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# Preventing large carnivore depredation: revitalising a traditional non-lethal method in Slovakia

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**Abstract.** Livestock guarding dogs have been used in Eurasia for millennia to protect domesticated animals from wild predators, stray or feral dogs and human thieves. The tradition was largely abandoned in Slovakia in the first half of the 20th century due to socio-economic changes and/or low levels of losses after large carnivores were virtually extirpated. By the late 20th century wolf, bear and lynx populations had recovered and predation on livestock increased. The overall level of losses is, however, still low: wolves and lynx reportedly killed 353 head of livestock in 1999, causing c.• 11,200 worth of damage; compensation paid for sheep, goats and cattle "damaged" by bears totalled c.• 11,900 in 1999. Nevertheless livestock depredation is frequently given as justification for killing large carnivores. The Protection of Livestock and Conservation of Large Carnivores project, launched in spring 2000, aims to revitalise the traditional system of raising livestock guarding dogs. Fourteen pups were bought in 2001 and raised with sheep in the Liptov, Turiec, Kysuce and Zemplín regions. Behavioural observations began to test whether two selected breeds (Slovenský čuvač and Caucasian shepherd dog) possessed the key traits of trustworthiness, attentiveness and protectiveness regarded as necessary for successful livestock guarding dogs; scat analyses will estimate the proportion of livestock in the diet of wolves and bears in the Western Carpathians.

*Key words: Canis lupus, depredation, livestock guarding dogs, Lynx lynx, preventive measures, Ursus arctos*

## Introduction

*Overview of large carnivore – livestock conflicts*

*"The Slovak Wolf Record ... Nobody remembers such a great massacre in our country ... a wolf rips and bites everything ... they are beasts: not only do they grab a sheep by the throat to suffocate it a little and bleed it a little, but they also like to bite the udder ... if a hunter doesn't succeed to find the wolf den ... we will certainly record further damage in the future."* (Kubínyi 2000).

Such views are quite typical amongst the rural community in Slovakia, even though the overall level of livestock losses to predators is low. In 1997, wolves (*Canis lupus*) were reported as having killed 191 sheep, 40 cattle and 3 goats; brown bears (*Ursus arctos*) killed 395 sheep, 9 cattle and 7 goats and lynx (*Lynx lynx*) killed just 5 sheep (Hell and Slamečka 1999). Wolves and (in a handful of cases) lynx killed, according to hunting statistics, 353 head of livestock in 1999, costing c.• 11,200 in damage, none of which was compensated, as the state only pays for damage by bears (Hell *et al.* 2001). Compensation paid in the Slovak Republic for sheep, goats and cattle "damaged" by bears totalled c.• 9,800 in 1998, c.• 11,900 in 1999 and c.• 10,100 in 2000 (Kassa 2001).

Although the numbers of livestock killed and injured by large carnivores are small on a national economic scale, they can be significant for individual concerns (Rigg and Finďo 2000). The largest reported loss during a single attack in 2000 was of 22 sheep, worth together c.• 2,500 (Rigg 2001a). The same farm lost c.40 sheep in a single wolf attack in 2001. Although shepherds do not usually have guns, after attacks on livestock permission can be sought for hunters to shoot large carnivores. In addition, sensationalist reports in the popular press (such as the article quoted above, which appeared in a widely-read weekly TV listings magazine) exaggerate the problem and give the false impression that wolves are rampaging through the countryside devastating herds. Large carnivore depredation on livestock is a minor problem in Slovakia. Working with individual farms to protect their animals more effectively may be a useful strategy to alleviate grievances held against large carnivores and hence reduce their persecution.

Preparation for an initiative to renovate the traditional use of livestock guarding dogs (LGDs) began in 1998 (building on pilot work in the mid 1990s) and in spring 2000 the Protection of Livestock and Conservation of Large Carnivores (PLCLC) project was launched. In its first year a total of 8 LGD pups were trained in the Pohronie region of central Slovakia. The project expanded in both size and range in 2001 with funding for an additional 22 Slovenský čuvač and Caucasian shepherd dog pedigree or pure-bred pups in northern, central and eastern Slovakia. This report deals with the 14 dogs placed in the Kysuce, Turiec,Liptov and Zemplín regions (Fig. 2).

*Project goals*

The PLCLC project aims to fund, field test and implement non-lethal methods of protecting livestock from wolves and bears in Slovakia. The initial goals of this project are:

1. Evaluate the suitability of livestock guarding dogs to prevent attacks by wolves and bears so


**Fig. 1.** Map of Central Europe showing Slovakia and the Carpathian mountains.

as to try and ease the anti-wolf/predator feeling that currently exists. This will also reduce the need for defence kills and address the animal welfare concerns of the current system of using permanently chained, untrained dogs;

2. Through educational presentations, primarily to National Park staff, farmers and shepherds, dog breeders and forestry students, explain the new methods being tested to ease carnivore-human conflict and begin to generate a more compassionate understanding of large predators and their role within the Western Carpathian ecosystem.

Within this project, work on the study described in this report – "The Use of Livestock Guarding Dogs to Protect Sheep and Goats from Large Carnivores in Slovakia " – began in January 2001 and will continue until the end of 2003. It aims to:

1. analyse the current situation regarding large carnivore depredation on livestock;
2. conduct a study of the food habits of bears and wolves in the Western Carpathians;
3. observe the development of 14 pups from two livestock guarding dog breeds and assess their ability, as yearlings, to protect a flock of sheep from predators;
4. from the results of points 1-3, draw preliminary conclusions regarding the feasibility and likely effectiveness of using dogs from sources currently available in Slovakia to protect sheep and goats against wolves and bears.

*Study area*

The majority of Slovakia's uplands are part of the Western Carpathian mountains and, at the same time, the largest portion of the Western Carpathians are in Slovakia (see Fig. 1). Relief across the country varies from wetlands at 94m a.s.l. to high mountains with a highest peak of 2,654m a.s.l. Large carnivores and traditional livestock herding occur mostly in the uplands of northwest, central, north and east Slovakia in Kysuce, Turiec, Orava, Liptov, Nízke Tatry, Podpoľana, Pohronie, Spiš, Gemer, Šariš and Zemplín regions. Livestock grazing areas studied in this report lie principally within or near the following larger protected areas: Tatranský (Tatras) National Park (NP), Nízke Tatry (Low Tatras) NP, Malá Fatra NP, Muránska Planina NP, Poloniny NP, Veľká Fatra Protected Landscape Area (PLA), Horná Orava PLA, Poľana PLA and Kysuce PLA. The most common tree species in Slovakia are beech (*Fagus sylvatica*), spruce (*Picea abies*), oak (*Quercus* spp.), pine (*Pinus sylvestris*), hornbeam (*Carpinus betulus*) and fir (*Abies alba*). The main wild ungulate species are red deer (*Cervus elaphus*), roe deer (*Capreolus capreolus*) and wild boar (*Sus scrofa*) and the three species of large carnivore present are the wolf, brown bear and lynx.

