Online ISSN: 2588-3526

Journal of Wildlife and Biodiversity

Volume 5 (2): 44-55 (2021) (http://www.wildlife-biodiversity.com/)

Research Article

Analysis of conflict reduction strategies in Iran; case study: Kharvana district, East Azerbaijan province

Naser-e-Asr Behnam, Habibzadeh Nader*

Department of Environmental Science, Tabriz Branch, Islamic Azad University, Tabriz, Iran

*Email: habibzadeh@iaut.ac.ir

Received: 29 June 2020 / Revised: 11 August 2020 / Accepted: 25 August 2020 / Published online: 30 October 2020. Ministry of Sciences, Research, and Technology, Arak University, Iran.

How to cite: Benham, N. A., & Nader, H. (2021). Analysis of conflict reduction strategies in Iran; case study: Kharvana district, East Azerbaijan province. Journal of Wildlife and Biodiversity, 5(2), 44-55. https://doi.org/10.22120/jwb.2020.130088.1160

Abstract

Nowadays, population growth and the exploitation of the natural environments lead to encroachment of human activities in wildlife habitats, which increases human-wildlife conflicts, especially with carnivores. The investment of livestock owners and natural conservationists for mitigating these inconsistencies is vital. There is more evidence of an increasing trend in the complaints reported by Kharvana herders on wolf damages. This study aimed to capture people's attitudes about wolves and investigate the familiarity and feasibility of four nonlethal methods, including attractant removal, guarding dogs, alarm and scare tactics, and moving livestock for reducing the wolf depredation on small livestock (goat and sheep) in the region of interest. In this study, 15% of the herders in each village from Kharvana were selected for interviews. We analyzed survey responses from 77 Kharvana-based herdsmen. Surprisingly, the results indicated that although the majority of survey respondents reported an insufficient current level of protection from wolves and had a high desire to eliminate and kill wolves. There was a considerable number of responses that neither agreed nor disagreed with having experienced negative impacts from wolves. We found that there is a perceived feasibility of implementing all four strategies in areas used as wintering feeding sites compared to areas that are allowed to be grazed during the warm part of the year. The use of guarding dogs (median rank = 1) was the most and significantly locally-feasible livestock protection measure (Friedman $X^2(3) = 118.6$, $P<0.0001$) for inclusion in conflict reduction programs that have already been used in the Kharvana area by the most herdsmen.

Keywords: Conflict, conservation, herder, nonlethal, small livestock, wolf

Introduction

Globally, human-wildlife interactions which date back to antiquity and have been continuing to persist in the 21st century (Graham et al., 2017) pose substantial food and economic threats to human (Treves & Karanth, 2003). Therefore, people have applied a variety of strategies to eliminate depredating predators despite ethically and scientifically restrictions that are available behind this human approach (Fortin et al., 2005; Hebblewhite et al., 2005). Subsequently, the investment in the mitigation measures of wildlife-human conflict has been a pivotal action on biodiversity conservation (Clark et al., 2017; Madden, 2004).

Livestock losses by predators can have high economic costs and cause emotional stresses for individual livestock producers (Bangs et al., 1998; Bangs & Shivik, 2001; Naughton-Treves et al., 2003), for example, in Norway bears and wolves on average killed 82 and 41 sheep annually (Kaczensky, 1999). It is not surprising, and then, while current conservation strategies have been attempting to shift historical human-predator interactions from control to coexistence (Bergstrom, 2017), this paradigm has not occurred for all predators in all places (Nelson et al., 2016). Predators shift their dietary preferences toward livestock prey and overlap their distribution with livestock prey distribution (Newsome et al., 2015). Hence, livestock producers eliminate the aggressive predators from those landscapes as an effective strategy to mitigate negative predator impacts (Treves & Karanth, 2003).

The gray wolf (*Canis lupus*), as one of the most widespread terrestrial species, occurs in a variety of habitats (Mech & Boitani, 2004), including arid environments in west Asia (Mech & Boitani, 2010). This apex predator is native to Iran, where there are frequent reports of the wolf predation on livestock due to habitat destruction and extermination of their prey (Behdarvand et al., 2014; Nematpour & Habibzadeh, 2019). The combination of this phenomenon with the engagement of wolves in the surplus killing of less protected livestock have currently bear a substantial portion of the cost of growing predator populations through the provision of livestock as an important source of prey for livestock agricultures (Muhly & Musiani, 2009) and in turn, provoke poaching and heavy harassment of wolves (Mech & Boitani, 2004; Ziaie, 2011).

