

Project

Protecting cattle from wolves in the Alps

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Introduction

The Alps are the highest, most extensive mountain range in central Europe, reaching a height above sea level of 4,808 m and a length of 1,200 km. They are shared by eight countries: France, Switzerland, Monaco, Italy, Liechtenstein, Austria, Germany and Slovenia (Fig. 1).

The grey wolf (*Canis lupus*) was eradicated from the Alps in the 1920s [1]. Wolves from the Italian Apennine population began recolonising the south-western Alps of Italy and France from 1992 (Fig. 2) and the Swiss Alps from 1995 [2]. In 2012, the first signs were documented of wolves naturally dispersing from the Apennine and Dinaric populations to the eastern Alps of Italy and Slovenia [3,4]. Today, wolves are regularly present in all Alpine countries except Monaco [5].

The return of the wolf to the Alps has repercussions for livestock farming, in particular the traditional activity of summer pasturing in the mountains (Fig. 3) [6,7]. This is especially the case where husbandry systems no longer include measures to protect livestock from wolves due to their long absence. The resulting impacts, in terms of both economic losses and psychological and social effects on breeders, who thus have attitudes of aversion and in-

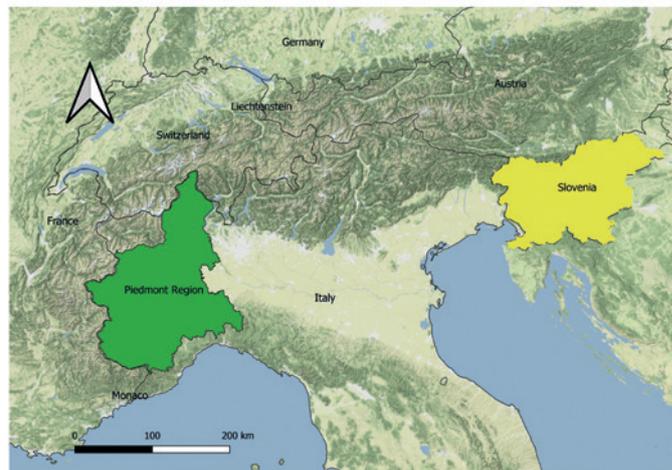


Fig. 1. The Alps showing project areas in Italy and Slovenia.

tolerance towards wolves, represents one of the concrete threats to wolf conservation in the Alps [8]. Reducing the impact of wolf depredation to economically acceptable and socially tolerable levels, through appropriate adaptation of breeding systems and correct adoption of prevention measures, is therefore a strategic priority in order to maintain and develop traditional economic activities in tandem with long-term wolf conservation in the region.





Fig. 2. A wolf in the SW Italian Alps in early spring (Photo: Andrea Avagnina).



Fig. 3. Sheep flock grazing in a typical high-altitude Alpine pasture (Photo: Arianna Menzano).

Although losses of livestock to wolves have mainly been of sheep and goats, depredation on cattle has become a growing issue in most of the Alps in recent years. During the period 2010–2019, annual cattle losses increased in France from 34 to 199, in Italy from 23 to 245 and in Slovenia from 25 to 60 [9]. This is problematic since the economic impact and compensation costs of damage to cattle are higher than those to sheep.

The LIFE WolfAlps (LWA) project implemented conservation actions in key areas of the Italian and Slovenian Alps in 2013–2018. A second project, LIFE WolfAlps EU¹ (LWA EU), is currently running with the goal of improving wolf–human coexistence across the Alpine region. One of this project’s actions aims to decrease negative impacts on livestock farming by implementing effective preventive measures in response to wolf attacks.

¹ <https://www.lifewolfalps.eu/en/>

The work presented in this article was implemented within the LWA and LWA EU projects in Slovenia and the Piedmont region of Italy (Fig. 1). We describe methods of protecting cattle; guidelines for removal of individual ‘problem wolves’; possible sources of finance for subsidising damage prevention measures and paying compensation; and the establishment of rapid response teams as a useful tool to support farmers in areas of wolf presence. Finally, we make recommendations for improvement of protection measures.