## Livestock husbandry

The farms dealt with in this report mostly operate on the principle of transhumance. In spring sheep are collected into flocks typically numbering 150-700 or occasionally 700-1,000 animals, often with a few goats, and taken by seasonally or permanently employed shepherds to graze on pastures in valleys,

foothills and, in some areas or at particular times, on alpine or sub-alpine meadows, until the onset of winter. Flocks may belong to one owner or a collective, private or state-owned. Usually one shepherd with one or two small herding dogs attends the flock all day. In the evening the flock is brought into a seasonal camp called a salaš on or near the pastures and either gathered inside a moveable fold for the night with untrained dogs chained to posts and/or trees around it or, less typically, left un-penned with dogs chained around. Some shepherds generally sleep in a trailer or caravan (maringotka) nearby. In addition to being milked in the morning and evening, many flocks are also brought back to camp once during the day for milking. The milk is used to make a variety of cheeses in a wooden cabin called the koliba (Rigg 1999, 2001a,b,c).

At one camp between Nízke Tatry NP and Muránska Planina NP observed from 30th June to 4th July 2000, which had three shepherds, 2 chained guarding dogs, one chained and two free herding dogs, two free pups (one herding, one untrained LGD) and one two-month old LGD pup being socialised with lambs in a training enclosure, the following was the typical daily routine in taking care of c.380 sheep and goats:

05:00 Shepherds get up and immediately begin milking; dogs wake and bark.
06:30 Milking finishes; the flock lies under trees at the forest edge behind the milking pens.
07:00 One shepherd with herding dogs begins to take the flock out to pasture; the remaining shepherds stay in camp to make cheese.
11:30 The flock is brought back into camp and rests under trees.
13:30 The flock is rounded up for milking. Two shepherds milk while the third pushes (with herding dogs, a stick, whip or boot) the sheep and goats forward towards the milking pens. The herding dog pup joins in while the chained herding dog barks throughout.
14:30 Milking finishes; the flock grazes/browses near the camp.
15:15 One shepherd rounds up the flock with the two herding dogs and drives it out to pasture.
18:15 The flock is brought back to camp.
19:15 The flock moves itself to the milking pens in response to whistles and shouts from the shepherds standing in front of the koliba.
20:15 Milking finishes.
20:30 The flock is rounded up into a pen made of separate sections of metal fencing; the two chained guard dogs are moved nearer for the night (the shepherds began doing this after losing a sheep to a wolf two days earlier).
21:45 The shepherds go to bed in their maringotka, c.30 m from the flock.

Operations at many camps are often somewhat loosely managed, with carcasses left to rot in close proximity to live animals, on pastures or even in the camp itself. Camps and their flocks usually move to fresh pastures through the season. Livestock is kept in or near the village and/or in barns during the winter.

The basis of this husbandry system of intensive utilisation of mountain pastures came to Slovakia from the Balkans and Romania with the Walachian colonisation, in the 13th and 14th centuries through to the 18th and 19th centuries (Laurinčík *et al.* 1958, Podolák 1982, Stoličná 1997, Zuskinová 1999). Grazing on alpine meadows is now restricted in the Západné, Belianské and Nízke Tatry mountains, where timberlines have been substantially lowered and the quality of grazing adversely affected (Jamnický 2000), but exceptions are sometimes granted for limited periods in parts of Nízke Tatry and livestock in other areas (e.g. Veľká Fatra) is still regularly grazed on meadows above the timber line, though some heavily eroded areas are closed and further limitation of grazing is possible in the future in the interests of nature protection.

It is the stated aim of the current government of the Slovak Republic to join the European Union as soon as possible. The traditional transhumance system of grazing sheep and milking them by hand to produce a variety of dairy products, already under threat due to the factors mentioned above as well as a shortage of workers willing to spend such long periods of time away from home on long hours of hard manual labour (with alcoholism widespread amongst those who are) is likely to be further eroded – if not completely eradicated – as legislation is changed to bring Slovak law into line with the EU's. Indeed, the results of this process are already being felt as, for example, regional branches of the Ministry of Agriculture appear less willing to issue permission for the traditional *salaš* and EU officials deliberate over which country they will "allow" to sell soft sheep's cheese called *bryndza*, an essential ingredient in Slovakia's national dish (*bryndzove halušky*). For the time being it seems the EU will not insist on pasteurisation, which had threatened to cause the closure of operations unable to afford the necessary changes. Other forms of husbandry, such as the use of automatated milking machines or keeping sheep mainly for meat rather than milk, may grow at the expense of the traditional systems.

## Large carnivores and depredation on livestock

### Wolf (*Canis lupus*)

*Numbers, range and legal status*

The wolf naturally recovered in Slovakia from near extirpation in the 1950-70s (reviewed in Voskár 1993; Rigg 1998; Rigg and Finďo 1999, 2000; Hell *et al.* 2001). Population estimates currently vary from 140 individuals in March 2000 and 2001 (J. Lukáč pers. comm. 2001) to a spring population of 1,281 quoted in hunting statistics compiled for the year 2000; density estimates from tracking suggest the actual population number is likely to be at the lower end of this range. The wolf hunting season is currently open from 1st November to 15th January, with no bag limit

(Lehocký *et al.* 2001). There are wolves present in all regions where livestock guarding dogs have been located during this study (see Fig. 2 for distribution).

*Diet*

Brtek and Voskár (1987) reported that stray dogs (7.9%) were a more frequent food item than sheep (3.7%) in 161 scats collected in 1976-83. Their findings have not been confirmed by an analysis of 353 wolf scats collected from 15 mountain ranges across a wide area of central and eastern Slovakia in 1992-2000, which found that domestic animals formed an insignificant portion (0.8% occurrence for sheep, 0.3% cattle and 0.3% domestic dog) of the wolf's diet (Kolenka 1997; Rigg and Finďo 2000; Strnádová 2000). Red deer *Cervus elaphus* and roe deer *Capreolus capreolus* were the most frequent prey species (70.4% for *Cervidae* combined, though the majority would have been red deer), followed by wild boar *Sus scrofa* (22.1%, more in winter).

