

Research paper

# LIVESTOCK GUARDING DOGS IN GEORGIA: A TRADITION IN NEED OF SAVING?

Robin Rigg<sup>1\*</sup>, Gareth Goldthorpe<sup>2</sup>, Teimuraz Popiashvili<sup>3</sup>, Claudio Sillero-Zubiri<sup>4</sup>

<sup>1</sup> Slovak Wildlife Society, Liptovský Hrádok, Slovakia - [www.slovakwildlife.org](http://www.slovakwildlife.org)

<sup>2</sup> Fauna & Flora International, Cambridge, UK - [www.fauna-flora.org](http://www.fauna-flora.org)

<sup>3</sup> NACRES Centre for Biodiversity Conservation & Research, Tbilisi, Georgia - [www.nacres.org](http://www.nacres.org)

<sup>4</sup> Wildlife Conservation Research Unit, University of Oxford, UK - [www.wildcru.org](http://www.wildcru.org)

## 1. Introduction

Livestock guarding dogs (LGDs) are integral to the herding traditions of the Tushetian pastoralists of East Georgia (Fig. 1). Largely a sheep-breeding community, the Tush have practised transhumance for centuries, moving their flocks between the Greater Caucasus Mountains in summer and various lowland pastures in winter. Livestock breeding continues to be their main economic activity today.

The Georgian Mountain Dog, recognised by the Cynological Federation of Georgia (though not yet by the Fédération Cynologique Internationale, FCI), has been described as an ‘ancient’ natural breed, the ‘ancestor’ of many other Molossian-type dogs and the ‘real’ Caucasian Shepherd Dog, which was popularised and registered with the FCI by the Soviets (Beradze, 2003; Sicard, 2003). According to the breed standard<sup>1</sup>, the Georgian Mountain Dog, also known as the Georgian Shepherd Dog or locally as Kartuli Nagazi, is large and robust, with a shoulder height of at least 65 cm in males and 60 cm in females. It

has strong bones and musculature, a large head, short neck and powerful body. The short, coarse coat has several colour varieties. Although there are regional variations within Georgia, the greatest value is placed on the Tushetian Nagazi.



**Fig. 1.** Livestock guarding dog with flock in Georgia.  
Photo: Robin Rigg/FFI.

\*Corresponding author: [info@slovakwildlife.org](mailto:info@slovakwildlife.org)

<sup>1</sup> [www.fcg.ge/eng/index.php?option=com\\_content&view=article&id=25:georgian-mountain-dog&catid=2:static-page](http://www.fcg.ge/eng/index.php?option=com_content&view=article&id=25:georgian-mountain-dog&catid=2:static-page)

**Fig. 2.** Shepherds, livestock and guarding dogs completing the annual migration from the Caucasus to winter pastures in Vashlovani, East Georgia. Photo: Robin Rigg/FFI.



Political changes and economic development have had major impacts on the Tushetians' transhumant lifestyle. During the Soviet period, many of them were coerced into resettling (Mühlfried, 2010). Whereas many livestock owners and shepherds once crossed from their homeland in Tusheti into neighbouring Dagestan, since the dissolution of the Soviet Union transboundary transhumance is no longer possible, reducing the availability of lowland winter pastures to the herders. The majority now take their flocks from the Greater Caucasus Mountains to the semi-arid grasslands of Vashlovani in East Georgia, bordering Azerbaijan (Fig. 2). Even this route is being encroached upon by settlers and cultivation of the surrounding land (Anthem, 2009).

As well as limiting access to traditional migration routes, Georgia's recent history is thought to have affected other aspects of Tusheti pastoralism. Current shepherding practises have been criticised, with poor livestock management thought to result in overgrazing of winter pastures (Gintzburger et al., 2012) and high livestock mortality, including substantial losses to predators. Moreover, some Georgian cynologists believe that the quality of the Georgian Caucasian Sheep Dog has decreased due to crossbreeding, inbreeding and export of the best dogs to the former Soviet Union, where they were used as military patrol dogs and show dogs (Sicard, 2003). Traditional knowledge, including how to raise attentive, trustworthy and protective LGDs, is said to have declined in recent years (Kikvidze and Te-

vzadze, 2015). According to the Bombora Caucasian Sheep Dog Club and the Caucasian and Georgian Sheep Dog Developing and Revival Union, the breed is 'close to disappearing in its natural environment' (G. Goldthorpe, unpublished data).