Project areas

Slovenia

Activities were implemented throughout Slovenia. The Dinaric and Alpine mountain regions, each with approximately 70% forest cover, have regular presence of wolves as well as brown bears (*Ursus arctos*) and Eurasian lynx (*Lynx lynx*) whereas the eastern part consists mainly of lowlands with sporadic occurrence of large carnivores in recent years. The main prey of wolves in the mountains are red deer (*Cervus elaphus*), roe deer (*Capreolus capreolus*) and wild boar (*Sus scrofa*). The spatial distribution of wolves expanded in 2018–2020 and packs were detected in the Slovenian Alps for the first time since the 19th century [10]. In 2020/21 the country was estimated to have a total of 106–147 individuals in 12 packs [4].

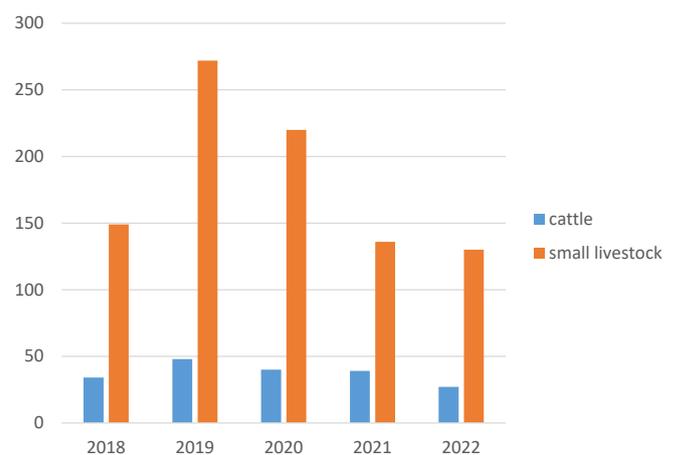


Fig. 4. Livestock damage events by wolves in Slovenia from 2018 to October 2022.

Slovenia has large areas of grassland and many family (hobby) farms with a tradition of livestock breeding. Cattle predominate (482,000 head in 2021) followed by poul-

try, pigs, small stock (145,000 head in 2021, 82 % of them sheep), horses and bees [11]. Dairy cattle (Fleckvieh, Holstein Friesian, Braunvieh) are more numerous than meat breeds (Limousin, Charolais, Belgian Blue) [12].

Wolf attacks on livestock most often target sheep and goats. Approximately 11 % of damage cases involve cattle, around 65–75 % of them calves less than one year old. According to field evaluations by Slovenia Forest Service (SFS) damage inspectors, calves up to three months of age are the most vulnerable. Wolf attacks on cattle increased until 2019, since when the number of cases per year has fallen (Fig. 4) [13].

Piedmont, Italy

The Piedmont region in northwest Italy has a highly varied landscape, from rugged peaks, high mountain meadows and forests of the Alps to plains dotted with farms and industrial companies. The main economic activities are agriculture, viticulture, rice-growing, animal husbandry, automotive, textile and food industries as well as financial services and tourism.

Cattle dominate the livestock sector, with 808,500 head at c.11,500 farms in 2022 taking advantage of the large availability of fodder and Alpine pastures. Around 165,000 cows are managed through extensive Alpine grazing from June to September, with only occasional surveillance and little use of protective measures. The most common breed in Alpine pastures is the Piedmontese, which is mainly kept for meat according to the ‘cow-calf’ system. Sheep and goats occupy a relatively marginal role associated with more fragile areas (hills and mountains) and less intensive farming.

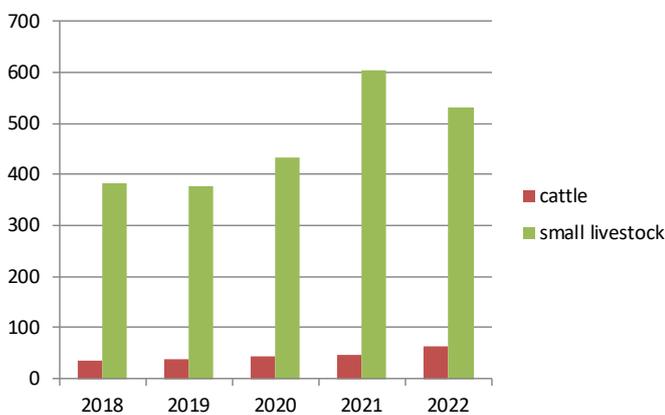


Fig. 5. Wolf damage to livestock reported in Piedmont in 2018–2022.

