDs, shepherding, as well as a combination of these methods. It is also indispensable to implement effective **livestock management**, so as to favour greater cohesion in the flock (as isolated animals are more vulnerable) and adequate management of births (timing and location). The

importance of introducing shepherds should be emphasised because their presence is fundamental for the applicability of the other tools (fences and dogs) and for the correct management of the grazing livestock. EU funds (EU Rural Development Program) are available to support their implementation. The downside of these funds is that close collaboration with farmers and regular controls are not ensured which results in limited efficiency of the distributed funds.

2. the necessity of **response teams composed by mediators/qualified experts (like WPIUs)** that intervene quickly so that breeders do not feel abandoned. This aspect should not be underestimated. Operators must work in the field in close contact with the breeders, maintaining a constant dialogue and helping them find local, case-by-case preventive solutions that need to be the result of an ongoing, participatory process.

3. the necessity **of evaluating the efficacy of prevention systems**, above all after a depredation event, to define the factors influencing success or failure (i.e. Was the system in place structurally or circumstantially not effective in preventing the attack? Why?). The correct use of prevention systems (LGDs, fences and other tools) should not be taken for granted since faulty fence installation or maintenance and/or poor LGD socialisation with the flock may reduce or nullify the protective role of the measure and lead farmers to distrust the effectiveness of prevention systems. It is therefore essential to check the conditions of use, especially in relation to the depredations suffered, and this should be done by qualified operators (like WPIUs). Obtaining objective information on the efficacy of preventive systems and the factors influencing it is decisive for improving their functioning and reducing the risks of inefficiency, as well as for promoting trust and awareness among breeders and technical staff.

Recommendations for improvement of protection interventions – Best practices

WISO platform working in the frame of Alpine Convention and Life WolfAlps EU project have grouped technical solutions into three main methods of protecting grazing animals (Berce et al., 2022):

(1) the use of electricity to surround a pasture to prevent large carnivores from reaching grazing animals, particularly at night;

(2) the use of livestock guarding dogs – dogs that are brought up within the herd and that are therefore bonded with animals they are protecting;

(3) the presence of shepherds guarding the herd/flock during the day and closing the animals into a night pen to protect them from predators.

(4) Regular control of the implemented prevention measures and close collaboration with farmers should be ensured.

Within each method, a range of approaches has been developed to be implemented on different terrains and considering the needs of protected grazing animals. As there are no uniform solutions, every case has to be adapted to suit specific circumstances.

Nevertheless, each method has a set of obligatory steps and procedures that need to be considered and all experts agree that the best solution for reducing attacks by large carnivores is to combine different protection measures.

ELECTRIC FENCES - They can be used to create a night enclosure, to provide permanent protection on the pasture or be used in a particular situation (presence of dense fog, heavy rainfall, etc.). Usually there are two types of electric fences, depending on the species to be enclosed: multi-wire electric fences and electric nettings. Main recommendations are:

- to ensure the constant presence of electricity - even if no animals are within the pen (otherwise, the fence should be laid on the ground) - to transmit electric shocks when predator touches the wires, with a voltage of minimum 3000 - 5000 V.
- to regularly check the proper installation (including regular removal of the vegetation that can be in contact with the fence and lead to loss of electrification) and to maintain the barrier in an optimal state.
- regardless the height of the fence, the lowest electrified wire has to be at maximum 20 cm above the solid ground along the circumference, in order to prevent animals from digging under the barrier.
- the grounding system has to be functional in all types of soil (including dry and rocky terrain) and therefore checked and maintained regularly.
- the shape of the fenced area has to be preferably oval or round to avoid sharp angles enabling the herd to circle within the perimeter of the fence and stay at distance from a visitor on the other side of the fence. If corners are present, frightened sheep tend to crowd together and tear down the fence, or become entangled and die of exhaustion and suffocation. The circumference of the fence must be large enough to allow the animals to move freely during panic reactions. An area of at least 5 m² per sheep is therefore recommended.
- increase the visibility of the fence (e.g. by placing dangling pieces of tape on the upper wire at least every 5 m, preferably in blue and white colour) to prevent the entanglement of wild animals into the fence.
- when the risk of attack is particularly high, a double electric fence is recommended. It is composed of 2 electric nets separated by a corridor of 1-2 m. In this way the flock stays at distance from the disturbance element, reducing the panic behaviour. Livestock guarding dogs that do not jump over fences can also be temporarily placed within the two fences if the pressure from wolves is particularly high.
- if possible, fences should be set up on flat instead of sloped ground to prevent large carnivores moving downhill from easily jumping over the fence.

LIVESTOCK GUARDING DOGS (LGDs) – Main recommendations are:

- the number of LGDs has to be adjusted in relation to the size of the flock, but also considering the habitat and the experience of the breeder in managing them.
- dogs need to be compatible with each other and work collectively when defending the herd. Constant assessments of dog behaviour should be conducted through visual observations or via other means (e.g., GPS collars), and the help of professionals should be solicited when required.
- female LGD in oestrus should not be kept with the flock to avoid attracting wolves and to prevent distracting conflict among LGDs.
- in general, LGDs can be used both for protecting small (sheep) and large (e.g. cattle) livestock.
- pure-bred guarding dogs ensure traceability of dogs' good features. However, there is no consensus on which dog breeds are more or less effective in protecting livestock. Dog personality might be of greater relevance.
- if possible, professional advice should be made available to breeders on how to acquire, raise, introduce to the herd, maintain and dispose of LGDs. All these steps can be challenging and need to be performed correctly if the dog is to be effective in protecting the flock.
- a strict education with constant corrections of the unwanted behaviour of the young dog is key for obtaining a reliable mature LGD.

SHEPHERDS – The shepherd's presence is the key for an efficient protection. In fact, in addition to checking what is happening in the field and intervening promptly in case of need, he or she can enable the use of other preventive tools (night enclosures, LGDs, ...). Main recommendations are:

- especially in remote Alpine areas, the presence of a shepherd is very important also during the day to prevent attacks.
- the most important task of the shepherd is to protect the animals during the night by enclosing them in a night pen.
- in regions where many small herds are roaming freely, the option of pooling herds from different farmers together should be considered.
- educational measures and the professionalisation of the shepherd profession is highly recommended in order to achieve enhanced (social and financial) appreciation and to reach a higher level of attractiveness.
- in order to encourage the presence of shepherds in the mountain pastures, local authorities should be involved in improving the infrastructure (roads, housing).

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