



## A Review: The Use of Livestock Protection Dogs in Association with Large Carnivores in the Rocky Mountains<sup>1</sup>

C. Urbigit<sup>1,2</sup> & J. Urbigit<sup>2</sup>

<sup>1</sup> Corresponding Author: [catu2@mac.com](mailto:catu2@mac.com) P.O. Box 1663, Pinedale WY 82941, 307-276-5393

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<sup>2</sup> The authors are western Wyoming sheep producers.

### Summary

Livestock protection dogs (LPDs) in the United States have helped to protect livestock herds from certain predators, but expanding, large-carnivore populations pose new challenges, and the number of LPDs killed by large predators is increasing. We conducted a literature review to identify LPD breeds that may be more suited for use around large carnivores, such as gray wolves. The use of spiked collars to increase the survivability for LPDs in areas of coexistence with large carnivore populations is also discussed. This paper advances the adoption of techniques and LPD breeds used outside of the United States in areas where large carnivores exist with livestock production.

**Key Words:** Bears, Carnivores, Livestock, LPD, Protection Dogs, Wolves

### Introduction

The traditional use of livestock protection dogs (LPDs) has been pivotal to the historical coexistence of gray wolves (*Canis lupus*) and domestic sheep (Rigg 2001) in Europe and Asia, but the use of LPDs in the Rocky Mountains of the United States is a relatively new venture. Most modern LPD use in the Rocky Mountains originated after the 1970s passage of the Endangered Species Act and the concurrent ban on the use of most poisons on public lands (Feldman 2007). Livestock producers

sought for alternate methods of predator control at the same time efforts were initiated to protect large carnivores, such as grizzly bears (*Ursus arctos*) and gray wolves. LPDs of several breeds were imported into the United States under an organized program in the 1970s, and use of these dogs as a non-lethal tool has since expanded (Dohner 2007). LPDs have proven to be effective in reducing predation to livestock herds, including cattle, sheep, and goats, from various species of predators (Andelt 2004), but expanding populations of large carnivores provide new challenges. Livestock producers in areas with large carnivores are experiencing similar problems, whether in the United States or in other countries, including Finland, where there are no LPD traditions (Otstavel et al. 2009). Agricultural producers in the western United States have the highest reported economic losses due to wildlife damage, and those losses occur on the patchwork land ownership of public and private lands (Messmer 2009).

Effective management of predator damage at the edges – defined as the intersections of carnivores, people and livestock – are where efforts now need to be focused, using methods that allow the coexistence of livestock and large predators (Shivik 2006). While some advocate the adoption of new strategies and approaches to address wildlife damage concerns (Messmer 2009), we advocate the adoption of ancient approaches for use in this new world of large-carnivore recovery.

Western Wyoming provides a natural laboratory for the study of conflict with large carnivores, since it contains reintro-

duced gray wolf and recovering grizzly bear populations amid livestock production. As these species have reached biological recovery goals and expanded their ranges, conflicts with livestock have escalated (Sommers, et. al. 2010). Various methods to reduce conflict, both lethal and non-lethal, have been used. While smaller predator species, including the most common and most serious predator of livestock in the western United States, the coyote (*Canis latrans*), are subjected to numerous control methods, recovering populations of large carnivores are granted special protections, that limit the methods of control.

In general, as these rare, threatened or endangered species populations recover, managers seek more sustainable management options rather than automatic lethal control when conflicts arise. Effective conflict management seeks to prevent or reduce the frequency or severity of conflicts; deal with the individuals that cause the conflict (most often through removal); and increase tolerance for carnivores (through education, compensation, harvest, etc.) (Sillero-Zubiri et al. 2007).

All control methods, lethal or non-lethal, will fail at some time, in some situations. Control methods are simply tools in a toolbox, that when used help to reduce the amount or severity of conflict. One of the most important tools for resolving conflict is lethal control. Shivek (2006) noted that to ensure the successful reintroduction of some predators, it may be necessary to lethally control them.

Shivik (2006) called the use of LPDs "old technology of special note due to its recent popularity," while adding that guardian animals may be useful in a theoretic way as "continued understanding of their training and use may result in what amounts to the ultimate disruptive stimulus device."