The wolf has been present in Piedmont for almost 20 years and can now be found in around 63% of the region. In 2020/21 there were estimated to be a minimum of 195 individuals in 33 packs and two pairs in an occupied range of c. 20,000 km² [3]. The main prey are wild ungulates, which are abundant throughout the region: roe deer and wild boar in lowland areas as well as red deer, chamois (*Rupicapra rupicapra*) and ibex (*Capra ibex*) in mountain areas.

Livestock damage caused by wolves, mostly to small stock, has increased in recent years. Attacks on cattle, although much less frequent than those on sheep, almost doubled from 2018 to 2022 (Fig. 5). According to data from the public veterinary system, depredations of cattle in the last two years were mainly of calves less than one month old (34%), 1–4 months old (27%) or 4–12 months old (21%), with animals more than one year old accounting for 18% of cases (Fig. 6).

■ <1 month ■ 1-4 months ■ 4-12 months ■ >12 months

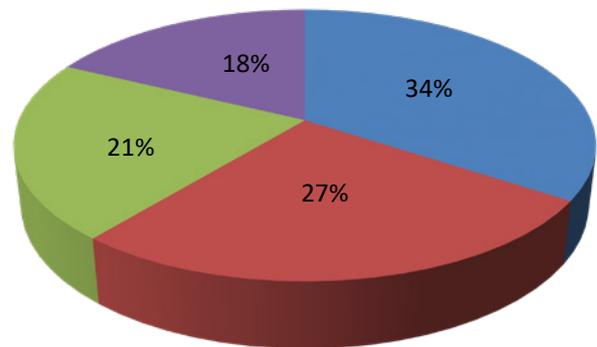


Fig. 6. Age classes of cattle depredated by wolves in 2021–2022.

Damage prevention measures

Protecting livestock from attack is widely regarded as one of the main strategies to enable coexistence of wolves with human communities. Most cattle breeders use single current-carrying wires to delimit grazing areas. However, such simple fences clearly cannot prevent wolves from entering and in many cases they allow calves to exit by passing underneath, thereby becoming more vulnerable to predation. Animals are most at risk when isolated, as they cannot benefit from herd protection. Scenarios with a heightened level of risk include:

- a) females leaving the herd for parturition (both mother and new-born may be at risk);

- b) young calves left alone lying/hiding in the grass while their mothers feeding (calves up to 3–4 months of age or until they are able to follow their mothers – primiparous cows in particular may leave their calves unattended for long periods of time);
- c) injured or sick animals of any age have difficulty following the herd or defending themselves if attacked.

Damage prevention strategies developed for small stock are not always suitable for cattle, particularly where farmers do not attend their animals on a daily basis. Nevertheless, good examples of solutions adapted to fit specific characteristics of cattle management are available:

- Livestock guarding dogs (LGDs) in Portugal, Spain, Turkey and North America [14–17];
- Fixed or mobile physical barriers in Italy, Portugal and Spain [16,18,19];
- Fladry and electrified fladry ('turbo fladry') in North America [20,21];
- Other possible tools include acoustic devices to scare off predators [22–25].

There are no universal solutions and each case should be carefully evaluated in order to define ad hoc prevention strategies designed to fit the local circumstances taking into account husbandry, environmental context, age of livestock and farm finances.

Slovenia

Interested livestock farmers in 'hot-spots' of persistent wolf damage were invited to participate in testing possible solutions within the [LWA EU²](https://www.lifewolfalps.eu/en/axes-of-intervention/prevenzione/) project and other projects (such as [Carnivora Dinarica³](https://www.dinapivka.si/en/project/project-carnivora-dinarica/)). So far, five cattle breeders have improved their fencing, opting for high electric netting or fixed multi-wire electric fences.

For efficient implementation of prevention measures it is crucial to ensure strong collaboration among experts and farmers. This means that farmers have to be able to receive expert advice any time they need it. In addition, electric fencing should be checked regularly (more often than once per year) and, in case of improper use, instructions provided on how to improve the system.

Electrified nets: In Slovenia, high electric netting with

at least 5 kV is recommended for protection of livestock from large carnivores. It can be 170 cm high or, alternatively, 145 cm netting is used with an electric tape above it at a height of 160–170 cm (Fig. 7). Such fences have



Fig. 7. Suckler cows with calves protected by 145 cm high electric netting topped with an electric tape at a height of 160 cm (Photo: Tomaž Berce).

proven effective at protecting sheep and other grazing animals. The main downside is the extra workload for farmers associated with gathering their animals into night pens, releasing them in the morning and frequent relocations of the mobile fencing.