*Attacks on livestock*

Voskár (1993) reported a total of 1,070 sheep (1,468,000 Sk or c.• 36,700 damage) in 153 separate attacks and 28 heifers (254,000 Sk or c.• 6,400) in 6 attacks killed by wolves in the period from 1979 to 1989. In 1997, wolves were reported as having killed 191 sheep, 40 cattle and 3 goats (Hell *et al.* 1997; Hell and Slamečka 1999). Wolves (lynx in a handful of cases) killed, according to hunting statistics, 353 head of livestock in 1999, causing 447,500 Sk (c.• 11,200) worth of damage (Hell *et al.* 2001). Damage by wolves is not compensated and therefore often not documented (Rigg and Finďo 2000).

Attacks often occur on animals in the fold but are also reported to occur during the daytime, when the flock is out of camp, away from chained LGDs and usually attended by just one shepherd with one or two small mongrel herding dogs. In 2000 at 21 flocks with a total of c. 9,150 sheep and goats (average 436 per flock), wolves killed 16 sheep in 8 daytime attacks (average 2.0) on grazing animals and 51 sheep in 9 attacks (average 5.7 or, if an exceptional case of 22 sheep killed at one time is excluded, 3.6) on animals in the fold at night (after Finďo 2000). These results should not be taken as a representative sample, however, as this study aimed to document and describe attacks leading to losses, not to estimate levels of attacks or losses.

There is some anecdotal evidence that weather conditions influence the occurrence of attacks. The 22 sheep mentioned above, for example, were killed by wolves at night in fog and rain at the end of July (Rigg 2001a). The shepherd reported that 11 were killed and 11 injured (later died) outside the fold, having broken out in panic (Kubínyi 2000). In 2001, wolves killed or seriously injured c.40 sheep at the same location in the same month, again during a night-time thunderstorm (Rigg 2001c). The occurrence of vegetation cover on pastures and the proximity of a grazing flock to the forest edge also seem to be important factors, as well as the vigilance of accompanying shepherds. Sixteen sheep and 7 goats were killed by wolves on 26th June 1999 when the flock was allowed to scatter into the forest (S. Ondruš pers. comm. 2000). On 30th June 2000 a wolf killed one ewe between 9 and 10 am when the shepherd briefly left his flock to go to the toilet. He claimed to have then driven the wolf off, after considerable effort on both his part in shouting and cracking his whip and on the part of the wolf, which he described repeatedly circling round in an attempt to attack from different sides of the flock. This shepherd and others reported seeing wolves observing their flocks from the cover of bushes or at the forest edge, sometimes for long periods.

It should be noted that both shepherds and owners are prone to exaggerate, report inaccurately and even invent (Hell and Slamečka 1999) accounts of predation. For example, on 21st June 2000 shepherds in the Horehron region said that wolves had killed a sheep at a neighbouring flock the day before, but the shepherds working at that flock stated that they had had no problems with predators since a wolf grabbed a sheep on the first day of herding, three weeks earlier. The owner of the first flock stated at the beginning of the 2000 season that he lost around 20 sheep every year, 5 or 6 at a time, but only minor losses occurred in 2000.

Attacks can occur throughout the grazing season, which lasts from April/May until November, depending on the weather and location, though wolf attacks are often said to increase during pup raising in July and August. Voskár (1993) reported wolf attacks on sheep within corrals every month from April to October inclusive (total of 131 attacks, 850 animals killed, mean 6.5 per attack, in the period 1979-89) on pastures from May to November (20, 174, 8.7) and in farmyards in November (2, 46, 23.0).

## Brown bear (*Ursus arctos*)

*Numbers, range and legal status*

Estimates for the population size in 1999-2000 were generally between 550 and 850 (Hell and Slamečka 1999; Finďo 2000; E. Baláž pers. comm. 2001); there is good evidence to suggest that the real population number is at the upper end of this range (Baláž 2002). Official hunting statistics for the 2000 season quoted a figure of 1,467 (Lehocký *et al.* 2001). Bears can only be shot with permission (or "exceptions") granted by the Ministry of the Environment and Ministry of Agriculture (Hell and Slamečka 1999). There are bears present in all regions where livestock guarding dogs have been located during this study, but they are less common in Kysuce and Zemplín (see Fig. 2 for distribution).

*Diet*

A detailed analysis of scats from the Vysoké, Západné and Nízke Tatry by Jamnický (1988 reviewed in Hell and Slamečka 1999) showed that livestock are an unimportant part of the diet of most bears; preliminary results of a scat analysis in Poľana and Západné Tatry and direct observation of bears in Západné Tatry (E. Baláž pers. comm. 2001; Baláž 2002) indicate the same for these areas.

As part of this study on livestock guarding dogs, bear scats are being collected in mountain ranges