Western Wyoming's pattern of land ownership includes the majority of acreage administered by federal agencies, with most of the remainder held in private ownership as ranches. The lowest elevation of this arid region is about 5,500 feet, and large acreages are needed to provide enough forage for cattle and sheep operations. Thus, most of the ranches graze their herds at least a portion of the year on federally administered land. Nearly 70 percent of the nation's

sheep inventory is found in the western states, and an estimated 25 to 30 percent of all sheep in the United States graze on public land allotments (National Research Council 2008). Some range sheep herds spend nearly all year on public land, grazing in lower-elevation deserts free of deep snows in the winter, moving to higher-elevation mountain pastures as the snow melts in the summer. Sheepherders live in wagons alongside the herds, with camp tenders checking on them every few days and bringing supplies to the herders. Similar to nomadic cultures in other areas of the world, range sheepherders in the western United States also practice transhumance, moving herds with the seasons and using LPDs to protect them (Gehring et al. 2010). Herds graze over hundreds of miles of range and often go unnoticed by the public although their grazing practices are regulated by federal agencies (Urbigkit 2008, National Research Council 2008). Most range-sheep operations utilize land that is primarily unfenced and unimproved, that involves long-distance movements from season to season and requires on-site herders (National Research Council 2008).

The LPDs live with the herds full time. Most herd's sheep are highly gregarious western, white-faced sheep, primarily of the Rambouillet breed. They

have a strong flocking instinct, which helps in guarding against predation. Each herd, usually consisting of about 1,000 ewes and their lambs, will have two to five protection dogs (Andelt 2004). The sheep herd spreads out up to about one-square mile to graze during the day, but bed together in a tighter group at night (P. Arambel personal communication 2-21-2010).

Range-sheep producers in western Wyoming have individual ranch operations, with changing LPD populations. For example, one sheepman might place five dogs with each band of sheep, and three bands are trailed to separate mountain pastures. Some bands may retain all their dogs, while other bands may gain or lose dogs, so that one band may have two dogs and another may have seven. In other cases, the dogs associated with each band may not see other LPDs until late in the fall, when the sheep come off the mountain and the dogs converge at sorting pens. The dogs belonging to one ranch will travel with their sheep herds to a shared winter range, where herds and dogs from other ranches are encountered (some from Utah, Colorado, Idaho, and Wyoming). The LPD population constantly changes as the dogs mature, are hurt or killed. Some dogs may leave their herd to go with an adjacent herd, and owners will switch ownership of dogs,



*Two Akbash females (yearling female on left, her five-year old mother on right) at play. Akbash have proven to be effective at guarding herds in large carnivore country, but the use of spiked collars on these dogs may improve their ability to survive aggressive encounters with wolves and are used in their country of origin for this purpose. Photo by Cat Urbigkit.*

“borrowing” studs for breeding. No specific breed is maintained in this natural-breeding program, but the most fit dogs breed (males fight for breeding rights) and only the strong pups survive.

It has been reported that the most common LPDs used in the United States are Great Pyrenees, Akbash and Komondor, with Anatolian Shepherd, Maremma, Shar Planinetz used to a lesser extent (Andelt 2004). These dogs usually weigh from 75 to 100 pounds, and have been very successful at reducing predation from coyotes (Andelt 2004).

The need to achieve a balance of human contact with LPDs, so the dogs are bonded to their sheep while capable of being handled by their owners, was discussed in early bulletins for agriculturalists in the United States (Green and Woodruff 1983, Green and Woodruff 1990). Other early LPD researchers in the United States advised that LPDs should be left to bond with their animals, with little human contact (Lorenz and Coppinger 1988). Our observations in the Rocky Mountains indicate that the method limiting human contact has resulted in dogs well bonded to their sheep, but with little or no bond to their human owners. As a result, owners have LPDs that are shy of humans, and cannot even be caught by their owners for veterinary treatment. Similar results have been reported from other countries that used similar techniques, including Switzerland (Landry 2005).