The use of compensation programs as a common tool to reimburse livestock owners for lost potential revenue due to confirmed wolf depredation events (Ravenelle & Nyhus, 2017) is also used by the Iranian Department of the Environment (DoE). Yet, this program may compensate the livestock owners for the role they have in the conservation of predators (Steele et al., 2013) and ignore the indirect costs of predator (Clark et al., 2017; Cooke et al., 2013; Kluever et al., 2008; Laporte et al., 2010). Tools available to alleviate predator-caused economic losses, other than compensation from the government for damage, are various preemptive conflict reduction strategies. Some tools available are non-lethal strategies such as fencing, herding, stalling at night, guarding dogs, translocation, calving control, and deterrents (Andelt, 1999; Bruns et al., 2020; Marker et al., 2005). Other tools available are lethal strategies such as trapping, snaring, and shooting (Pearson & Caroline, 1981). Although there is a high degree of variation within the application of mitigation strategies reducing the risk of large carnivore predation (Eklund et al., 2017), effective mitigation strategies that balance wildlife conservation and sustainable agriculture are needed (Johnson & Wallach, 2016). There is a consensus among activists, the general public's attitude, and academic wildlife groups of a preference for "more humane" non-lethal methods

(Bergstrom, 2017; Slagle et al., 2017; Treves et al., 2016).

Non-lethal tools include aversive conditioning techniques, livestock protection animals, separation of livestock from predators using physical barriers, and animal husbandry practices (Brown, 2011). The goal of using aversive and disruptive stimuli is to aversively condition wolves from utilizing livestock as prey (Brown, 2011). Domesticated dogs' use to protect livestock has been developed in Europe and Asia for thousand of years ago (Brown, 2011). Physical barriers for deterring wolves from pastures with livestock as a promising tool can reduce the frequency of encounters between wolves and livestock in field situations (Brown, 2011). Livestock practices such as managing food attractants (e.g., carcass disposal), detecting livestock vulnerability, and human presence can be useful for reducing livestock losses to wolves (Brown, 2011). There is evidence that suggests proactive use of nonlethal techniques applied conditionally can be sufficient to reduce depredation on large open-range operations (Bruns et al., 2020; Stone et al., 2017); however, it has been documented that rancher reported efficacy of mitigation in Wyoming, USA, varied by predator species, mitigation strategy, and lethality of strategies, but not livestock type (Scasta et al., 2017). Proven effective ways to protect livestock in restricted areas are guarding dogs, fladry, and night enclosures for livestock (Linnell & Cretois, 2018; Treves et al., 2016). Regardless of the increased frequency of wolves occurring in the human-dominated landscape of Iran (Habibzadeh, 2016; Nematpour & Habibzadeh, 2019; Safavian et al., 2018), there is a lack of information to understand how livestock owners in Iran perceive the livestock protection measures' feasibility for implementation in their operations. This paper aimed to capture people's attitudes about wolves and investigate the familiarity and possibility of various nonlethal methods for reducing the small livestock (goat and sheep) depredation by wolf in Kharvana district, East Azarbaijan province, Iran.

Material and methods

This study was carried out in the Kharvana region of East Azerbaijan province based on the northwestern part of Iran (Fig. 1). It covers an area of 1417 km^2 and is populated from 155 settlements (Iran Statistical Center 2017). The area lies in the semi-arid mountainous Zone of East-Azerbaijan. On average, it receives 21.5 mm of rainfall per month with a peak in April and January (Iran Statistical Center 2017). Rainfall is erratic and often inadequate, leading to low productivity and high agricultural losses in drought years. Maximum temperatures reach 36 ^{o}C in July and minimum temperatures of – 30 ^{o}C in January (Iran Statistical Center, 2017). The area comprises agricultural patches, dry grass, and scrub-lands, interspersed with clustered settlements. Grazing areas consist of grassy areas along the tops and slopes of hillocks, which may be private or government-owned. The agricultural system can be considered a mixed crop-livestock farming system, wherein crops and livestock both contribute to household incomes. The majority of small livestock owners in the Kharvana district moves to grasslands at high altitudes in summer and use the lowland grasslands in winter.

To collect related regional data about demographics, attitudes toward wolves, and familiarity with and the likelihood of implementing specific livestock protection measures, we developed a three-part survey to interview livestock owners in the region of interest. The survey design was modeled by reviewing several other rancher-specific inquiries regarding wolves to align our survey questions with current research (e.g., Browne-Nuñez et al., 2015; Naughton-Treves et al., 2003;