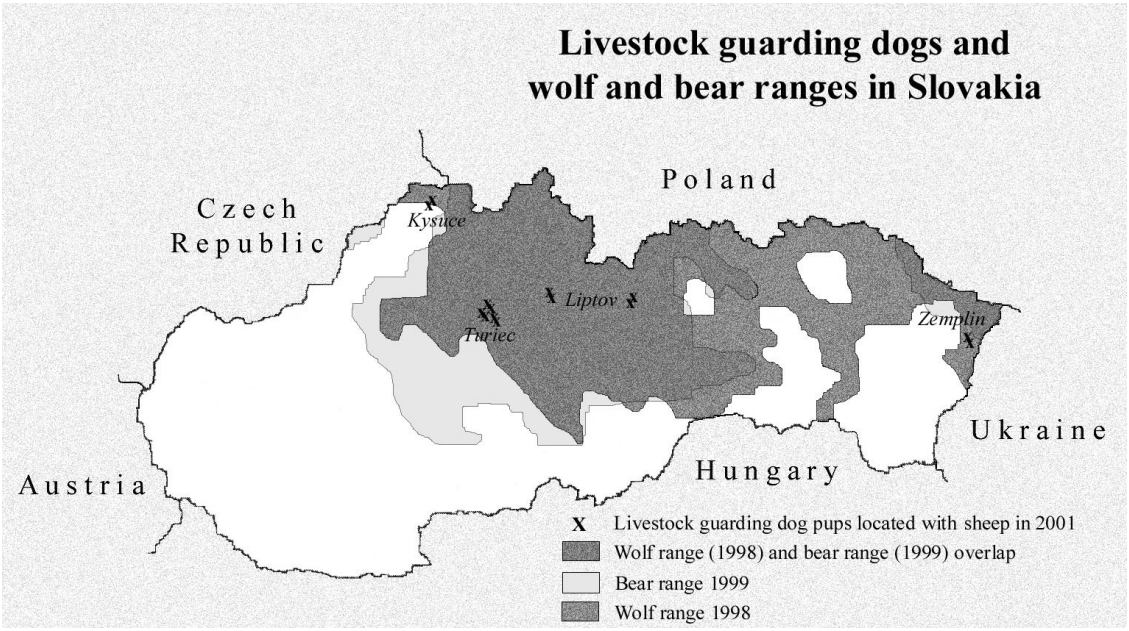


**Fig. 2.** Wolf and bear distributions in Slovakia and the locations of livestock guarding dogs described in the text.

within or adjacent to which are livestock grazing areas. Preliminary analysis of scats found mostly in Nízke Tatry and Západné Tatry has so far revealed livestock remains in none of c.100 scats collected from April to December 2001. The majority of spring and early summer scats were full of green vegetation, including grasses/sedges, while late summer and autumn scats were much more varied, containing a variety of forest fruits, berries and seeds as well as apples, corn, beech mast, etc., reflecting the bears' intensive feeding from a multitude of available sources, both natural and anthropogenic, in preparation for over-wintering.

Although at least some bears in some areas were active throughout November (tracks were seen on the north and south sides of the Nízke Tatry main ridge and in Poľana PLA (S. Ondruš pers. comm. 2001) and Malá Fatra NP (Ľ. Remeník pers. comm. 2001), scats were hard to come by, perhaps due to more restricted movements, snow cover and lower availability of food. As flocks were moved down to barns mostly away from large carnivore areas around mid-November, and then stopped grazing outside after heavy snow on the 21st, it was decided not to spend more time searching. One bear scat was collected on the south side of Nízke Tatry in mid-December which was full of beech mast (S. Ondruš pers. comm. 2002) and tracks were seen on the north side on 9th December along a hotel kitchen waste pipe. Scats collected in 2001 will be analysed in detail early in 2002 and further scats will be collected as the project continues.

A number of human-habituated bears fed on refuse around hotels in, for example, the Demänovská valley of Nízke Tatry NP throughout the summer and autumn, until at least 9th December. In one instance a bear actually gained entry to a hotel by smashing the glass of the entrance doors, injuring itself in the process. A bear was removed from the Vysoké Tatry (High Tatras) after it had fed on refuse around a mountain lodge for several weeks. As a result of such incidents there are calls to shoot more bears: there seems to be a rather haphazard and inconsistent approach to these cases and few ideas of how to alleviate the problems or much effort to do so. A leaflet has been produced by a joint initiative involving a number of organisations which gives advice to tourists on recommended behaviour and procedure in areas with bears, based mainly on North American experience and conditions, but it must be a very small percentage of Park visitors that ever see it and so for the time being incidents of people hand-feeding bears (and, in several cases, being injured as a result) are not so infrequent.

*Attacks on livestock*

Škultéty (reviewed in Hell and Slamečka 1999) described successful attacks on domestic animals as occurring from April to September, though this data came from stomach contents of 27 bears shot in spring and autumn. In 1986 bears killed 659 sheep and 1 cow (Hell and Bevilaqua 1988 reviewed in Kaczensky 1996; Hell and Slamečka 1999). In 1997 bears killed 395 sheep, 9 cattle and 7 goats (Hell *et al.* 1997; Hell and Slamečka 1999). Losses to bears are compensated after inspection of the damage by an official commission and if reasonable prevention measures are judged to have been in place (S. Ondruš pers. comm. 2000) and so are fairly comprehensively reported, though farmers may not bother to report losses involving one or two sheep (on the other hand there are likely to be some false claims made to obtain compensation). Compensation paid in the Slovak Republic for sheep and goats "damaged" by bears totalled 210,816 Sk (c.• 5,300) in 1998, 360,991 Sk (c.• 9,000) in 1999 and 351,903 Sk (c.• 8,800) in 2000. The figures for cattle were 176,269 Sk (c.• 4,500), 114,190 Sk (c.• 2,900) and 51,496 Sk (c.• 1,300) respectively (Kassa 2001). In hunting grounds where permission to shoot a bear was given, the user of the hunting ground must settle damages (Hell and Slamečka 1999). In 2000 at 21 flocks with a total of c.9,150 sheep and goats (average 436 per flock), bears killed and wounded 28 sheep in 13 attacks (average 2.1 sheep per attack), all of which were at night (after

Finďo 2000). These results should not be taken as a representative sample, however, as this study aimed to document and describe attacks leading to losses, not to estimate levels of attacks or losses.

## Lynx (*Lynx lynx*)

Population estimates are very approximate, perhaps 300 to 500 individuals (Rigg and Finďo 2000; Hell and Slamečka 2000); hunting statistics reported 1,037 in the 2000 season (Lehocký *et al.* 2001). There is currently no open season for hunting lynx, though four exceptions were issued in 2001 and further such exceptions are likely to be granted in response to the widespread – though unsubstantiated – belief that the lynx is an important factor in the recent dramatic decline of the chamois *Rupicapra rupicapra tatrica* population in Tatranský NP. Lynx cause only very minor losses to sheep and poultry, e.g. 5 sheep reported killed in 1997, which are not compensated (Hell *et al.* 1997; Hell and Slamečka 1999), and will therefore not be dealt with further in this report.

## Anti-predator measures currently used

*Chained dogs*

The current practice of chaining untrained LGDs around the fold and milking enclosure provides some protection, mainly at night, by barking to alert shepherds (Bloch 1995) but losses have occurred when predators bypassed these dogs, their effectiveness being limited by the length of their chain (Coppinger and Coppinger 1994 reviewed in Landry 1999; Bloch 1995; G. Bloch pers. comm. to Kaczensky 1996).

*Aversion*

Firecrackers are carried by some shepherds; they appear to be of some use in chasing off predators, though one shepherd in Veľká Fatra, 2001, reported that bears very quickly became habituated. One shepherd in Liptov, 2001, carried a small revolver/ starting pistol to frighten bears. Some camps leave lamps (electric or petroleum) on at night and report this to be helpful.