The Georgian Carnivore Conservation Project (GCCP), a joint initiative between Fauna & Flora International and NACRES Centre for Biodiversity Conservation & Research, began work in Tusheti and Vashlovani in early 2009 with the goal of improving the conservation status of large carnivores as key components of the region's unique and globally important biodiversity (Zazanashvili and Mallon, 2009). Unregulated hunting following the collapse of the Soviet Union in 1991 precipitated major reductions in wildlife populations (Bragina et al., 2015), whilst the large-scale abandonment of agricultural land in Georgia led to an expansion of available wolf habitat (Goldthorpe, 2016). In areas where natural prey has been depleted, wild carnivores tend to shift to livestock and come into conflict with people (Sillero-Zubiri et al., 2007). Human-carnivore conflict (HCC) typically has a negative impact on attitudes towards the implicated species and their management and may result in retaliatory killings, with consequences for wildlife conservation and the integrity of associated protected areas (Woodroffe et al., 2005). HCC was therefore identified as an important issue for the GCCP to address in partnership with the Tushetian community.



**Fig. 3.** Locations of Vashlovani (VNP) and Tusheti National Parks in the Kakhети Region of East Georgia.

As part of the GCCP, we undertook a baseline survey of livestock husbandry and HCC in East Georgia. We characterized contemporary livestock farming practices in the winter range, quantified depredation in comparison with other causes of livestock mortality and assessed the use of damage prevention measures. We also conducted a survey of attitudes to large carnivores and their management (Rigg and Sillero-Zubiri, 2010a). Here, we report our findings on the status and effectiveness of LGDs in East Georgia.

## 2. Materials and methods

### 2.1. Study area

We conducted our study in and around Vashlovani Protected Areas (VPA) in the Dedoplistskaro District of East Georgia (Fig. 3). In winter, when high-altitude pastures in the Caucasus are inaccessible due to deep snow, VPA and surrounding areas are used extensively by Tusheti pastoralists for grazing sheep, goats and cattle (Fig. 4). Wool and lambs, primarily for export, are the main sheep products in winter, whilst cows from a few permanent dairy farms are used to produce milk, cheese and meat.

The main vegetation types in VPA are: open arid forests dominated by pistacieta (*Pistacia mutica*) mixed with juniperita (*Juniperus foetidissima* and *J. polycarpus*); open scrub habitat typified by low

and dense, drought-resistant small trees and shrubs; semi-desert occurring on foothills and dominated by *Artemisieta phytocoenosis*; steppe vegetation dominated by Gramineae; and an area of mountain forest dominated by *Quercus iberica*, *Acer ibericum* and *A. campestre* (Kikodze, 2007; Gintzburger et al., 2012). Elevations range from 90 to 708 m a.s.l., and the area has a dry climate. Livestock grazing is forbidden in Vashlovani Strict Nature Reserve (110 km<sup>2</sup>), but widespread in the remainder of the National Park (240 km<sup>2</sup>) and surrounding Eldari Lowland, Patara Shiraki and Iori Steppe, where there are mostly open grasslands.

Vashlovani supports a rich array of wildlife, including 35 species listed in the Georgia Red Book (MENRPG, 2013). There is a diverse guild of carnivores, including the grey wolf (*Canis lupus*), brown bear (*Ursus arctos*), Eurasian lynx (*Lynx lynx*) and golden jackal (*Canis aureus*). Few data on wolves in Vashlovani were available at the time of our study, but packs seemed to be relatively small (2–5 adults). Since



**Fig. 4.** Livestock grazing in Vashlovani NP, Georgia. Photo: Robin Rigg/FFI.

the 1990s poaching has drastically reduced wild ungulate populations, with wild boar (*Sus scrofa*) being the only extant species. The goitered gazelle (*Gazella subgutturo*) was extirpated in the mid-20th century (APA, 2011; Anon., 2014).