Multi-wire electric fences: To protect larger pastures, some breeders agreed to try fixed electric fences with six wires and a total height of approximately 150 cm (Fig. 8).



Fig. 8. Horses and cattle protected with a 150 cm high, 6-wire electric fence (Photo: Tine Gotar).

A crucial element of this approach is the farmers' commitment to take down the fencing at the end of the sum-

² <https://www.lifewolfalps.eu/en/axes-of-intervention/prevenzione/>

³ <https://www.dinapivka.si/en/project/project-carnivora-dinarica/>

mer grazing season. This is to enable free passage of wild animals and, most importantly, to avoid predators getting used to the fences when electricity is not switched on. There are two alternative approaches: either to remove the wires from the fence and place them on the ground or, if removable posts are used, to lay the entire fence on the ground (Fig. 9).



Fig. 9. Electric fence with removable posts lain flat on the ground at the end of the grazing season (Photo: Tine Gotar).

Removal of problem wolves: Based on the need for an efficient response to repeated attacks on cattle, guidelines for removal of ‘problem wolves’ were agreed in 2020 between decision-makers and stakeholders including the Chamber of Agriculture and Forestry of Slovenia. The threshold for intervention was set at three attacks on cattle, horses or donkeys (or at least nine on small stock) by the same wolf/wolves during a three-month period. In this context, the type of preventive measures used is not relevant. Following approval of a permit by the Ministry of Environment and Spatial Planning (MESP), the SFS defines the rules of engagement, which typically specify that removal has to be carried out where the problems occurred. Up to 2022 a total of six permits for removal of 11 problem wolves (1–2 individuals per permit) were issued after damage to cattle, horses or donkeys. As the rules of engagement are very strict in order to achieve the best possible results in the field, only four of the 11 targeted individuals were actually removed. Another downside of this measure is that it usually takes approximately 2–3 months from initial proposal to formal confirmation of permission.

Piedmont, Italy

To minimise the risk of depredation, we suggest a combination of changes to livestock management together with other measures such as electric fencing, LGDs, acoustic and visual deterrents. We selected cattle farmers to test various options within the LWA project on the basis of their availability, established relationship with project staff and high risk of wolf attack. In addition, general recommendations for adaptations of management strategies to reduce damage risk were given to farmers both within the LWA project and on other occasions.

Management strategies:

- synchronisation of births and avoiding calving during summer grazing;
- avoid taking calves younger than 3–4 months to pasture, otherwise protect them with electric fencing or in steel cages (Fig. 10);
- prevent cows, especially those at the end of pregnancy, from using areas most at risk of depredation and keep them under observation;
- provide more water points so cattle do not disperse over long distances;
- avoid removing horns, which breeders have reported to be an effective defence tool [26].

Active herding: The presence of a shepherd acts to deter wolves from approaching livestock and also permits the implementation of other damage prevention measures such as livestock guarding dogs and night pens [27].

Electric fences: Most cattle farmers use mobile electric fences rather than permanent structures. To deter large carnivores, the voltage must be at least 5 kV with an energiser providing 2–3 J. Farmers should check their fences regularly (at least once a week) to maintain functionality. It is best to avoid fencing large areas in which livestock can disperse and so become more vulnerable to predators. Within the LWA project, 14 livestock breeders in the Maritime Alps Natural Park tested 3-wire electric fences (wires at 30, 60 and 90 cm from the ground) to contain livestock at night and during bad weather (Fig. 11). Although wolves can easily pass under the lowest wire, we expect such fences to have a beneficial effect by preventing calves from leaving their mother’s protection.



Fig. 10. A steel cage (1.9 × 1.9 m) to protect young calves in pasture (Photo: Arianna Menzano).

Electrified nets: Although rarely used for adult cattle, 100–145 cm high netting is sometimes used to enclose new-born calves and protect them during the first weeks of life while their mothers are grazing. We suggested this option to all breeders with livestock grazing in the LWA project area but only 15 (4.8%) of them agreed because most of them prefer to keep the whole herd together. None of the calves protected with electrified nets was predated during the project.