*Legal killing*

In the 2000 season, 118 wolves, 31 bears (permission given for 68) and 0 lynx (exceptions issued for 4) were officially reported shot (Lehocký *et al.* 2001). Permission to shoot individuals reported to be causing damage during closed seasons is given by agreement between the Environment Ministry and the Agriculture Ministry (since 1995 in the case of bears, S. Ondruš pers. comm. 2000). There is pressure to devolve decisions on permission for shooting wolves to the regional level (see, for example, Hell and Slamečka 2000 or Kubínyi 2000). Bear hunting is planned annually with the aim of regulating numbers as well as removing problem animals, but never meets its targets (S. Ondruš and J. Lukáč both pers. comm. 2001) and also seems to be failing in its aim to improve the age structure of the youthfully-skewed population (Baláž 2002). Bears are generally shot from 1st June to 30th November (S. Ondruš pers. comm. 2001) at baiting sites with maize, molasses or fruit, often by guests who provide a substantial income to hunting clubs, which therefore lobby to be given permission for bear shooting. Targeting small bears(usually only bears up to 100 kg may be shot) might tend to remove young animals which are believed to cause more damage to livestock and crops (Ľ. Remeník pers. comm. 2001).

*Illegal killing*

This mostly applies to wolves, especially opportunistic shooting either during hunts for wild ungulates (Hell 1993) or, in the 1990s, at baiting sites for bears. Baiting bears with carcasses is now banned although foxes can still be hunted this way in the same area (S. Ondruš pers. comm. 2001). Hunters officially declared 27 wolves shot in 1996, 74 in 1997 and 54 in 1998 (Hell *et al.* 2001) despite full legal protection effective since 1995. An open season was again granted from 1999 due to the strong pressure of the hunting lobby (Rigg and Finďo 2000). Bears and lynx are also occasionally poached (E. Baláž, S. Ondruš and Š. Šramka all pers. comm. 2000-01).

*Electric fences*

A flock of c. 1,000 sheep in an area of the Nízke Tatry well-known for the occurrence of wolves reported no losses for 2 or 3 years since starting to use an electric fence. One shepherd working with this flock said they had stopped using the fence in 2000 because they no longer lost any sheep. Many shepherds are reluctant to use such fences due to the extra work they require to install and maintain (Hell 1995 reviewed in Kaczensky 1996). On the night of 29th April 2000 a flock inside a fold protected by electric fence was attacked, probably by one or two wolves. Five sheep were killed, two injured and the others scattered due to poor installation of the fence: on two sides it had only one electrified wire c.65 cm from the ground and on the other two sides were two wires at 50 cm and 70 cm. The fence was better constructed with three wires all around in 2001 and no losses were suffered.

*Fladry*

This is an old hunting technique recently also used by researchers (Okarma and Jędrzejewski 1997) which employs lines made of thin but strong string with pieces of coloured (usually red) material 10x40 or 10x60 cm sewn on every 30-40 cm. For unknown reasons, wolves avoid crossing such lines. According to J. Lukáč (pers. comm. 2001) it is commonly used to protect livestock from wolves in the northeast of Slovakia near the Polish border, using rags attached to lines and suspended around folds.

*Relocation of livestock*

One sheep owner said that, after he had lost 9 sheep to bears on 5 or 6 separate occasions in July 2000, Muránska Planina NP staff advised him to move his flock to a different location, but no other pastures were available to him. Shepherds of another flock c.7

km away claimed that they had had to move their camp in 1999 due to heavy losses to a female wolf. A wolf, possibly the one they described, successfully attacked the flock when it was set up in its original location the following year. A flock of young sheep in Veľká Fatra was relocated to a farmyard and pastures near the home village in July 2001 after a serious attack by wolves. There were no further losses.

*Relocation of predators*

Slovakia has no large areas of wilderness in which to relocate carnivores identified as persistent livestock-depredators and so it is not clear that moving such an animal to a different location would necessarily solve the problem, as there would most likely also be livestock and/or human settlement within 15 km of the release site. A small number of bears causing damage have been captured and put into zoos in the last few years (S. Ondruš pers. comm. 2000).

## Livestock guarding dogs

### Brief history and current situation

*Origins*

Dogs have been used by people in Europe and Asia for millennia to guard domesticated animals against wild predators, stray or feral dogs and human thieves. Over the centuries, a distinct set of dogs has been developed throughout Eurasia from Portugal to Tibet known as livestock guarding dogs or flock guards. Livestock guarding dogs (LGDs), rather than helping herdsmen move their stock as do typical herding dogs such as collies, protect the animals from external threats. They are usually large (often 70 cm at the withers and >45 kg), independent, stubborn and intelligent. They are less energetic than herding dogs, with calm dispositions. Most breeds have a large head and pendant, rather than pricked, ears (reviewed in Rigg 2001d).

*Use in the past*

The native breed of LGD in Slovakia is the Slovenský čuvač (Laurinčík *et al.* 1958; Finďo 1997). In the past, every *salaš* had several for protecting livestock from predators and assisting shepherds with herding. A hunting law from the late 19th century decreed that free-roaming LGDs had to have a wooden beam hung from their necks which trailed below the knees of the front legs to prevent them chasing after wild animals. This law was mostly not respected, especially in the mountains where no one checked (Jamnický 2000). With the advent of dog shows and kennel clubs breeding of the Slovenský čuvač (as well as of other traditional LGD breeds elsewhere) has recently become largely focussed on exhibition dogs and the traditional system of LGDs socialised to livestock is almost never used, having presumably been abandoned either due to socio-economic changes during the Communist period of 1948-89 (Bloch 1995) and/or low levels of losses when large carnivore populations were much reduced (bears in the 1920-30s, reviewed in Hell and Slamečka 1999; wolves at the end of the 19th century and again in the 1950-70s, reviewed in Voskár 1993; Rigg and Finďo 2000). Perhaps the disruption caused by the Second World War also played a part.

*Use at present*

During tours of 6-8 camps in 1999 only one free-ranging adult LGD was seen which seemed to be at least partially socialised to sheep. In May-August 2000, 8 out of a total of 32 LGDs noted at 8 different camps were not chained. Of these, two were bitches nursing pups. One other bitch and four dogs stayed in camp and did not accompany the flock to pasture. The remaining dog was the only one of the 32 LGDs seen (average 4.0 per camp) which was not chained, went with the flock to pasture and followed the livestock rather than the shepherd. He had been bought in February on the advice of Muráňska Planina NP staff.