## 2.2. Farm survey

Data on livestock, husbandry, damage prevention measures, predator attacks and losses were gathered using a semi-structured interview protocol based on a similar study in Slovakia (Rigg, 2004), revised and tailored to the specific objectives of the present study (Rigg and Sillero-Zubiri, 2010a). Potential questions for the survey were piloted with the aid of an interpreter during informal interviews with livestock owners (defined as owning  $\geq 100$  sheep/goats or  $\geq 15$  cattle/horses) as well as hired shepherds (tended livestock on a daily basis but owned  $\leq 10\%$  of the herd/flock) at eight farms in and around VPA in December 2009.

For the full survey, we prepared a face-to-face interview protocol which was tested and finalised in February–March 2010. The final protocol contained a total of 74 items, including the following about LGDs: how many were at the farm (adults and juveniles  $< 1$  year old); the breed or variety (Caucasian, Georgian, mixed or other); where they were obtained; how they were

trained; and the respondent's rating of their working ability (good, partially good or not good).

An interviewer was recruited on the basis of prior experience working with rural communities in Georgia. Training in the specifics of the current survey was provided. Emphasis was placed on best practice to minimise observer bias (e.g. Rubin and Rubin, 1995; Leech, 2002), the interviewer being instructed not to share personal experiences or views and to use neutral probes and prompts to maximize the information obtained. Phrasing of questions was kept short, straightforward and clear. Jargon and leading questions were avoided.

Using a database of livestock farms developed by VPA administration and augmented by the GCCP, in March 2010 the interviewer visited all active farms within VPA and up to 2 km from its periphery. The basic sampling unit was the farm (Fig. 5): if more than one livestock owner or shepherd contributed answers at the same farm their responses were pooled and treated as a single 'respondent'. After eliminating farms that were either permanently abandoned or unoccupied in the current season, a total of 69 GPS-referenced farms were included in the survey, which was conducted towards the end of the grazing season. In the winter pastures, livestock owners typically aggregate their



Fig. 5. Typical livestock farm in Vashlovani, East Georgia. Photo: Robin Rigg/FFI.



**Fig. 6.** Interviewing livestock owners in Vashlovani.  
Photo: Robin Rigg/FFI.

flocks and each farm had, on average, three owners with a total of 848 sheep, 23 goats, 77 cattle and 14 horses tended by three hired shepherds. The interviewer used individual datasheets to record responses to survey questions and make additional notes (Fig. 6). Statistical analyses were carried out using SAS/STAT® 9.3 (SAS Institute Inc., Cary, NC, USA) and PASW® Statistics 18 (SPSS Inc., Chicago, IL, USA). Null hypotheses (H0) were rejected at  $\alpha=0.05$ .

### 3. Results

LGDs were ubiquitous in the study area, with at least one at every farm (mean=7.8, SD=4.8). We documented a total of 525 dogs: 376 adults and 149 juveniles. Respondents most often described their dogs as being of ‘mixed’ descent (66%), with a minority claiming to have either Georgian (25%) or Caucasian (10%) Shepherd Dogs or a combination of pure and mixed breed (4%). Most dogs were reported to originate from on-farm breeding (82%), with some exchanged (9%) or given as gifts (9%).

Usually no special regime for training LGDs was described, with most respondents claiming that dogs learned what to do by themselves (40%), from being brought up with the flock (31%) or from older dogs (25%). Only two respondents mentioned specific actions to train dogs: promoting attentiveness by encouraging dogs to accompany the flock and feeding them near livestock. Spaying/neutering of dogs was not normal practice in the Tushetian community.