Livestock guarding dogs: The use of LGDs is increasing in Piedmont in part due to aid available to maintain them. Experience of socialising LGDs with sheep is widespread but many farmers still have difficulties achieving this with cattle. As part of the LWA project, eight 4–7 months old Pastore Maremmano Abruzzese pups from working lines, already socialised with cattle, were given to five breeders. To create a bond between dog and cattle at the new farm, pups were initially kept with young calves in a



Fig. 12. An Abruzzese LGD pup with calves in a stable (Photo: Arianna Menzano).



Fig. 11. A 3-wire electric fence to protect cattle (Photo: Davide Sigauo).

stable (Fig. 12). Later, LGDs were put with cattle in a fenced pasture [28]. A second activity within the LWA project was to evaluate the efficiency of LGDs protecting cattle (Fig. 13). Nineteen dogs bought and raised by farmers themselves were included in the study. Preliminary results suggested that the dogs were attentive to cattle, tending to stay with them even at night and despite not being contained within fences [29]. However, complaints from tourists frightened by the dogs led to farmers preferring to keep them tied up near the pasture or mountain hut during the daytime and release them in the evening, thereby compromising the ability of dogs to protect livestock from wolves. More in-depth studies are underway within the LWA EU project.

Visual deterrents: Twenty breeders whose cattle grazed in areas of wolf presence tested the use of fladry (mostly turbo fladry) to deter wolves [20,28]. Fladry lines consisted of 50 × 10 cm red flags suspended at 50-cm intervals from a fence wire 90 cm above the ground (Fig. 14). In eight cases this was the highest of a 3-wire electric fence (described above); in two cases the top of a 2-wire electric fence was used; in nine cases there was only one electrified wire and in one case fladry flags were suspended from a single non-electrified wire. In 15 cases, the main goal was to evaluate the compatibility of fladry with cattle management and assess the workload needed to instal and maintain it. In the remaining five cases, fladry was used as an emergency measure following depredation. No cattle were attacked while fladry was in place.

Acoustic deterrents: Twenty cattle breeders tested acoustic devices which emit pre-recorded sounds, either



Fig. 13. Abruzzese adult protecting a herd (Photo: Arianna Menzano).

at programmed intervals or by photocell activation. Four breeders wanted to use acoustic and visual deterrents concurrently (Fig. 14). So as not to disturb LGDs, we generally recorded the voice of the shepherd. One device per herd was activated at 30-minute intervals from dusk to dawn for a period of 5–7 days (to avoid predators habituating to the sounds). They were positioned close to the herd, which was gathered into a restricted area, in such a way that the emitted sounds could be heard over long



Fig. 14. Use of fladry and acoustic device to protect a herd (Photo: Massimo Sciandra).

distances. Farmers checked their functioning (no maintenance was required). In 14 cases there was no imminent risk of wolf attack and the goal was to evaluate the compatibility of this tool with cattle management. However, in the other six acoustic deterrents were implemented following depredations. No cattle were attacked during the trials and no negative aspects of the devices were reported by shepherds [28].

Sources of finance

Slovenia

Compensation: The MESP compensates damage to livestock by large carnivores based on market value. Veterinary costs to treat injured animals are reimbursed. Indirect costs (e.g. lost milk production) or missing animals are not compensated.

Preventive measures: Livestock breeders can obtain subsidies within the EU Rural Development Programme (RDP) for the extra workload to set up, move and maintain enclosures with high electric netting (€119.90/ha), to take care of at least three LGDs (€112.60/ha) and to employ shepherds to protect animals by guiding them into a night enclosure (€107.60/ha). Co-financing (80%) for the purchase of equipment to instal high electric netting is avail-



Fig. 15. Italian WPIU supporting a farmer in the field (Photo: Arianna Menzano).

able from the MESP to farmers who experience damage by large carnivores. The SFS has been involved in many projects regarding damage prevention measures and since 2011 has donated 80 sets of high electric fences to farmers, mainly for sheep protection.

Piedmont, Italy

Compensation: Piedmont regional programmes 1 and 3 for livestock breeders compensate damage caused by large carnivores. Reimbursement covers 100% of the commercial value of killed or lost animals and indirect costs including veterinary and pharmaceutical expenses for injured animals, removal and disposal of carcasses and lost production.