Dogs used for protecting livestock are currently almost always chained to stakes or trees around the fold and milking pen, though at some camps they are released at night. Many of them are crossbreeds. The Caucasian shepherd dog as well as other imported breeds are used at some camps. Eight camps observed in 2000 had an average of 426 sheep (range 210-600), in many cases including a few goats (up to 34) – even though this is forbidden by hygiene laws where sheep are milked (M. Kollárová pers. comm. 2001) – and 3.0 chained dogs (range 1-7).

*Reviving the tradition*

A five year wolf research project launched in spring 1994 (Finďo and Bloch 1995a) or 1993 (Finďo and Bloch 1995b) had the additional aim of renovating the traditional use of free-ranging, livestock-socialised LGDs. In 1995 two seven-week old Owczarek Podhalanski pups, brother and sister, were imported to Slovakia from Głodówka in southern Poland. They were socialised with sheep during the winter at a farm in the Nízke Tatry and the project supplied their regular vaccinations as well as dog food (Bloch 1995; Bloch and Finďo 1996). Finďo (1997, 1999) translated into Slovak the background information and guidelines for raising and training LGDs according to a system developed at Hampshire College in the USA (e.g. Lorenz and Coppinger 1986).

A more extensive effort to renovate the traditional use of LGDs in Slovakia – the Protection of Livestock and Conservation of Large Carnivores project, of which the work described in this report forms a part – was conceived in 1998 (Rigg 1999) and launched in spring 2000 (Rigg 2000).

### Raising pups and socialising them with sheep

A substantial literature is available on raising livestock guarding dogs from pups, the basic principle of which was succinctly stated by Coppinger (1992 quoted in Marker 2000): In order to achieve a good adult LGD showing the three required behavioural traits (attentiveness, trustworthiness and protectiveness), a dog should be kept with, brought up with, socialised with and bonded with the stock it is going

to protect. Lorenz (1985) put it even more simply: "If the dog isn't with the sheep it isn't where it's supposed to be." See Rigg (2001d) for a thorough review of the literature on livestock guarding dogs.

*Critical period*

The critical period for domestic dogs to form social attachments is between about 2-4 and 12 weeks of age (Scott and Fuller 1965). During this period they can form strong social attachments to other species; it is this phenomenon which is exploited in raising livestock guarding dogs. Removing pups too early from their mother may make them afraid of other dogs in later life; too late and socialisation with livestock may be weak or fail (see e.g. Marker 2000).

*Training*

In the present study, the guidelines provided by Lorenz and Coppinger (1986) were broadly followed. Pens were constructed of 6-8 metal or wooden frames (one of which had a door), 2-4 metres long and at least 1.5 metres high with deer fencing wire attached which were set up on summer pastures or in barns. These specially constructed, portable and re-useable enclosures cost an average of €220 each including materials, labour and transport. Some shepherds improvised simpler, and far cheaper, enclosures within farmyards. The aim was to place one c.8 week old pup in each pen with 5-6 sheep (initially lambs) which would then be replaced with different sheep every few days. In practice, the means and wishes (generally to minimise additional work) of individual farmers and shepherds led to variations, such as two or three pups left together with either fewer or, sometimes, many more sheep. The age of the pups' first contact with sheep also varied (from 5 to 11 weeks), according to the availability of suitable pups and farmers wishing to receive them. Two pups (Eva and Goro) may have had some contact with sheep even earlier than 5 weeks as they were born on a sheep farm and remained there until removed from their mother. Pups with pedigree papers were preferred but, when none was available within the available time, pups were accepted from allegedly pure-bred lines but without papers (Table 1 and see below, Selecting pups).

*Care of pups*

Placement of pups began in the last week of May and was completed by the second week of September. Each was vaccinated by a qualified veterinarian against distemper, parvovirus and rabies and regularly wormed. In most cases, farmers were helped with the cost of raising pups – and in order to ensure a high quality diet for good growth – by supplying food, both tinned meat and dry pellets (mostly special mixtures for pups). Project workers visited farms with pups every one to four weeks, as it was deemed necessary or possible, to carry out health checks, solve any problems and weigh pups. We were also in regular contact with farmers and shepherds by telephone. There have been very few health problems with any of the pups (but see below, Working with shepherds).

## Pup behaviour

Livestock guarding dogs should have greatly attenuated, or missing, predatory behaviour. In particular, eye-stalk as well as – of course – kill-bite motor sequences are unacceptable (see Coppinger *et al.* 1987; Coppinger and Schneider 1995; Coppinger and Coppinger 2001). If the socialisation process has been successful, dogs will show con-specific behaviours, such as active and passive submission, toward sheep.

Preliminary observations were conducted in 2001 to identify the most important behaviours for further study. A focal observation design was then devised, following the excellent guidelines of Martin and Bateson (1993) as well as published studies of LGD behaviour such as McGrew and Blakesley (1982), Coppinger *et al.* (1983) and Hansen and Bakken (1999). This design will be employed throughout 2002, both in barns and out on pastures.

Differences in behaviour were apparent among pups both within and between breeds in their reaction to and/or interest in sheep, though it is not yet clear if this is due more to different genetics,

| Name | Breed [a] | DoB [b] | Sex | Start age [d] | Location [e] |
|---|---|---|---|---|---|
| Axo | SČ p | 31/5/01 | m | 10 weeks | Zemplín |
| Bak | SČ p | 3/4/01 | m | 8 weeks | Liptov |
| Baron | SČ p | 3/4/01 | m | 8 weeks | Liptov |
| Bianca | SČ p | 25/5/01 | f | 7 weeks | Kysuce |
| Blanka | SČ p | 25/5/01 | f | 7 weeks | Zemplín |
| Brita | SČ p | 25/5/01 | f | 7 weeks | Liptov |
| Eva | SČ | 10?/6/01 [c] | f | 5 weeks | Liptov |
| Goro | SČ | 10?/6/01 [c] | m | 5 weeks | Kysuce |
| Asan | CSD p | 4/5/01 | m | 11 weeks | Turiec |
| Finestra | CSD p | 16/8/01 | f | 6 weeks | Turiec |
| Flavia | CSD p | 16/8/01 | f | 6 weeks | Turiec |
| Dona | CSD | 20/7/01 | f | 7 weeks | Turiec |
| Maco | CSD | 20/7/01 | m | 7 weeks | Turiec |
| Pazur | CSD | 20/7/01 | m | 7 weeks | Turiec |

**Table 1.** Details of pups located with sheep (a - SČ = Slovenský čuvač, CSD = Caucasian shepherd dog, b - pups with the same date of birth were littermates, c - the shepherd was not sure on exactly which day Eva and Goro were born, d - age when first placed with sheep, e - see Fig. 2.

variations of conditions during the critical period for socialising pups with livestock or a combination of the two. Further observations will be needed as the pups develop to determine if such differences at this stage are important to their eventual effectiveness as livestock guardians. Studying the characteristics of each dog is a vital element of this project, as it will allow the selection of the best blood lines for breeding and the recommendation of good working practice to farmers or shepherds interested in raising LGDs themselves, as well as allowing some comparison of the relative merits of the two breeds tested, of pedigree versus unregistered dogs, male versus female, etc., though the sample sizes will be very small for each comparison.