A large majority of respondents rated their dogs as good (61%) or partially good (22%). They considered good dogs to be attentive to livestock (51%),

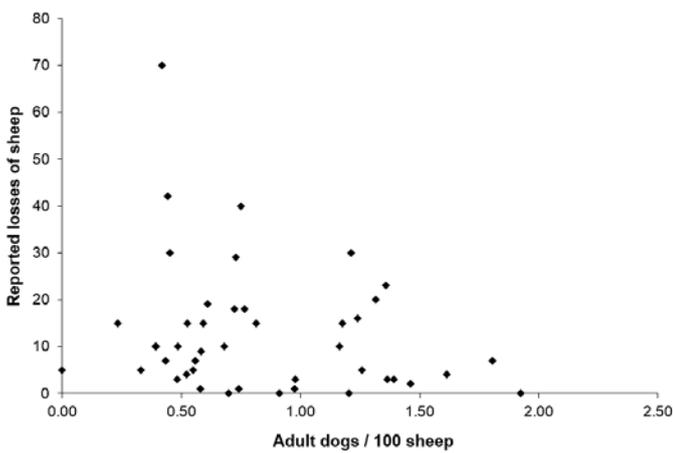
aggressive to predators (12%) and unafraid of wolves (7%). Partially good dogs were regarded as not being attentive enough (38%), insufficiently protective (33%) or attentive but afraid of predators (19%). At five farms, respondents stated that their dogs (some or all of which were described as ‘mixed breeds’ that had bred at the farm) were not good, citing lack of attentiveness (2), the dogs’ fear of wolves (1), poor breeding (1) or a failure to train them as pups (1).

Respondents provided details of 105 attacks by predators on livestock that occurred during the current grazing season. Most of them were reported to have occurred in the afternoon or at dusk, typically when flocks were in the pasture (69%). Dogs were said to have been present during 62% of attacks, to which they were alleged to have responded by chasing and barking ( $\geq 90\%$ ). In two cases respondents stated that their dogs had killed an attacking wolf; one of these assertions was corroborated by the remains of a dead wolf and an injured dog with major facial injuries seen at the farm (Fig. 7).

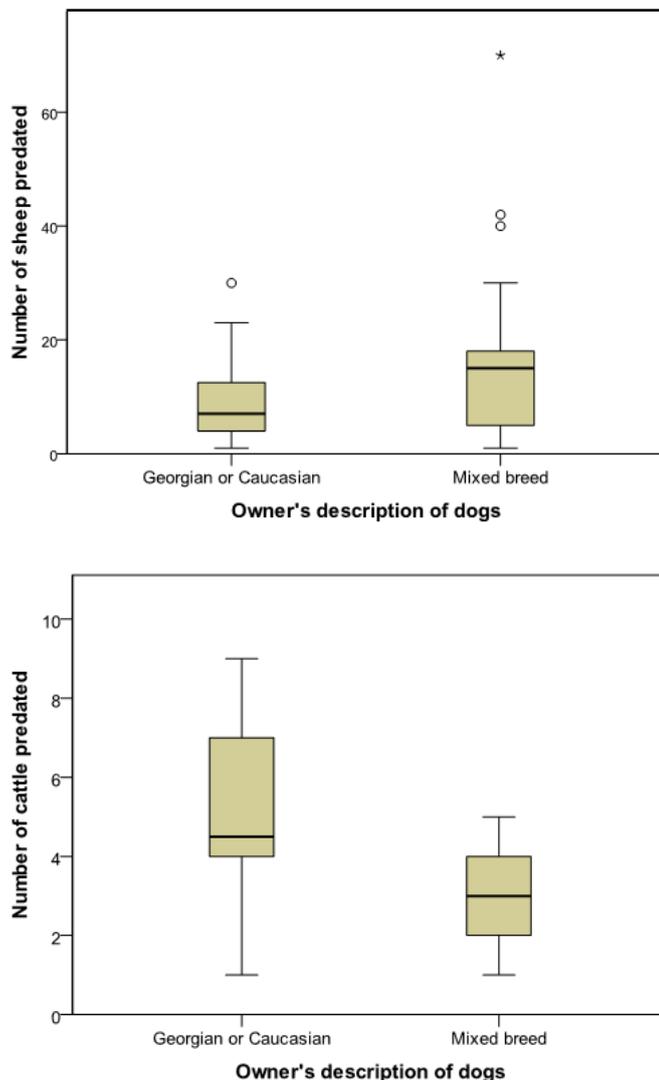
Although only four cases were reported in which dogs and shepherds were said to have successfully repelled wolves without loss of livestock, higher dog/sheep ratios were associated with lower levels of damage (Fig. 8).