Pate et al., 1996). We shared a draft of our survey with several ranchers and DoE's rangers to obtain feedback about the community's relevance. Three sections of the study included (1) general attitudes and experiences with wolves with five multiple-choice questions. The first two questions addressed the impact of the wolf on an individual's livestock operation. The next two questions covered livestock owners' attitudes toward wolf protection policies, asking the interviewees about the acceptable size of a potential wolf population and under what circumstances a livestock owner should be permitted to shoot and kill a wolf. The final yes/no question intended to discern whether the respondent has had interactions with a wolf on his or her property, (2) knowledge and perceived feasibility of four conflict reduction strategies including attractant removal, guarding dogs, alarm and scare tactics, and moving livestock. We asked respondents to answer the four questions: (a) what is your degree of familiarity with the conflict reduction strategy? (five-point Likert scale from not at all familiar (coded as 1) to exceptionally usual (coded as 5)), (b) is it possible to use this tool on your land? (yes-no responses), (c) if not, why not? (open-ended question), and (d) how likely would you be to implement this strategy to minimize wolf-livestock conflicts? (five-point Likert scale, ranging from 1 (very unlikely) to 5 (already implement this strategy)). The questions of this section were asked for two grazing areas i.e., highland and lowland grasslands that are grazed in summer and winter by Kharvana's livestock owners, respectively, and (3) general demographic information, which contained five questions regarding the respondent's age, gender, education, number of years spent on livestock producing, and number of livestock owned.

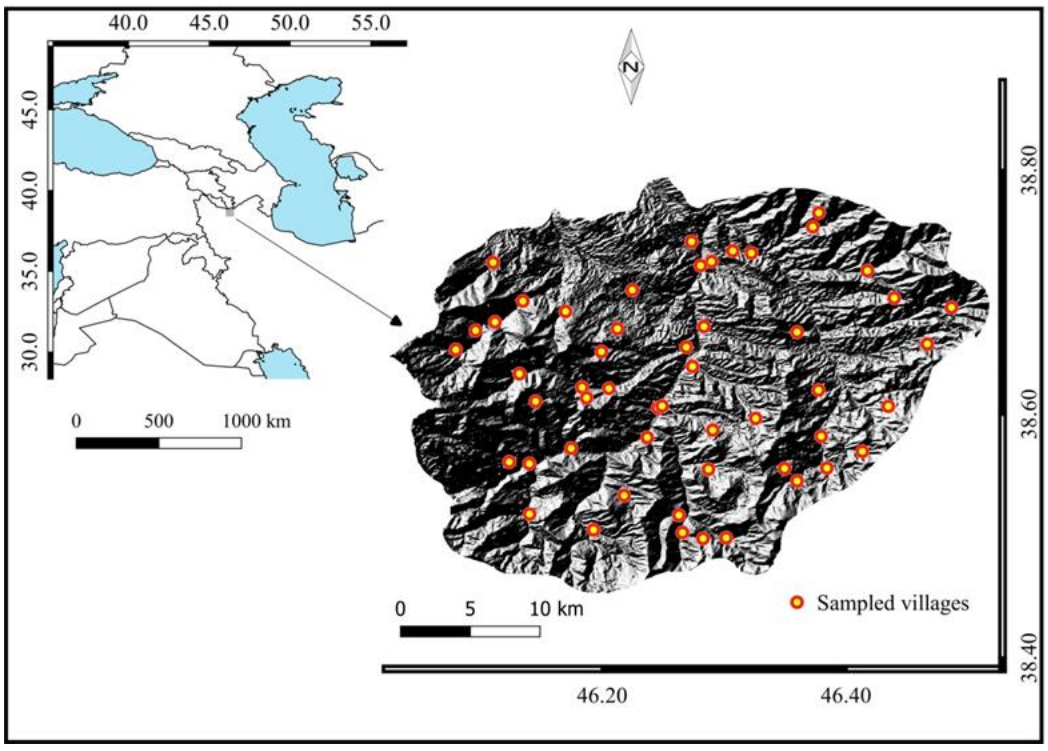

Figure 1. The location of the study area and sampled villages in Kharvana district, East Azerbaijan, Iran

Herdsmen were asked to rank the familiarity and feasibility of four abovementioned non-lethal livestock protection measures. Any indication of mitigation method familiarity and implementation

is assumed to indicate first-hand knowledge by the participant. The index for the familiarity and implementation rating used the Likert scale, and the familiarity and implementation possibility of the mitigation methods were calculated as the median responses for each question. To reach the highest number of potential survey respondents, we focused on villages that they had people were involved in livestock production. We considered herders who only produced sheep, not cattle, because sheep are the primary livestock species grazed in the region. To compile survey responses, 15% of the herders in each village who possessed a large number of livestock and had been for a long time in herd activity were subjected to an interview. Before interviews, respondents were asked for consent following an explanation of the research objectives and assurance that all personal information would remain strictly confidential. We verbally translated our questions written in Persian to Azeri language for the interviewees who were illiterate and completed the questionnaire. Chi-square tests of association were conducted to test for significant associations between variables. A Friedman test for ranks was used to determine whether the differences in the reported rank of the four conflict reduction strategies were significant.