The behaviour towards lambs and sheep of most of the 14 pups in this study has been encouraging and no eye-stalk behaviour has been observed in any of them, though chasing sheep and grab-biting of wool, legs and tails as well as chewing ears were common. Sheep were typically somewhat nervous of dogs approaching them – even when this was done slowly and calmly – so some shepherds called dogs back when they started to go to sheep. Hopefully this will be less necessary as the sheep get more used to the dogs' presence. Some shepherds are far more patient and tolerant than others (see below). Three lambs died whilst in training pens with pups. However, in each case the lamb had been weak and sickly and may well have died anyway. Pups did not consume any part of these lambs although they were left in the pen for some time after death.

## Problems encountered

*Selecting pups*

Ideally, pups would have been chosen from working blood lines or parents but, as discussed above, there are currently very few – if any – livestock guarding dogs working in the traditional way in Slovakia. Having decided to test recognised LGD breeds, rather than crossbreeds, two choices were therefore available: to use pedigree or unregistered but "pure-bred" pups from lines bred primarily for exhibition, property guardians or pets, or to use LGDs raised on farms which have no pedigree papers. As even LGDs raised on farms have not been employed correctly for an unknown number of generations, it was decided to concentrate on pedigree pups that would at least give some certainty as to their identity and origin.

Eight Slovenský čuvač pups were placed in unrelated pairs in order to allow convenient breeding in future. The intention was to do the same with the six Caucasian shepherd dogs but this was not possible due to the different wishes of each farmer in Turiec and pressures of time. The most expensive dogs bought were two female pedigree Caucasian shepherd dogs costing • 375 (15,000 Sk) each. Pedigree Slovenský čuvač cost • 150 (6,000 Sk) for males and • 100 (4,000 Sk) for females, whereas "pure bred" Caucasian shepherd dogs without papers were bought for • 75 (3,000 Sk) each and čuvač-type pups without papers cost just • 35 (1,500 Sk).

The deleterious effects on working breeds of the modern fad of breeding for phenotypes and closing stud books to unregistered dogs have been highlighted (e.g. Budiansky 2001; Coppinger and Coppinger 2001) and this may be an important long-term consideration in choosing to use a breed such as the Slovenský čuvač, of which only c.100 pups with papers are born annually in Slovakia (J. Goliášová pers. comm. 2001), many of them presumably closely related. On the other hand, Tsingarska *et al.* (1998) reported crossbreeds in Bulgaria to be less effective and Finďo (2000) considered them less trustworthy, especially females, in a sample of 5 crossbred versus 3 pedigree pups. It would seem unwise to exclude all but pedigree registered dogs from possible livestock guarding work until a) non-pedigree čuvač- and Caucasian-type dogs have been shown to be ineffective or inferior and b) an analysis of the inbreeding coefficient such as that described by Fonseca (2000) for rare Portuguese LGD breeds has been carried out on the registered dog populations in Slovakia.

*Choosing farms*

At the beginning of the project a meeting was held at the regional office of the Agriculture Ministry in Liptov to which livestock owners and/or farmers were invited. It was thought that by requiring people to travel to such a meeting, a self-selected group of those seriously interested and motivated in trying to raise effective LGDs would be obtained. This was indeed the case (there was even a representative of a farm which had not suffered any losses to large carnivores – it was decided not to place pups there), but just because a farmer was interested did not mean that his shepherds were; there were many problems in this region (see below). Unfortunately, such a meeting could not be organised in Turiec before the herding season began and people became busier, so instead various farms were visited and partners were selected from those interested on a first "yes", first served basis. Farms in Kysuce and Zemplín requested to have livestock guarding dogs, having heard about the project. Surprisingly in Orava region, where the numbers of livestock killed by large carnivores appeared to be somewhat higher than the rather trivial losses reported in Liptov, within the time available for searching no farmers could be found who wanted to raise LGDs, with no clear reasons given for why not. Perhaps people there were content with the status quo. It could therefore be argued that the actual number of animals lost to large carnivores is not the point, but rather what the reaction is to such attacks.

*Fitting a "new" method into current practice*

Although the use of livestock guarding dogs in Slovakia dates back centuries it is, at the present time, a "new" concept to the Slovak livestock industry. The original methods of raising LGDs were not only abandoned, but seem to have been completely forgotten, even by some old shepherds in their seventies. Most shepherds met said that guard dogs should be chained and therefore a dog not on a chain must be a herding dog: they often did not understand the concept of free-ranging, sheep-socialised LGDs, even after it had been explained to them repeatedly. Some shepherds said they had raised a dog or two in the way described for socialising them with sheep,

but this always seemed to be something they had done in the past, rather than were still doing. There were therefore no adult dogs to show pups what to do, shepherds and sheep owners had no experience of LGDs and neither did sheep, which were sometimes afraid of larger pups and ran, provoking chasing. Even when dogs calmly approach sheep which were unafraid, shepherds – not used to working with LGDs – sometimes called them away, thinking that the dog should stay at heal, as their herding dogs did. All parties needed time – and usually help – to get used to each other and this "new" way of working. Socialising pups with sheep on summer pastures is probably, overall, the worst approach possible, although it can be done, shepherds willing (see below). Using a barn and/or a sectioned off part of the farmyard, either during the winter or in summer with lambs and rams, which are often based there throughout most of the grazing season, seems much more successful, although there can be other complications connected with lambing or the dogs wandering into nearby villages.

*Working with Slovak shepherds*

Traditional rural life in Slovakia, including shepherding, dramatically declined in the 20th century. Animal husbandry is now often very lax and cases of drunken shepherds beating and kicking sheep are widespread. Farmers, while they may be discontent with such workers, are often apparently unable to employ anyone better.