**Fig. 7.** Remains of a grey wolf (top) apparently killed by livestock guarding dogs, one of which was seriously injured (bottom), at a farm in Vashlovani, East Georgia, in 2010. Photos: Aleco Baghdadze/FFI.



**Fig. 8.** Number of adult dogs per 100 sheep and reported losses to predation during the winter 2009–2010 season at 69 farms in and around Vashlovani Protected Areas, East Georgia.



**Fig. 9.** Reported losses to predators (mainly wolves) of cattle and sheep during the winter 2009–2010 season at farms with ‘pure-bred’ versus ‘mixed’ dogs in and around Vashlovani Protected Areas, East Georgia.

There was a tendency for owners of ‘pure-bred’ dogs to be more satisfied with their performance (Mann-Whitney U test,  $U=247.500$ ,  $P=0.001$ ), even though such dogs were not associated with fewer reported losses (all livestock combined, Mann-Whitney U test,  $U=388.000$ ,  $P=0.294$ ). Neither were owners’ ratings of dogs correlated with reported losses (Kruskal-Wallis test,  $\chi^2=1.613$ ,  $df=2$ ,  $p=0.446$ ). However, there was some evidence, though not statistically significant, that mixed breed dogs were better at defending cattle while pure-bred dogs were possibly slightly more effective with sheep (Fig. 9).

#### 4. Discussion

The ability of livestock guarding dogs to protect livestock from predators has been documented in a range of settings (reviewed in Rigg, 2001; Gehring et al., 2010). Although we found that their use in East Georgia did not prevent losses, the percentage of livestock depredated at farms in our study area (1.3% killed, 0.2% injured) was only slightly higher than generally found in Europe (Kaczynsky, 1999), despite the presence of a diverse predator guild and a paucity of wild prey. Damage was spread across a high proportion of farms (Rigg et al., in prep.), similar to the pattern found in central Greece, where stocking densities of sheep and cattle were comparable to Vashlovani in winter and represented the only abundant food for wolves due to human-caused depletion of wild prey populations (Iliopoulos et al., 2009). We suspect that in such circumstances losses would be much higher if prevention measures such as LGDs were not used.

During our fieldwork, we frequently encountered dogs away from flocks. Livestock owners and shepherds stated that LGDs were often absent during attacks by predators, most of which occurred during daylight hours (Rigg et al., in prep.). Wolves may have been observing flocks and waiting for opportunities, such as when LGDs left to seek food at farm buildings. Watchful behaviour by wolves has also been reported by shepherds in Slovakia (Rigg, 2004) and Portugal (S. Ribeiro, personal communication). Insufficient attentiveness (cf. Mertens and Schneider, 2005) may explain why the majority of attacks in Vashlovani were reported to occur when flocks were in pastures (not necessarily always accompanied by dogs), rather than under cover of darkness, when livestock was gathered in corrals close to farm buildings, presumably where LGDs were most likely to spend the night.



Fig. 10. A portrait of Joseph Stalin at a livestock farm in East Georgia in 2010. Photo: Robin Rigg/FFI.

In our study, higher dog/sheep ratios were associated with fewer losses of sheep. Iliopoulos et al. (2009) postulated that if the number of LGDs with a flock exceeds a certain threshold their effectiveness declines, as large numbers of dogs may result in poor nutrition, lack of appropriate training and undesirable behavioural traits. Farms in our study had up to 17 adult dogs. Instead of keeping a large, uncontrolled number of dogs, maintaining an 'optimal' number of well-trained LGDs from proven working parents, adapted to flock size and attentive to livestock, may result in more effective protection of livestock while also reducing costs. In Greece, the optimal number was shown to be 3–4 LGDs in flocks of 100 animals rising to 7–9 in flocks of 500–1,000 (Iliopoulos et al., 2009). This suggests that the average number of dogs we found at farms in Vashlovani was appropriate, although it was not clear if there were sufficient LGDs to adequately cover all livestock when flocks were subdivided for management purposes.