In the United States, LPDs are used to protect against coyotes, but the original LPD breeds were developed in Asia and Europe to combat predation by large carnivores—brown bears and wolves (Smith et al. 2000). Smith summarized recorded accounts of LPDs and bears in the United States and several other countries, where LPDs successfully repelled bears, and losses were reduced when flocks were protected from bear depredation by LPDs.

While LPDs are successful at repelling black bears (*Ursus americanus*) and grizzly bears during most encounters (Andelt 2004), their effectiveness against wolves has met with mixed results. The number of conflicts between LPDs and wolves is increasing in the Rocky Mountains of the United States, with 83 LPDs killed by wolves in this region from 1985 to December 2005 (Bangs et al. 2006). Confirmed fatal wolf



*This adult male Great Pyrenees livestock protection dog shows the battle scars of previous predator encounters. Great Pyrenees dogs often do not survive their encounters with wolves. Photo by Cat Urbigkit.*

attacks on LPDs are only a fraction of all wolf-caused deaths, since many LPDs will simply disappear, with their fate unknown (Bangs et al. 2005).

Most (11 of 18 = 61 percent) of the documented fatal wolf attacks on LPDs from 1995 through 2004 in the Yellowstone region of the Northern Rockies involved the killing of Great Pyrenees LPDs (Bangs et al. 2005). Researchers suggest that these conflicts involved LPDs that were outnumbered and outweighed by their wild counterparts (Bangs et al. 2005).

There are similar reports of wolves killing LPDs in France, and both hunting dogs and LPDs in Italy (Rigg 2001). Wolves in the United States have been taking their toll on hunting dogs, as well. There were 49 hunting dogs confirmed as killed by wolves in Wisconsin 2004 through 2006, with an additional 10 injured (Ruid et al. 2009). The 35 dogs confirmed to have been killed by wolves in Montana, Idaho and Wyoming during 2006 to 2008 included LPDs, hunting dogs, and pets (U.S. Fish and Wildlife Service 2009).

In one stunning case in Romania, wolves killed 157 adult LPDs from January 2001 to October 2002, with wolves consuming the majority of the carcasses in most cases, and leaving the nearby livestock unscathed. This situation appeared to be the result of one wolf pack that had specialized in preying on dogs (Mertens and Schneider 2005).

## Materials and Methods

We conducted a literature review of references from around the world to gain insight to increasing the effectiveness of LPDs in wolf range in two ways: a) By identifying survival tools that may provide existing LPDs more protection from wolves to better their chances of staying alive to guard their herds; and b.) By identifying different LPD breeds more suited to facing wolves, that could be utilized in the Northern Rockies of the United States. In selecting LPD breeds, the following criteria were used:

- Must be canine-aggressive, so that the dogs are inclined to actively challenge wolves;
- Must not be human aggressive, since many herds graze on public lands for part of the year;
- Should originate in areas with large carnivores to take advantage of working characteristics similar to that to be faced in the Northern Rockies; and
- Must not be of small body size, so that the animals stand a better chance against large carnivores.

Some breeds that may work well in the United States were left off the list of potential breeds because of their rarity and/or prohibition of export out of countries of origin.

## Results and Discussion

Just as wolves have been persecuted throughout the world, with wolf popula-

tions falling to near extinction in some countries, the LPDs that protected their flocks from wolf predation have fallen to the same fate (Rigg 2001). Without pressure from large carnivores and with livestock herds decreasing worldwide, use of LPDs decreased to the extent that there are now recovery programs in place (Rigg 2001) to get these dogs back onto their historic landscapes to address expanding, large-carnivore populations.

The spread of communism in Europe and Asia brought with it an active campaign of collectivized agricultural policy, which worked to rid entire regions of its free people—the nomadic livestock cultures. Livestock and their guard dogs were killed or collectivized, and their nomadic herders and families were taken from the land (Gehring et al. 2010). When the herders became villagers, the cultures lost their old traditions (Ivanova 2009).