Results

Overall, 77 interviews were conducted in 52 villages in the Kharvana county, of which 2 only women accounted for total respondents. The highest number of respondents belonged to the age group of 45-60 years old (44.2%), 20.8% were over the age of 60, and the rest of the interviewees were between the ages of 30-45. Regarding the level of literacy, 43% of interviewees were illiterate, 22.1% had high school diplomas, and the rest of them had primary education. Most respondents acted in livestock production for 10-30 years (42.9%), only 6.2% of interviewees were engaged less than five years in herding professions. The herd size ranged from 30-450, with a mean of 89 animals.

Wolf conflicts

While most respondents expressed an overwhelmingly negative perception of wolves, there was a notable number of respondents that were neutral for expressing the negative impact of wolves on herding operations.

Discussion

The majority reported an insufficient current level of protection against wolf attacks, and somewhat surprisingly desired wolves to be eliminated by DoE but would not prefer to shoot or kill any wolves (Fig. 2). The hypothesis that a long history of coexistence will lead to greater acceptance of wolves among local inhabitants (Williams et al., 2002) does not support our finding. This less positive attitude and lower support for wolf conservation in our study region with a long history of uninterrupted wolf presence represents the same pattern with other studies (Gosling et al., 2019), which is usually attributed to residents' greater exposure to wolf-related conflict (Dressel et al., 2015; Treves et al., 2013).

Although most respondents claimed that they were inconsistent with the wolf, it was interesting that 83% of them reported that the wolf had damaged their property or livestock. If this reported

number is accurate, they are trying to cover up their real viewpoint for various reasons (for example, fear of their pursuit of environmental conservation laws). They may act in practice contrary to their apparent claims when dealing with the wolf.