Preventive measures: The 2014–2020 RDP (Operation 10.1.6 ‘Defence of livestock from depredation by canids on hill and mountain pastures’) provides area-based flat

rate payments of €50/ha/year with a 5-year commitment for mobile electric fences, LGDs and constant human presence during grazing. Subsidies cover the workload to set up, move and maintain fences, care of LGDs and constant human presence. Breeders must implement all three measures to access subsidies. Breeders who do not meet the RDP criteria can apply to Piedmont regional programme 2, which also supports the costs of damage prevention measures.

Rapid response teams

Farmers’ negative attitudes towards wolf presence are often compounded by two main factors: lack of damage prevention measures and lack of timely, effective assistance from local authorities [30,31]. Experience from other projects such as Progetto Lupo Piemonte⁴, LIFE DinAlp

⁴ <https://www.centrograndicarnivori.it/progetti/progetto-lupo-piemonte>

Bear⁵ and LIFE SloWolf⁶ has shown that the presence of project staff to assist farmers in using prevention systems and taking prompt action in case of attacks is fundamental so that livestock breeders do not feel abandoned. Within the LWA EU project we created a new ‘first aid’ approach to facilitate direct and immediate contact with breeders who suffer damage or graze livestock in areas of recent wolf recolonisation. Multidisciplinary staff of Wolf Prevention Intervention Units (WPIU) give farmers ad hoc advice and support to improve prevention strategies based on best practice; administrative assistance; information on how to access compensation and subsidies; and mediation through active listening (Fig. 15).

Beginning in 2021, WPIUs have been established in each country of the project (Italy, Slovenia, Austria and France⁷) and there are now a total of around 400 operators in 42 units. During their first year they intervened more than 600 times. They are mostly composed of local public administration staff in order to guarantee their continued operation beyond the end of the project. Those in Italy and Slovenia provide preventive systems such as electric fences, visual and acoustic devices.

Conclusions and recommendations

As both Slovenia and Piedmont face regular and increasing depredation by wolves on cattle, finding long-term solutions is crucial to prevent further damage to livestock and opposition to wolf conservation. Various options are available to protect livestock from large carnivores, but it takes time for farmers to become familiar with the methods, gain trust in their effectiveness and adopt innovative solutions. A key element in this process is to provide technical support so that farmers do not feel alone in dealing with problems related to wolf recovery. Collaboration and exchange of experience between experts and farmers within countries and on an international level are very important in finding good solutions quickly.

Calves are at higher risk of attack by wolves. It is therefore important to encourage farmers to implement a

schedule that avoids calving during extensive grazing or adequately protects mothers during calving and in the first few months of calves’ lives.

The use of electric fences, both to enclose larger grazing areas and to isolate animals in vulnerable stages, is one of the most common and effective ways of preventing wolf attacks. Correct implementation and adequate maintenance are key to achieving successful results as only fully functional measures can ensure security for livestock. Regular visits by professional advisors such as damage inspectors are therefore crucial to check proper fence installation.

To support the use of livestock guarding dogs (LGDs) to protect cattle, there is a need to raise awareness among breeders of the importance of proper pup selection and socialisation in order to create a strong bond with livestock and to avoid aggression towards people. It is also important to develop specific awareness campaigns for other mountain users with information on how to behave in the presence of LGDs. In addition, clear and solid legal bases, including better legal protection for owners, are needed at the country level to encourage the use of LGDs. In Slovenia, LGDs are now defined as working dogs (like police and military dogs), which is an important step. However, since current legislation requires them to be kept in pastures with electric fencing they cannot be used in free-grazing Alpine pastures.

Acoustic deterrents may be beneficial in protecting livestock for short periods (5–7 days) of heightened risk (e.g. calving away from secure areas) or in emergency situations to prevent further attacks before other measures can be implemented. They are not suitable for routine prevention as predators are likely to habituate to them. As reported in the literature [23–25,32], visual deterrents can provide protection for longer periods (90 days or more), especially in the case of turbo fladry.

If particular problem wolves persist in attacking livestock, causing repeated and ongoing damage, removal of the implicated individuals should be considered to prevent further losses and potential escalation of conflicts.

⁵ <https://dinalpbear.eu/en/>

⁶ <https://www.volkovi.si/?lang=en>

⁷ <https://lifewolfalps.eu/prevenzione-degli-attacchi-da-lupo-esempi-dai-territori-di-recente-ricolonizzazione/>

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