In the 1930s, demand for dog skins resulted in the destruction of the largest dogs available, rabies campaigns called for wholesale extermination of all dogs in certain regions, including LPDs (Ivanova 2009), as well as later intermixing of dog breeds and dog diseases taking tolls on native dog populations. The loss of interest in livestock husbandry, as well a decline in predator populations as a result of persecution by humans, also played a role in the reduction of working LPDs (Cruz 2009). Recent interest in dogs declared as members of “national” dog breeds has resulted in a greater demand for dogs in the pet trade than as working animals. Additionally, some LPDs are now being used and bred for dog fighting rather than guarding herds (Cruz 2009, Plakhova and Plakhova 2008).

Ovcharkas (both Central Asian and Caucasian) are used in the dog-fighting ring in current times, including in Central Asia and Russia. While there is much criticism of dog fighting, traditional dog fights in Asia are not like pit bull dog fights in America, which involve severe injury or the death of the dog. Dog fights involving LPDs in their historic context of nomadic people play an entirely different role—that of testing the best dogs as wolf fighters, and promoting the best dogs for breeding. Dogs with the proper drive, tenacity and strength needed to confront and kill a

wolf are selected to pass their genes on to the next generation. Serious injuries are reported to occur rarely since these matches are conducted to observe traits, such as dominance display, agility and physical strength ([http://www.centralasianshepherd.us/cao\\_or\\_alabai.html](http://www.centralasianshepherd.us/cao_or_alabai.html), accessed Nov. 1, 2009).

Dogfights, which are called “wrestling” in Central Asia, serve to test a dog’s level of canine aggression and have a set of stringent rules developed over centuries (Gasymzade and Azizov 2007). Any dog that is inactive or cries is determined to have lost, and human handlers end the match. Signs of submission end the fight as well. Traditional LPD dogfights or wrestling matches involve the dogs’ controlled aggression, not blind fury as seen in pitbull-type fighting. In LPD matches, the fights begin and end quickly, and the result is a determination of the best dogs to fight wolves. One champion fighting dog, a Caucasian Ovcharka dog that lived in Russia in the 1930s, was believed to have killed 100 wolves in his lifetime, an enviable record (Gasymzade and Azizov 2007).

The willingness to aggressively challenge a wolf can be an important factor in a LPD’s effectiveness. Sedefchev (2005) told the story of seeing a Great Pyrenees LPD chase a wolf a short distance before the dog left the wolf, but continued to bark. The researcher noted “the dogs show him with their behavior that they are not a real obstacle, and the wolf’s success is just a question of time” (Sedefchev 2005). The story continued, “When the dogs chase the wolf with the intention to kill it, this means much more for the wolf” (Sedefchev 2005).

In contrast to the Great Pyrenees, the Karakachan dog of Bulgaria has been known to chase a wolf away from the flock for nearly a mile and a half. It has been reported that after such encounters, wolves leave that flock alone and turn their attention to other flocks (Dohner 2007). Dohner (2007) wrote, “The shepherds believe that their dogs must show this level of dedication to harassing and even attacking wolves in order to combat the strong predator pressure in the area; therefore they value physically strong, confident dogs.”

#### a. Survival tools/spiked collars

Some breeds of LPDs already in use

in the Northern Rockies, such as the Akbash, demonstrate proper canine aggression and have proven to be an effective LPD breed, but individuals of this breed have been killed by wolves. Our review found that in other regions of the world, where LPDs and wolves coexist, the use of spiked, anti-wolf LPD collars is common, and herders use several LPDs with each herd, the number varying from two to five.

The use of spiked, anti-wolf collars on LPDs has been reported from various regions of the world, including Italy, Poland, Romania, Spain, Turkey, and Portugal (Rigg 2001, Cruz 2009). Unfortunately, there is little detailed information in written literature about this LPD survival tool. Use of spiked collars has been very limited in the Rocky Mountains, based on a variety of factors including questions of how to properly use them; concern about the safety of the collars where there are barbed or woven wire fences and heavy brush, and frigid temperatures and snow; as well as the lack of access to the collars.