Despite having little understanding of sheep-socialised LGDs, many shepherds are nevertheless quick to pre-assess their abilities with statements such as, "I know dogs, I don't trust any of them, they're predators – they'd eat the lambs if we left them with ewes giving birth, once they taste blood they're sheep-killers" (this latter point was made by a shepherd standing next to a training pen on which he had left a bloody sheep skin, but he did not seem to notice the irony) and "they will run away from bears", which tends to make them reluctant to go to any extra trouble required to raise pups appropriately with sheep. The main problem is, perhaps, that these people learn from experience, not explanation, and their experience is that guarding dogs are on chains. Unfortunately, shepherds often end up dictating proceedings, as they are the ones constantly present. In the worst case, an old head shepherd or *bača* lsimply refused to have dogs released among sheep while he was in charge and threatened to leave if this was done. In such circumstances, the owner of the sheep – who wanted, and still wants, to try LGDs – had little choice; his sheep went out but our pups stayed in the barn, thus interrupting their socialisation.

At one remote *salaš* in Liptov there were serious concerns over animal welfare. Particularly the male LGD pup located there became under-weight at various times through the season, prompting more visits by project workers to this locality than any other and direct feeding to ensure that our pup food did not end up in the shepherds' own dogs. By November both pups placed at this farm were weak-boned and afraid of the shepherds, suggesting they had been beaten (as the sheep were seen to be) – although this was denied. The male was even put on a chain but the shepherds were unable to explain why. For the time being the pups are in better health but will be kept under close observation; an alternative home has been identified should the situation deteriorate again.

There seemed to be differences among regions, with shepherds in Liptov and Horehron being particularly disaffected and difficult whereas those in Turiec are more amiable and amenable (at one farm a shepherd was even seen affectionately scratching a sheep's head). To some extent permanently-employed (year-round) shepherds tended to be more motivated and easier to work with than those only seasonally hired. Certainly it is vital to see and assess the complete livestock operation – including its shepherds – before deciding to place pups. Some individual shepherds are remarkably tolerant: one in Zemplín was extremely patient as a five-month old pup, out with the whole flock for the first time, chased his sheep all over the pasture. He left both this pup and another (separately) with lambing ewes and has reported no problems. These two pups are by far the best socialised of the Slovenský čuvač in this study.

*Legal issues*

Exceptions from the Protection of Nature and Landscape Act (1994 no.287) are required for fieldwork off marked tourist routes within protected areas. These were obtained for scat collecting from the Environment Ministry (for National Nature Reserves) and the relevant Regional Office (National Parks and Protected Landscape Areas excluding nature reserves) for scat collection.

For the time being farmers, shepherds and livestock owners have not been given ownership of the dogs involved in this study, which can therefore still be relocated if they are not taken care of or are not successful guardians. This raises the question of who is responsible in the event of any damage, biting of people or other problems. Consultations have been held with the State Veterinary Service, farm veterinarians, dog breeders and a Slovak lawyer, the conclusion of which is that those who have the dog are liable for it, but that it is advisable to have them sign a document clearly confirming the identity of the responsible individual. Before, or when, locating pups at farms a contract should be signed outlining roles and responsibilities. In the Slovak Republic the most applicable laws relating to the keeping and raising of domestic animals as well as animal welfare are no.115/1995 and no.337/1998.

## Publicity and publications

Slovakia*:* Articles on the project with photographs were published in Liptov's weekly newspaper in May and July. A two-part feature was broadcast on the popular Slovak radio station Rádio Rebeka on 30th August and 2nd September, including an on-site interview with a project assistant. An interview was given about the project for a local television programme which was broadcast at the end of October. Copies of a brochure on LGDs in Slovak (Finďo 1999) were distributed in all four regions where pups were located as well as in Orava, northern Slovakia. The project's aims and progress have been discussed

with a number of state nature protection employees, Agriculture Ministry representatives, non-government organisation staff, veterinarians, students and local people as well as farmers, shepherds and livestock managers additional to those that received pups.

Elsewhere: The following articles were published, dealing wholly or partially with this project:

Rigg, R. 2001: Wolves in Slovakia. *International Wolf Newsletter*, March. [online] URL: www.wolves.de/cgi-bin/iwn.pl?lang=_e&article=2#1809

Rigg, R. 2001: Wolves of Slovakia. *Wolves*, Haliburton Forest Wolf Centre, Ontario, 3-5.

Rigg, R. 2001: Overcoming traditional prejudices in Slovakia. *Wolves newsletter*, Wolf Society of Great Britain, Reading, **3**: 1-3.

A report titled "Livestock guarding dogs: their current use world wide" (Rigg 2001d) was posted on the internet in November and can be downloaded via the following web-sites:

http://www.canids.org/occasionalpapers
http://www.carnivoreconservation.org
http://www.large-carnivores-lcie.org

The Slovak Wildlife Society hosted a visit by a BBC film crew with naturalist and presenter Nick Baker, from 8th to 10th December. As well as tracking a bear in Demänovská valley and finding a red deer female recently killed by wolves elsewhere in Nízke Tatry National Park, they filmed one of the livestock guarding dogs with his flock in a barn in the Turiec region. Subject to editing and scheduling, this footage will hopefully be shown in an episode of the Really Wild Show sometime in 2002.

A poster was presented at the University of Aberdeen Zoology Department's Research Day on 12th December 2001. The poster will also be used at future meetings and conferences to raise awareness of the project.

## Conclusions and interim recommendations

Despite various unexpected complications in establishing them among flocks, eight Slovenský čuvač and six Caucasian shepherd dog pups were raised with sheep at a total of eight farms in four regions of Slovakia. So far the majority of these dogs seem to show generally good behaviour, with undesirable, "predatory" motor patterns limited to chasing and grab-biting, plus ear-chewing.

By far the greatest difficulties have been in working with shepherds. Although there is always the potential for such problems when introducing this "new" method of working to a very strong-minded group of people, they can be alleviated by:

1. Taking more time over selecting farms, including viewing the whole set-up and discussing the project with all employees, ideally a number of times, and planning in detail how dogs will fit into the various operations of the farm at all times of year. Livestock guarding dogs are not a universal solution: many farmers do not want to take the trouble to raise pups with their stock, others may not be able to. Detailed selection and planning should preferably be done the summer before any dogs are placed;
2. Summer pastures are usually not good choices for socialising pups with livestock. This is where shepherds can exert the most influence, they are often extremely reluctant to take on the extra work involved, building complete training pens can be costly and time-consuming, plus either the component parts or the completed pens must be transported to and from remote locations. Raising pups in barns or sectioned off areas of farmyards, rather than on open pastures, seems much more promising.

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