Issues of breed identity and origin have been somewhat politicized. The standard accepted by the Cynological Federation of Georgia in 2000 describes the Georgian Mountain Dog as originating in the northeast mountains of Georgia, which include Tusheti. On the other hand, the FCI standard for the Caucasian Shepherd Dog (*Kavkazskaja Ovtcharka*), first published in 1985, gathered several types, including Georgian dogs, within a single 'breed' that was claimed to originate in Russia i.e. the Soviet Union, of which Georgia was then a part. Interestingly, Joseph Stalin (born Dzhugashvili), leader of the Soviet Union until 1953, was an ethnic Georgian and is still revered by some Tushetian pastoralists (Fig. 10), des-

pite his part in the Red Army invasion of Georgia in 1921 and the impact of subsequent Soviet policies on their cultural heritage.

At the time of our study there were breeding programmes in Georgia aiming to 'save' the 'pure' Georgian Shepherd Dog and 'return it to nature', i.e. to work on farms. The standardised, selective breeding of kennel and breed clubs emphasises size, coat colour and other phenotypic traits considered desirable for show, pet or guard dogs but which are of less relevance to farm dogs. Regional varieties (*landraces*) of LGD, many of which are nowadays termed breeds, probably arose by processes closer to natural selection than artificial selection, as transhumant shepherds lack the means to conduct planned breeding programmes (Coppinger and Coppinger, 2001). Notwithstanding the pessimistic prognosis of Georgian cynologists, we found the use of LGDs to be ongoing and widespread in East Georgia: all 69 farms we surveyed in 2010 had at least one, with an average of eight per farm.

According to our survey results, livestock owners with pure-bred dogs were more satisfied with their performance than those who said they had mixed dogs. However, we found no significant relation between reported losses and either how owners rated their dogs or if they described them as 'pure' versus 'mixed breed'. Moreover, during informal pilot interviews prior to the survey, several livestock owners and shepherds had rated non-pure dogs as superior on the basis that they were 'faster'.

Coppinger and Coppinger (1995) and others have emphasised the deterrent effect of LGD presence and their supposedly ritualised, non-violent interactions



**Fig. 11.** A livestock guarding dog in East Georgia wearing a spiked metal collar as protection from wolves. Photo: Robin Rigg/FFI.



**Fig. 12.** Carcass of a telemetry-collared male wolf probably killed by livestock guarding dogs in East Georgia, November 2010. Photo: Gareth Goldthorpe/FFI.

with wolves, dismissing the use of protective collars fitted by owners to LGDs in many regions, including East Georgia (Fig. 11), as status symbols and machismo. However, we found evidence of LGDs occasionally fighting with, being injured by and even killing wolves. Since our baseline survey was conducted, the GCCP has documented two cases in which wolves fitted with telemetry collars were probably killed by dogs (Fig. 12). LGDs have also killed wolves and other predators in Bulgaria (Sedefchev, 2005), Turkey (R. Rigg, unpublished data) and elsewhere. It therefore seems that LGDs are not necessarily always a non-lethal measure, which has clear implications for conservation management, especially where rare and protected species are involved.

## 5. Follow-up work

Based on the survey results, we developed a strategy to mitigate human–carnivore conflict in East Georgia, drawing on approaches that have been successful in comparable situations elsewhere (Rigg and Sillero-Zubiri, 2010b). In 2011 the GCCP established a HCC response team to investigate instances of predation, assist with damage prevention and improve access to veterinary care. The response team also initiated annual surveys of livestock husbandry and losses to predators and other causes in Vashlovani.