*Iron, leather and webbing collars on sale in the Ankara market in Turkey. Photo courtesy Sir Terence Clark.*



There are two general types of spiked collars—leather or fabric and iron. Leather or fabric collars may be a safe alternative during the winter months when herders are concerned about harm to the dogs from having iron collars on their dog's necks with snow and cold temperatures. The heavy iron collars, if manufactured of a large enough size to drape over the lower portion of a LPD's neck, may provide enough room for the dog to slide the collar over its head should it become hung up in a fence or brush. Although herders live with the dogs in range-sheep outfits, the dogs are not always in sight and only may be seen once or twice a day. In this situation, ensuring the safety of the collars is an important consideration.

The use of spiked collars is worth exploring for existing LPDs in wolf country of the Northern Rockies. Spiked collars may reduce the amount of inter-pack aggression and dog fights in more aggressive breeds of LPDs guarding a herd. Spiked collars may also find a use in protecting hunting dogs in the United States as well.

### b.) Potential wolf-fighting breeds

Using the criteria described earlier, our review determined the list of breeds with high potential to protect livestock

herds in the Northern Rockies from large carnivore predation include Central Asian Ovcharka, Transmontano Mastiff, Karakachan, Kangal, and Shar Planinetz.

**Central Asian Ovcharkas** are believed to be one of the oldest breeds of dogs on Earth (Plakhova et al. 2008) and are raised in their countries of origin from birth with sheep. Central Asian Ovcharkas (also known as Central Asian Shepherds) have various names in their countries of origin, including Aziat in Russia, Alabai or Kopek or Volkodav ("wolf killer") in Turkmenistan, Tobet in Kazakhstan, Sage Koochee in Afghanistan, and Dakhtarma in Tajikistan, but they all fall into the Ovcharka group which was developed by peoples with a nomadic pastoral lifestyle over large territories (Plakhova and Plakhova 2008, Ivanova 2009). Herdsmen, called chobans, rejected dogs that were aggressive to humans (Ivanova 2009). Ivanova wrote: "The Central Asian Ovcharka was developed by the native peoples of Central Asia to fit their nomadic way of life. The specific nature of their way of life has determined the need for a reliable protection dog. This is an ancient livestock protection breed with innate instincts for guarding animals and property. In different countries with nomadic

life and sheep breeding, there was a need for a reliable guard dog that did not make demands on the conditions of life" such as the limited resources involved in a subsistence lifestyle (Ivanova 2009). This breed is known for loyalty to people, and it has been reported that for centuries in their countries of origin, individual dogs of this breed that were aggressive to humans were killed (Bagiev 2006).

**The Transmontano Mastiff** of Portugal is a breed that originated in a pastoral livestock system where stock are grazed in uncultivated areas away from villages, with the continuous presence of wolves leading to its functional body structure of massiveness with long head and limbs, which enable it to travel with the herds (Cruz 2009). Ninety-five percent of the northern Transmontano LPD population is still used to protect extensive sheep flocks from wolf predation (Dohner 2007). An aggressive program to reduce wolf predation on sheep and cattle herds in Portugal's Montesinho Natural Park was begun in 1994, placing Transmontano Mastiff LPD pups with herdsmen. The result has been a reduction in the amount of damage caused by wolves ([www.caodegadotransmontano.org.pt](http://www.caodegadotransmontano.org.pt), accessed 10/30/09). The breed is described as quite reserved and docile, while not being highly aggressive.

**The Karakachan Dog** is an aboriginal LPD breed of Bulgaria, developed by nomadic people who practiced transhumance with their herds. After World War II, nationalization of land in Bulgaria began, with nomads forced into villages and livestock placed on state cooperative farms. Many dogs were killed, and when the state farms were discontinued in 1991, much of the livestock and LPDs were killed as well (Sedefchev and Sedefchev 2009). Official recognition of the Karakachan as a breed under Bulgarian law did not occur until 2005. A program was begun in Bulgaria in 1996 to conserve the Karakachan LPD and its original type and working abilities, and this program has focused on "conservation of predators, livestock, pastures and pastoral traditions: conservation of the unique symbiosis between all these elements" (Sedefchev and Sedefchev 2009). According to Sedefchev and Sedefchev: "We unite the conservation of a guardian and a predator, because evolutionarily they devel-



*This is a yearling female Central Asian Ovcharka at work guarding sheep. The sheer size and canine aggression of this breed makes it an appropriate breed for consideration in areas of large carnivore populations. Photo by Cat Urbigit.*



*Turkish Kangal LPD with iron collar in Turkey. Photo courtesy Sir Terence Clark.*

oped together. Survival of the guardian depends on the survival of the predator and vice versa.” The program, which places LPDs with shepherds, has resulted in a reduction of harm from predation of about 80 percent in areas inhabited by large carnivores (Sedefchev and Sedefchev 2009). Karakachan dogs of Bulgaria live amid one of the highest densities of bears and wolves in Europe (Dohner 2007), and react accordingly. The dogs work in teams and actively chase and harass wolves (Dohner 2007).