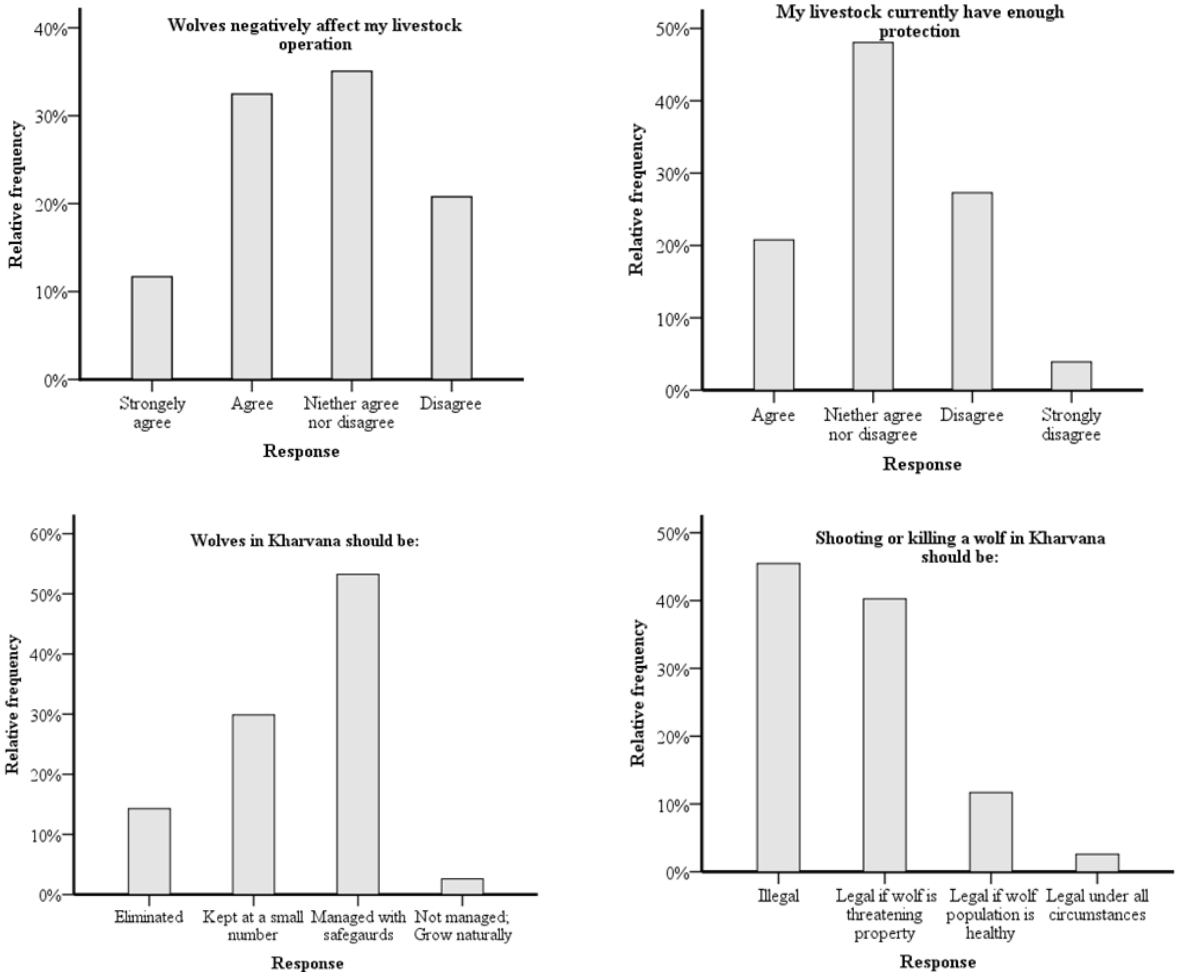

Figure 2. Distribution of responses for multiple-choice questions on attitudes towards wolves

Table 1. A summary of results for each livestock protection measure. Familiarity and implementation likelihood is calculated as the median responses on the Likert scale for each question. The rank is calculated as the median rank response for each method

Method	Familiarity (median score)	Likelihood of implementation (median score)	Rank
Attractant removal	Very	Very likely	3
Guarding dogs	Extremely	Already implemented	1
Alarm and scare tactics	Extremely	Already implemented	2
Livestock moving	Very	Very likely	4

Livestock protection measures: Cross-Strategy Comparison

The likelihood of implementation of all mitigation methods in the lowland grasslands was more feasible than the highland grasslands. Respondents showed a significant preference for guarding dogs and alarm tactics when asked to rank the willingness to implement each tool (Fig. 3; Friedman $\chi^2(3) = 118.6$, $P<0.0001$). The tendency to moving livestock with a median ranking of 4 was reported as a least willing to implementing (Table 1).

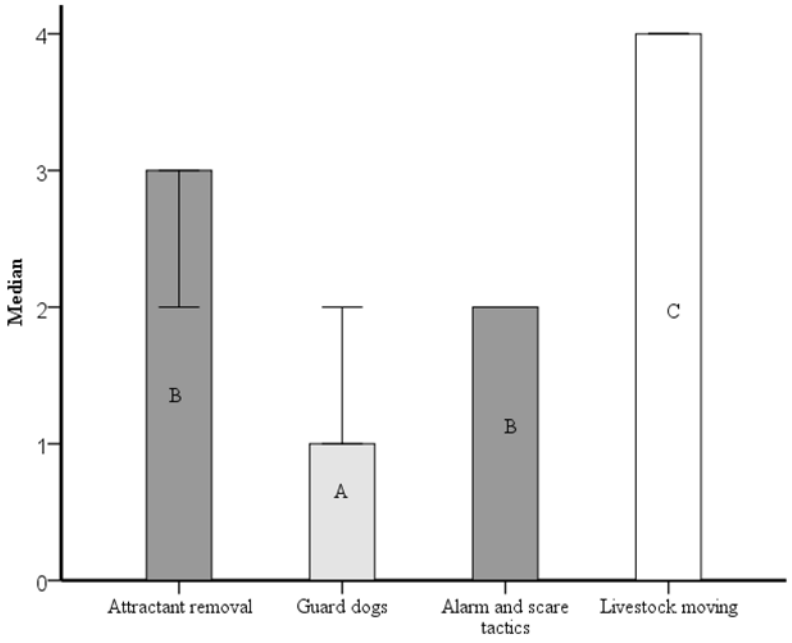

Figure 3. Livestock protection measures are ranked by the willingness to implement. Respondents were asked to rank the surveys from 1 (most willing to implement) to 4 (least willing to implement). A Friedman test demonstrated significant differences among the median ranks ($\chi^2(3)=118.6$, $p<0.0001$). Post-hoc testing clarified differences among the four tools, as indicated by different letters (like letters indicate no significant difference). Guarding dogs' method (letter A) was ranked significantly better than other tools.

Guarding dogs were reportedly the most feasible and significantly preferred compared to the other livestock protection measures. It had the largest percentage of respondents who have already implemented it on their land. Only 28.6% of respondents who fully understood the implementation of guarding dogs' approach claimed that they could use it in the lowland grasslands, but in the highland grasslands, they preferred to employ this method. 92.2% of respondents stated that they had already implemented this method, and 6.5% expressed they would be very likely to use it in the highland grasslands. All respondents were very or extremely familiar with guarding dogs before completing this survey. A chi-square test determined there was not a significant association between familiarity with guarding dogs and perceived feasibility ($\chi^2(1) = 2.7$, $P = 0.15$). This shows that familiarity with this method did not increase the likelihood of implementing it.