Improving the attentiveness of adult dogs can be problematic and requires a patient and consistent approach. Success is more likely to be achieved if starting with young pups. As part of a suite of initiatives to address HCC in Vashlovani, the GCCP initiated a pilot study in 2011–2012 aimed at improving methods used within the Tusheti community for rearing LGDs. A manual of best practices was prepared for the long-term use of Georgian sheep breeders (Rigg, 2011a). Training in socialisation and husbandry techniques was provided to members of the HCC response team as well as participating livestock owners and shepherds in Vashlovani (Rigg, 2011b).

Although all farms included in our survey had LGDs, these were not always present during predatory attacks. In order to determine whether insufficient daytime attentiveness of LGDs is a key factor leading to losses in East Georgia, more systematic and intensive study of dogs and flocks would be necessary. Data could be gathered either by direct observations (e.g. from a vehicle or horseback) using a focal observation protocol (e.g. Rigg, 2012) or by fitting a sample of dogs and livestock with tracking devices to record their relative positions (Ribeiro et al., in this issue). It could also be revealing to investigate relationships between dogs and what influence these might have on the effectiveness of LGDs at repelling predators.

## Acknowledgements

This work was carried out under the auspices of the Eurasia Programme of Fauna & Flora International (FFI) and NACRES. The Georgia Carnivore Conservation Project was funded by the European Union. We sincerely thank all those who participated in or otherwise helped with the survey. Livestock farms were mapped by Amiran Kodiashvili and pastoralists were interviewed by Aleco Baghdadze. NACRES, VPA administration and the University of Oxford's WildCRU provided facilities and resources. Paul Johnson assisted with statistical analyses. We are grateful to Nino Markozashvili, Zaza Bostashvili, Irakli Shavgulidze, Bejan Lortkipanidze and Liesje Birchenough for their help, support and hospitality. We also thank Silvia Ribeiro and Daniel Mettler of CDP News whose suggestions and comments helped improve the manuscript.