**The Turkish Kangal** is a LPD that is able to fight wolves, and rather than just try to deter the predators, Kangals reportedly prefer to kill wolves (Tepeli and Tepeli 2008). Kangals are famous for their fierce battles with predators, and many adult dogs in their country of origin carry battle scars (Dohner 2007). Kangal pairs are known to work as a team to attack a wolf, with the smaller female chasing and blocking, while the larger male rushes in and hits the wolf with his chest, knocking it to the ground. The animals are raised in villages with children and small animals, and are known for their steady temperament and gentle manner (Dohner 2007).

Macedonia’s **Shar Planinetz** or **Sarplaninac (Shar)** is a slightly smaller LPD, but its heavy-boned structure and its canine aggression make this a viable breed for protecting flocks from wolves (Dohner 2007).

## Conclusions

It is recommended that range sheep producers in the Northern Rockies try using groups of two to five of these LPDs to protect each of their herds, with the objective of outnumbering and outweighing wolves or other large carnivores encountered. Individual dogs will have different behavioral and guarding tendencies, so developing the proper mix of traits into a group of LPDs may take time and readjustment of the animals involved.

The proper use of spiked collars should be explored as well. Producers considering using spike collars in the United States need to have an understanding about proper collar use. Unanswered questions at this time include: are collars used on younger dogs to stop littermate fighting and does this have an impact on the dog’s willingness to fight later on; are the collars worn by dogs year-round, or only when entering wolf areas/times; are they placed on dogs only when wolf presence is detected or predation begins; what’s the difference between iron and leather; how/why is cloth held to iron collar. If the collars can be designed in such a manner as to not pose a safety risk to LPDs in the United States, then a program for their design, manufacture and distribution is needed.

Those seeking to acquire LPDs from their countries of origin should note that although “herding” dogs in the United

States are defined as breeds such as the border collie, some LPDs are called “herding” dogs also, but in a different context. Some strains or lineages of certain breeds are called property protection dogs (Bagiev 2006). These dogs stay within defined property boundaries, and some are to protect the property from thieves. Other strains of the same breed are called herding dogs because they stay with livestock herds to protect them from wolves and no aggression towards humans is acceptable. The Caucasian Ovcharka is an example of a breed with these two different types of protection dogs, which is also reflected in the physical confirmation of the two (Bagiev 2006). The wolf-fighting or herding type is found in the North Caucasus where there are migratory sheep herds. Bagiev 2006 reports that “a pack of dogs resembling a pride of lions is present with each animal herd” and the dogs not only protect the herd, but control its movements as well.

Kazakhstan has the highest density of wolves in the world, and LPDs are the only reliable form of protection against predation there (Plakhova et al. 2008). The importance of LPDs is reflected in the Kazakh proverb, “The dog is more important than sheep” (Plakhova et al. 2008).

It should be noted that even if livestock producers use the most effective LPDs, there will inevitably be conflict between wolves and livestock, and their human and canine guardians. Instead of eliminating this conflict, management programs should aim to reduce the amount and severity of that conflict.

LPDs can reduce sheep depredation by 11% to 100%, and most livestock producers surveyed viewed LPDs as an economic asset, with high economic efficiency for a relatively low cost (Gehring et al. 2010). Livestock producers also note that the use of LPDs does not require assistance from government agencies or rely on advanced technology (Gehring et al. 2010).

We concur with the Gehring et al. (2010) recommendation that additional research on LPD behavior in terms of effectiveness for protecting livestock from large carnivores is needed, as is an information exchange between producers who use LPDs in the presence of large carnivores in their countries of origin and those who are new to the interaction of LPDs and large carnivores.