The use of alarm tactics to scare wolves away from livestock is reportedly was the second most feasible livestock protection measure. About 92% of the respondents were familiar with this method and implemented it in the region. About 74% and 26% of the herdsmen believed that this

method could be implemented in the highland and lowland grasslands, respectively. The perceived feasibility of implementation in the highland and lowland grasslands tended to increase with increasing familiarity, though there was not a significant association (χ^2 (1) = 2.37, P = 0.41).

As 58.8% of respondents already implement alarm tactics on their highland grasslands and an additional 35.1% of respondents reported that they are very likely to implement alarm tactics, this is a tool that merits considerable attention. Conservation groups interested in promoting coexistence should look at successful programs for best practices in implementing wide-scale alarm tactic's programs.

The attractant removal to minimize livestock to wolf depredation was reported as the third most feasible tool, with 74% and 26% of respondents reporting that it would be possible to implement this type of livestock management strategy on their highland and lowland grasslands, respectively. Respondents were generally familiar with the method before completing this survey, and a chi-square test determined a non-significant association between familiarity with the attractant removal and perceived feasibility ($\chi^2(1) = 4.5$, P = 0.3). About 40.0% of survey respondents reported current use of attractant removal, while another 26.0% reported that they are very likely to implement the strategy on their highland grasslands. This high willingness to implement this method is similar to that of guarding dogs, and alarm tactics provide a good opportunity to consider this method in future plans for managing the wolf's incompatibility with the livestock in the Kharvana region.

Conclusion

The practice of moving livestock from area to area to avoid zones of wolf activity is reported as the least feasible method. Familiarity with the tool varied greatly among survey respondents. The perceived feasibility of moving livestock is not significantly associated with familiarity of the tactic ($\chi^2(1) = 7.13$, p = 0.45). About 13% of herdsmen reported current use of moving livestock, but 50% of herdsmen had a high inclination to use this method to manage their livestock in dealing with wolf attacks. The high tendency to use this method and the lack of practical use of it indicate several limitations and obstacles to its implementation (for example, translocation costs, less availability of suitable useable pastures). It should be noted that the necessity of considering and studying these constraints is essential in future studies to find out whether or not it is practical or not in the livestock management programs in the Kharvana region.

Management implications

Our study provided evidence that less positive attitude and lower support for wolf conservation in our study region likely due to the direct driver of attitudes on wolf (there was a high rate of self-reported wolf depredation on livestock) sheds light on the importance of curbing wolf-livestock conflict for example through mixed measures (dogs, alarm tactics, and attractant removal) to increase local acceptance of the wolves.

References

Andelt, W. F. (1999). Relative Effectiveness of Guarding-Dog Breeds to Deter Predation on Domestic Sheep in Colorado. Wildlife Society Bulletin (1973-2006), 27(3), 706–714.

Bangs, E., Fritts, S. H., Fontaine, J., Smith, D. W., Murphy, K., Mack, C. M., & Niemeyer, C. C. (1998). Status Of Gray Wolf Restoration In Montana, Idaho, And Wyoming. Wildlife Society Bulletin, 26, 785–798.

Bangs, E., & Shivik, J. A. (2001). Managing wolf conflict with livestock in the Northwestern United States". Staff Publications, 550.

Behdarvand, N., Kaboli, M., Ahmadi, M., Nourani, E., Salman Mahini, A., & Asadi Aghbolaghi, M. (2014). Spatial risk model and mitigation implications for wolf–human conflict in a highly modified agroecosystem in western Iran. Biological Conservation, 177, 156–164. https://doi.org/10.1016/j.biocon.2014.06.024

Bergstrom, B. J. (2017). Carnivore conservation: shifting the paradigm from control to coexistence. Journal of Mammalogy, 98(1), 1–6. https://doi.org/10.1093/jmammal/gyw185

Brown, P. D. (2011). Wolves and Livestock: A review of tools to deter livestock predation and a case study of a proactive wolf conflict mitigation program developed in the Blackfoot Valley, Montana. The University of Montana.

Browne-Nuñez, C., Treves, A., MacFarland, D., Voyles, Z., & Turng, C. (2015). Tolerance of wolves in Wisconsin: A mixed-methods examination of policy effects on attitudes and behavioral inclinations. Biological Conservation, 189, 59–71. https://doi.org/10.1016/j.biocon.2014.12.016

Bruns, A., Waltert, M., & Khorozyan, I. (2020). The effectiveness of livestock protection measures against wolves (Canis lupus) and implications for their co-existence with humans. Global Ecology and Conservation, 21, e00868. https://doi.org/10.1016/j.gecco.2019.e00868

Clark, P. E., Johnson, D. E., Larson, L. L., Louhaichi, M., Roland, T., & Williams, J. (2017). Effects of Wolf Presence on Daily Travel Distance of Range Cattle. Rangeland Ecology & Management, 70(6), 657–665. https://doi.org/10.1016/j.rama.2017.06.010