## References

- Anon. (2014) National Biodiversity Strategy and Action Plan of Georgia 2014–2010. Tbilisi, Georgia, 106 p.
- Anthem H (2009) Report of November 2009 field visit to the villages of Qvemo Alvani, Zemo Alvani and Laliskhuri, Kakheti region, Georgia. Fauna & Flora International, Cambridge, 32 p.
- APA (2011) Draft management plan for Vashlovani Protected Areas for 2012–2017. Agency for Protected Areas of Georgia. Tbilisi, Georgia.
- Beradze I (2003) Georgian Mountain Dog - Georgian Shepherd Dog - Kartuli Nagazi. Fédération Cynologique de Géorgie, Tbilisi. 8 p.
- Bragina EV, Ives AR, Pidgeon AM, Kuemmerle T, Baskin LM et al. (2015) Rapid declines of large mammal populations after the collapse of the Soviet Union. *Conservation Biology* 29(3), 844–853.
- Coppinger R, Coppinger L (1995) Interactions between livestock and wolves. In: Carbyn LN, Fritts SH, Seip DR, editors. *Ecology and conservation of wolves in a changing world. Proceedings of the Second North American Symposium on Wolves*. Edmonton, Alberta, Canada, pp. 523–526.
- Coppinger R, Coppinger L (2001) *Dogs: a startling new understanding of canine origin, behavior and evolution*. Scribner, New York, USA, 352 p.
- Gehring TM, VerCauteren KC, Landry J-M (2010) Livestock protection dogs in the 21st century: is an ancient tool relevant to modern conservation challenges? *BioScience* 60(4), 299–308.
- Gintzburger G, Lachashvili N, Popiashvili T (2012) Rangeland condition and assessment in Vashlovani National Park and associated project areas. Fauna & Flora International/NACRES, Tbilisi, Georgia.
- Goldthorpe G (2016) The wolf in Eurasia: a regional approach to the conservation and management of a top predator in Central Asia and the South Caucasus. Fauna & Flora International, Cambridge, UK, 50 p.
- Iliopoulos Y, Sgardelis S, Koutis V, Savaris D (2009) Wolf depredation on livestock in central Greece. *Acta Theriologica* 54, 11–22.
- Kaczensky P (1999) Large carnivore depredation on livestock in Europe. *Ursus* 11, 59–72.
- Kikodze A (2007) Vashlovani Protected Areas – Field Guide. Georgia Center for the Conservation of Wildlife, Tbilisi, Georgia.
- Kikvidze Z, Tevzadze G (2015) Loss of traditional knowledge aggravates wolf–human conflict in Georgia (Caucasus) in the wake of socio-economic change. *Ambio* 44(5), 452–457.
- Leech BL (2002) Asking questions: techniques for semistructured interviews. *Political Science and Politics* 35(4), 665–668.
- MENRPG (2013) Management Plan for Vashlovani Protected Areas. Unpublished Report. Ministry of Environment and Natural Resources Protection of Georgia, Tbilisi.
- Mertens A, Schneider H (2005) What is wrong with Romanian livestock guarding dogs? A discussion. *Carnivore Damage Prevention News* 9, 9–14.
- Mühlfried F (2010) Did communism matter? - settlement policies from above and below in Highland Georgia. In: Tsitsishvili N, editor. *Cultural paradigms and political change in the Caucasus: collection of essays*. Lambert Academic Publishing, Saarbrücken, pp. 174–196.
- Ribeiro S, Dornig J, Guerra A, Jeremic J, Landry J-M et al. (2017) Livestock guarding dogs today: possible solutions to perceived limitations. *Carnivore Damage Prevention News* 15, 36–53.
- Rigg R (2001) Livestock guarding dogs: their current use worldwide. IUCN/SSC Canid Specialist Group Occasional Paper No 1, 133 p.
- Rigg R (2004) The extent of predation on livestock by large carnivores in Slovakia and mitigating carnivore–human conflict using livestock guarding dogs. MSc thesis, University of Aberdeen, UK, 263 p.
- Rigg R (2011a) Livestock guarding dogs: a manual of best practice. NACRES, Tbilisi, Georgia.
- Rigg R (2011b) Improving the effectiveness of livestock guarding dogs as used by the Tusheti sheep farmers of Eastern Georgia: Field report on provision of training. Fauna & Flora International, Cambridge, UK & Nacres, Tbilisi, Georgia, 37 p.
- Rigg R (2012) Improving the effectiveness of livestock guarding dogs as used by the Tusheti sheep farmers of Eastern Georgia: Monitoring plan for a trial of LGDs. Fauna & Flora International, Cambridge, UK & Nacres, Tbilisi, Georgia, 32 p.
- Rigg R, Sillero-Zubiri C (2010a) Baseline survey of human–carnivore conflict. Unpublished Report to Georgia Carnivore Conservation Project. Fauna & Flora International, Cambridge, UK & NACRES, Tbilisi, Georgia.
- Rigg R, Sillero-Zubiri C (2010b) Developing an HCC mitigation toolbox: A strategy for managing human–carnivore conflict in East Georgia. Unpublished Report to Georgia Carnivore Conservation Project. Fauna & Flora International, Cambridge, UK & NACRES, Tbilisi, Georgia.
- Rubin HJ, Rubin IS (1995) *Qualitative interviewing: The art of hearing data*. Sage, London, 291 p.
- Sedefchev S (2005) The Karakachan dog – continuation of an old Bulgarian tradition. *Carnivore Damage Prevention News* 9, 14–19.
- Sicard G (2003) Caucasian Shepherd Dog - Kavkazskaya Ovtcharka. Available: <http://molosserdogs.com/m/articles/view/1205-caucasian-shepherd-dog-kavkazskayaovtcharka>. Accessed April 2017.
- Sillero-Zubiri C, Sukumar R, Treves A (2007) Living with wildlife: the roots of conflict and the solutions. In: Macdonald DW, Service K, editors. *Key topics in conservation biology* Blackwell Publishing, Oxford, UK, pp. 266–272.
- Woodroffe R, Thirgood S, Rabinowitz A eds. (2005) *People and wildlife, conflict or coexistence?* Cambridge University Press, Cambridge, UK, 497 p.
- Zazanashvili N, Mallon D eds. (2009) Status and protection of globally threatened species in the Caucasus. Tbilisi: CEPF, WWF. Contour Ltd., 232 p.