In writing about the use of livestock guard dogs in Asia, Ivanova 2009 explained the relationship of the nomadic culture, their herds, herd protectors, and the landscape upon which they all depend: "Experience accumulated during hundreds of years is passed on for generations and it has achieved a high degree of perfection that cannot be improved any further but only preserved". While livestock producers in the Northern Rockies have been able to use some of the same tools used by these nomadic cultures, what has been lacking is the full range of techniques, and knowledge of how to use them. Tapping into the knowledge and tradition of ancient LPD cultures will help to fill that void.

## Literature Cited

- Andelt, W. F. 2004. Use of livestock guardian animals to reduce predation on sheep and livestock. *Sheep and Goat Research Journal* 19: 72–75.
- Bagiev, Z. 2006. Faithful and fearless. *Russian Primitive and Aboriginal Dog Society Newsletter* 7: 4–10.
- Bangs, E., M. Jimenez, C. Niemeyer, J. Fontaine, M. Collinge, R. Krishcke, L. Handegard, J. Shivik, C. Sime, S. Nadeau, C. Mack, D. Smith, V. Asher and S. Stone. 2006. Non-lethal and lethal tools to manage wolf-livestock conflict in the northwestern United States. Pages 7–16 in R. M. Timmand and J.M. O'Brien, editors. *Proceedings of the 22nd Vertebrate Pest Conference*, University of California. Davis, California, USA.
- Bangs, E., M. Jimenez, C. Niemeyer, T. Meier, V. Asher, J. Fontaine, M. Collinge, L. Handegard, R. Krishcke, D. Smith and C. Mack. 2005. Livestock guarding dogs and wolves in the northern Rocky Mountains of the United States. *Carnivore Damage Prevention News*, 8:32–39.
- Cruz, C., 2009. Livestock guarding dogs from Portugal: a review of current knowledge. *Primitive and Aboriginal Dog Society Newsletter* 20: 11–34.
- Dohner, J. 2007. *Livestock Guardians: Using Dogs, Donkeys and Llamas to Protect Your Herd* (Storey's Working Animal Series). Storey Publishing, North Adams, Massachusetts, USA.
- Feldman, J.W. 2007. Public opinion, the Leopold Report, and the reform of federal predator control policy. *Human–Wildlife Conflicts* 1(1): 112–124.
- Gasymzade, I. and N. Azizov. 2007. Do we need dogfights? *Russia Primitive and Aboriginal Dog Society Newsletter* 11: 8–10.
- Gehring, T.M., K.C. VerCauteren and J.L. Landry. 2010. Livestock protection dogs in the 21st Century: Is an ancient tool relevant to modern conservation challenges? In Press, *BioScience* 2010.
- Green, J.S. and R.A. Woodruff. 1983. Guarding work effectively, and a fuller appreciation of some dogs protect sheep from predators. *Agricultural Information Bulletin No. 455*, Agricultural Research Service and Extension Service, U.S. Dept. of Agriculture, Washington, D.C.
- Green, J. S. and R. A. Woodruff. 1990. Livestock guarding dogs: protecting sheep from predators. *Agriculture Information Bulletin No 588*, Agricultural Research Service and Extension Service, U.S. Department of Agriculture, Washington, D.C.
- Ivanova, T. M. 2009. The Central Asian Ovcharka: On some problems of preserving the breed. *Primitive and Aboriginal Dog Society Newsletter* 20: 3–11.
- Landry, J-M., A. Burri, D. Torriani and C. Angst. 2005. Livestock guarding dogs: new experience for Switzerland. *Carnivore Damage Prevention News* 8: 40–48.
- Lorenz, J.R. and L. Coppinger. 1988. *Raising and Training a Livestock-guarding dog*. ER1238, Oregon State University Extension Service, Oregon State University, Corvallis, Oregon.
- Mertens, A. and H. Schneider. 2005. What is wrong with Romanian livestock guarding dogs? A discussion. *Carnivore Damage Prevention News* 9: 9–14.
- Messmer, T. A. 2009. Human–wildlife conflicts: emerging challenges and opportunities. *Human–Wildlife Conflicts* 3(1):10–17.
- National Research Council. 2008. *Changes in the sheep industry in the United States: Making the transition from tradition*. Committee on the Economic Development and Current Status of the Sheep Industry in the United States. The National Academies Press, Washington, D.C.
- Oststavel, T., K. A. Vuori, D. E. Sims, A. Valros, O. Vainio, and H. Saloniemi. 2009. The first experience of livestock guarding dogs preventing large carnivore damages in Finland. *Estonian Journal of Ecology*, 58, 3, 216–224.
- Plakhova, K.N. and A.S. Plakhova. 2008. The Kazakh Tobet – myth, reality and necessity. *Primitive and Aboriginal Dog Society Newsletter* 12: 25–27.
- Plakhova, K.N., A.S. Plakhov, and M. Kh. Eleusizov. 2008. Aboriginal dogs breeds as full value elements of biodiversity and the cultural heritage of the peoples of southwestern Asia. *Primitive and Aboriginal Dog Society Newsletter* 16: 3–7.
- Rigg, R. 2001. Livestock guarding dogs: their current use world wide. *Occasional Paper 1*, Species Survival Commission, International Union for the Conservation of Nature and Natural Resources, Gland, Switzerland.
- Rigg, R. 2004. The extent of predation on livestock by large carnivores in Slovakia and mitigating carnivore-human conflict using livestock guarding dogs. Thesis, University of Aberdeen, Aberdeen, Scotland.
- Ruid, D. B., W. J. Paul, B. J. Roell, A. P. Wydeven, R. C. Willging, R. L. Jurewicz, and D. H. Lonsway. 2009. Wolf–human conflicts and management in Minnesota, Wisconsin, and Michigan. Pages 279–296 in A. P. Wydeven,, T. R. Van Deelen, and E. J. Heske, editors. 2009. *Recovery of gray wolves in the Great Lakes Region of the United States: an endangered species success story*. Springer Science. Berlin, Germany.
- Sedefchev, S. 2005. The Karakachan dog – continuation of an old Bulgarian tradition. *Carnivore Damage Prevention News* 9: 14–19.
- Sedefchev, A. and S. Sedefchev. 2009. The Karakachan dog: preservation of the aboriginal livestock guarding dog of Bulgaria. *Primitive and Aboriginal Dog Society Newsletter* 18: 1724.