Cooke, R. F., Bohnert, D. W., Reis, M. M., & Cappellozza, B. I. (2013). Wolf presence in the ranch of origin: Impacts on temperament and physiological responses of beef cattle following a simulated wolf encounter1. Journal of Animal Science, 91(12), 5905–5911. https://doi.org/10.2527/jas.2013-6777

Dressel, S., Sandström, C., & Ericsson, G. (2015). A meta-analysis of studies on attitudes toward bears and wolves across Europe 1976-2012. Conservation Biology, 29(2), 565–574. https://doi.org/10.1111/cobi.12420

Eklund, A., López-Bao, J. V., Tourani, M., Chapron, G., & Frank, J. (2017). Limited evidence on the effectiveness of interventions to reduce livestock predation by large carnivores. Scientific Reports, 7(1), 2097. https://doi.org/10.1038/s41598-017-02323-w

Fortin, D., Beyer, H. L., Boyce, M. S., Smith, D. W., Duchesne, T., & Mao, J. S. (2005). Wolves Influence Elk Movements: Behavior Shapes A Trophic Cascade In Yellowstone National Park. Ecology, 86(5), 1320–1330. https://doi.org/10.1890/04-0953

Gosling, E., Bojarska, K., Gula, R., & Kuehn, R. (2019). Recent arrivals or established tenants? History of wolf presence influences attitudes toward the carnivore. Wildlife Society Bulletin,

43(4), 639–650. https://doi.org/10.1002/wsb.1027

Graham, G. I. H., Behrens, K. G., Carruthers, J., Diemont, M., du Plessis, J., Minnie, L., Richardson, P. R. K., Somers, M. J., Tambling, C. J., Turpie, J., van Niekerk, H. N., & Balfour, D. (2017). Livestock predation in South Africa: The need for and value of a scientific assessment. South African Journal of Science, Volume 113(Number 3/4). https://doi.org/10.17159/sajs.2017/a0198

Habibzadeh, N. (2016). Key determinants of human-wolf conflict in Shabestar county's villages of East Azerbaijan province, Iran. European Journal of Wildlife Research, 62(2), 199–202. https://doi.org/10.1007/s10344-016-0993-1

Hebblewhite, M., White, C. A., Nietvelt, C. G., McKenzie, J. A., Hurd, T. E., Fryxell, J. M., Bayley, S. E., & Paquet, P. C. (2005). Human Activity Mediates A Trophic Cascade Caused By Wolves. Ecology, 86(8), 2135–2144. https://doi.org/10.1890/04-1269

Center, I. S. (2017). Annual climate statistical survey of East Azerbaijan. https://www.amar.org.ir.

Johnson, C. N., & Wallach, A. D. (2016). The virtuous circle: predator-friendly farming and ecological restoration in Australia. Restoration Ecology, 24(6), 821–826. https://doi.org/10.1111/rec.12396

Kaczensky, P. (1998). Large carnivore depredation on livestock in Europe. Ursus, 11, 59–71. https://doi.org/10.2307/3872986

Kluever, B. M., Breck, S. W., Howery, L. D., Krausman, P. R., & Bergman, D. L. (2008). Vigilance in Cattle: The Influence of Predation, Social Interactions, and Environmental Factors. Rangeland Ecology & Management, 61(3), 321–328. https://doi.org/10.2111/07-087.1

Laporte, I., Muhly, T. B., Pitt, J. A., Alexander, M., & Musiani, M. (2010). Effects of Wolves on Elk and Cattle Behaviors: Implications for Livestock Production and Wolf Conservation. PLoS ONE, 5(8), e11954. https://doi.org/10.1371/journal.pone.0011954

Linnell, J. D. ., & Cretois, B. (2018). Research for AGRI Committee–The revival of wolves and other largepredators and its impact on farmers and their livelihood in rural regions of Europe.

Madden, F. (2004). Creating Coexistence between Humans and Wildlife: Global Perspectives on Local Efforts to Address Human–Wildlife Conflict. Human Dimensions of Wildlife, 9(4), 247–257. https://doi.org/10.1080/10871200490505675

Marker, L. L. ., Dickman, A. J. ., & Macdonald, D. W. (2005). Perceived effectiveness of livestock-guarding dogs placed on Namibian farms. Rangeland Ecology and Management, 4, 329–336.

Mech, L. D. ., & Boitani, L. (2004). Canids: Foxes, wolves, jackals and dogs status survey and conservation action plan.

Mech, L. D. ., & Boitani, L. (2010). Canis lupus. IUCN Red List of Threatened Species. Version 2011.1. http://www.iucnredlist.org.

Muhly, T. B., & Musiani, M. (2009). Livestock depredation by wolves and the ranching economy in the Northwestern U.S. Ecological Economics, 68(8–9), 2439–2450. https://doi.org/10.1016/j.ecolecon.2009.04.008

Naughton-Treves, L., Grossberg, R., & Treves, A. (2003). Paying for Tolerance: Rural Citizens' Attitudes toward Wolf Depredation and Compensation. Conservation Biology, 17(6), 1500–1511. https://doi.org/10.1111/j.1523-1739.2003.00060.x

Nelson, A. A., Kauffman, M. J., Middleton, A. D., Jimenez, M. D., McWhirter, D. E., & Gerow, K. (2016). Native prey distribution and migration mediates wolf (Canis lupus) predation on domestic livestock in the Greater Yellowstone Ecosystem. Canadian Journal of Zoology, 94(4), 291–299. https://doi.org/10.1139/cjz-2015-0094

Nematpour, M. ., & Habibzadeh, N. (17 C.E.). The attitude of horand s villagers toward wildlife and determinants of human-wolf conflict, east Azerbaijan, Iran. Caspian Journal of Environmental Sciences, 3. https://doi.org/10.22124/cjes.2019.3668

Newsome, T. M., Dellinger, J. A., Pavey, C. R., Ripple, W. J., Shores, C. R., Wirsing, A. J., & Dickman, C. R. (2015). The ecological effects of providing resource subsidies to predators. Global Ecology and Biogeography, 24(1), 1–11. https://doi.org/10.1111/geb.12236

Pate, J. ., Manfredo, M. J. ., Bright, A. D. ., & Tischbein, G. (1996). Coloradans' attitudes toward reintroducing the gray wolf into Colorado. Wildlife Society Bulletin.

Pearson, E. W., & Caroline, M. (1981). Predator Control in Relation to Livestock Losses in Central Texas. Journal of Range Management, 34(6), 435. https://doi.org/10.2307/3898093

Ravenelle, J., & Nyhus, P. J. (2017). Global patterns and trends in human-wildlife conflict compensation. Conservation Biology, 31(6), 1247–1256. https://doi.org/10.1111/cobi.12948

Safavian, S., Alizadeh Shabani, A., Imani Harsini, J., & Naderi, M. (2018). Factors Affecting Predator-Prey Distribution in a Protected Area, Tehran, Iran (a Case with Wolves and Wild Sheep). Russian Journal of Ecology, 49(2), 172–179. https://doi.org/10.1134/S1067413618020121

Scasta, J. D., Stam, B., & Windh, J. L. (2017). Rancher-reported efficacy of lethal and non-lethal livestock predation mitigation strategies for a suite of carnivores. Scientific Reports, 7(1), 14105. https://doi.org/10.1038/s41598-017-14462-1

Slagle, K., Bruskotter, J. T., Singh, A. S., & Schmidt, R. H. (2017). Attitudes toward predator control in the United States: 1995 and 2014. Journal of Mammalogy, 98(1), 7–16. https://doi.org/10.1093/jmammal/gyw144

Steele, J. R., Rashford, B. S., Foulke, T. K., Tanaka, J. A., & Taylor, D. T. (2013). Wolf (Canis lupus) Predation Impacts on Livestock Production: Direct Effects, Indirect Effects, and Implications for Compensation Ratios. Rangeland Ecology & Management, 66(5), 539–544. https://doi.org/10.2111/REM-D-13-00031.1

Stone, S. A., Breck, S. W., Timberlake, J., Haswell, P. M., Najera, F., Bean, B. S., & Thornhill, D. J. (2017). Adaptive use of nonlethal strategies for minimizing wolf–sheep conflict in Idaho. Journal of Mammalogy, 98(1), 33–44. https://doi.org/10.1093/jmammal/gyw188

Treves, A., & Karanth, K. U. (2003). Human-Carnivore Conflict and Perspectives on Carnivore Management Worldwide. Conservation Biology, 17(6), 1491–1499. https://doi.org/10.1111/j.1523-1739.2003.00059.x

Treves, A., Krofel, M., & McManus, J. (2016). Predator control should not be a shot in the dark. Frontiers in Ecology and the Environment, 14(7), 380–388. https://doi.org/10.1002/fee.1312

Treves, A., Naughton-Treves, L., & Shelley, V. (2013). Longitudinal Analysis of Attitudes Toward Wolves. Conservation Biology, 27(2), 315–323. https://doi.org/10.1111/cobi.12009

Williams, C. K. ., Ericsson, G. ., & Heberlein, T. A. (2002). A quantitative summary of attitudes toward wolves and their reintroduction (1972-2000). Wildlife Society Bulletin.

Ziaie, H. (2011). A field guide to the mammals of Iran [in Persian]. Iranian Wildlife Center..