- 
- Shivik, J. A. 2006. Tools for the edge: what's new for conserving carnivores. *Bioscience* 56: 3, 253-259.
- Sillero-Zubiri, C., R. Sukumar and A. Treves. 2007. Living with wildlife: the roots of conflict and the solutions. Pages 253–270 in D.W. Macdonald, and K. Service, editors. *Key topics in conservation biology*. Blackwell Publishing, Oxford, England.
- Smith, M. E., J. D. C. Linnell, J. Odden and J. E. Swenson. 2000. Review of methods to reduce livestock depredation: I. guardian animals. *Acta Agriculturae Scandinavica, Section A-Animal Science* Volume 50:279–290.
- Sommers, A.P., C.C. Price, C. D. Urbigkit, and E.M. Peterson. 2010. Quantifying economic impacts of large carnivore depredation on calves. In Press, *Journal of Wildlife Management*.
- Tepeli, C. and T. Taylor. 2008. Utilization of Turkish Shepherd dogs in Turkey. *Primitive and Aboriginal Dog Society Newsletter* 14: 13–23.
- Urbigkit, C. 2008. Livestock guardian dogs in the northern Rocky Mountains. *Primitive and Aboriginal Dog Society Newsletter* 13: 2–6.
- U.S. Fish and Wildlife Service, Nez Perce Tribe, National Park Service, Montana Fish, Wildlife & Parks, Blackfoot Nation, Confederated Salish and Kootenai Tribes, Idaho Fish and Game, and USDA Wildlife Services. 2009. *Rocky Mountain Wolf Recovery 2008 Interagency Annual Report*. C.A. Sime and E. E. Bangs, editors. USFWS, Ecological Services, Helena, Montana.