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Factors Influencing Human Attitudes towards Wolves in Northwest Spain

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Abstract: Surveys have been used to study the current perception towards wolves by different stakeholders such as ranchers, landowners, hunters, experts in the field, and employees of the environmental administration in the provinces of Pontevedra and A Coruña, in the northwest of Spain. The main objective of this study is the evaluation and further discussion of the compensation offered to affected people for damages caused by wolf attacks and whether such compensations represent an improvement in the degree of tolerance towards these animals. Significant differences ($p < 0.05$) were found among the different sectors interviewed, with the hunters being the least tolerant sector, followed by ranchers. The number of attacks in the area was proven to influence their perspective toward wolves and the need for preventive measures. There was unanimity among hunters, ranchers, and locals, who do not consider the tools provided by the Galician administration sufficient to palliate the damages produced by wolves. However, 53.8% of ranchers, the group whose livelihood will most likely be affected by wolf attacks, and 60% of the wolf experts believe that compensation does not help to reduce tolerance towards wolves. Losing an animal makes people more likely to agree to the use of lethal and non-lethal methods.

Keywords: *Canis lupus*; compensation programs; human-wildlife conflict; livestock

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1. Introduction

The human-wolf conflict has always been present, especially in the northern hemisphere, where wolves (*Canis lupus*) and livestock share the same habitat [1–3]. Wolves' space requirements, and consequently their predation on livestock, has led to wolves being subjected to persecution and extirpation [4–6]. As a result, wolf populations suffered a decline that began in the mid-19th century and continued up to the 1970s, when wolf numbers critically decreased, even becoming extinct in most of the European continent [7].

Conservation measures and legal protection of the wolf began worldwide in the second half of the 20th century [8]. In North America, the US Endangered Species Act of 1973 included the wolf in its list of endangered species [5]. In Europe, large carnivores, including the wolf, have been protected by the 1979 Convention on the Conservation of European Wildlife and Natural Habitats, and the Nature 2000 network [9,10]. Other conservation measures, such as the implementation of protective laws, shared coordinated legislation by European countries, and socio-economic changes were also established [7,8]. These measures led to an increase in population numbers in the northern hemisphere, and therefore the number of attacks on domestic animals also increased [11]. Thus, livestock predation and, consequently, the lack of public acceptance, are the main threats that wolves currently face across their habitat [7,12]. In addition, very often non-objective and

negative press coverage can be a relevant and potential driver of how the public perceives wolves [13].

In the Iberian Peninsula, the most critical period for wolves ranged between the 1960s and early 1970s, when wolves were subjected to strong pressure and persecution [14,15]. The Ley de Caza (Hunting Law) [16], regional jurisdiction actions [17] such as the Conservation of Natural Habitats and of Wild Fauna and Flora [18], and European legislation measures [19] were established to protect the wolf in Spain. However, both hunting pressure, as a result of the low acceptance of the species by rural people, and culling of the wolf population by the regional administration, have jeopardized conservation efforts in the Iberian Peninsula [11,13]. Neither hunting nor culling have been shown to minimize predation on livestock [20,21]. In some areas such as Sierra Morena, in southern Spain, wolf populations are on the verge of extinction due to severe hunting pressure as a consequence of negative human attitudes [19]. Also in Spain, in the northwest of the Iberian Peninsula, the wolf population is categorized as a Near Threat (NT) by the International Union for the Conservation of Nature (IUCN) [14]. This could be a clear example that conservation efforts and changes in legislation might not be enough to protect wolves.

In Galicia, the evolution of wolf populations remained steady between 1850 and 2003 [22], suggesting that this area has been an important reservoir for wolves throughout the last two centuries. At the beginning of the 2000s, Galicia's wolf population density was 2.25 packs per 1000 km^2, with a total of 68 wolf packs identified [23]. The wolf population increased between 2012 and 2014, with total of 84 wolf packs [24]. According to Linnell and Boitani [25], one of the four isolated wolf populations that currently persist in western Europe occurs in the northwestern quarter of the Iberian Peninsula (an area covering eight autonomous regions in Spain and Portugal, including Galicia). Livestock breeding is one of the main farming occupations, with 1 million cows and 280,000 sheep and goats [26]. Livestock consumption makes up for 95% of the overall diet composition of wolves in west Galicia [4,23]. In north and central Galicia, wild horses (*Equus ferus atlanticus*) and cattle are the primary sources of wolves' diet, whereas in the mountains in eastern Galicia, 70% of wolves' diet consists of wild ungulates such as roe deer [27].

In addition to traditional conservation measures such as population control by the administrations, poison bans or the legal persecution of poaching [14], payment of compensation to ranchers is considered a way to increase rural citizens' tolerance towards wolves [11,28]. However, other factors such as education level, gender, occupation and social identity might play a stronger role in acceptance of the wolf than monetary compensation [11]. Furthermore, compensation can cause controversy, as it might compromise budgets used to protect other endangered species [28].

Currently, compensatory payments in Galicia vary according to the species attacked, its age, and its role within the farm. These amounts range from 26€, for an adult goat older than 6 years, to 1799€ for a native Galician cow. Requirements to obtain economic assistance such as for the cattle to have all the sanitary controls in order, and that the administration employees find proof of attack, are established by the regional government [29]. Wolves in Galicia live in areas with a high density of human population, feeding on garbage and livestock [30]. These characteristics make rural Galicia a favourable place for wolves.

The present work uses mail surveys to study and analyse the perception towards wolves from key stakeholders in the Galician provinces of Pontevedra and A Coruña. The main objective of this study is to evaluate attitudes towards compensation for the damages caused by wolves' attacks and to discuss if such compensation represents an improvement on the degree of tolerance towards these animals. Moreover, it was determined whether tolerance towards wolves and attitudes about compensation and wolf control methods vary among stakeholders.

2. Materials and Methods

2.1. Area of Study and Questionnaires

The present study was carried out in Galicia, in the northwest of Spain. The surveys were conducted in the provinces of Pontevedra (n = 45, 86.5%) and A Coruña (n = 7, 13.5%), located on the western part of the region (Figure 1). This study area has been selected because the data on wolf attacks and their associated costs have been provided by the Dirección Xeral de Conservación da Natureza for this area. No ethical approval was required to carry out this project.

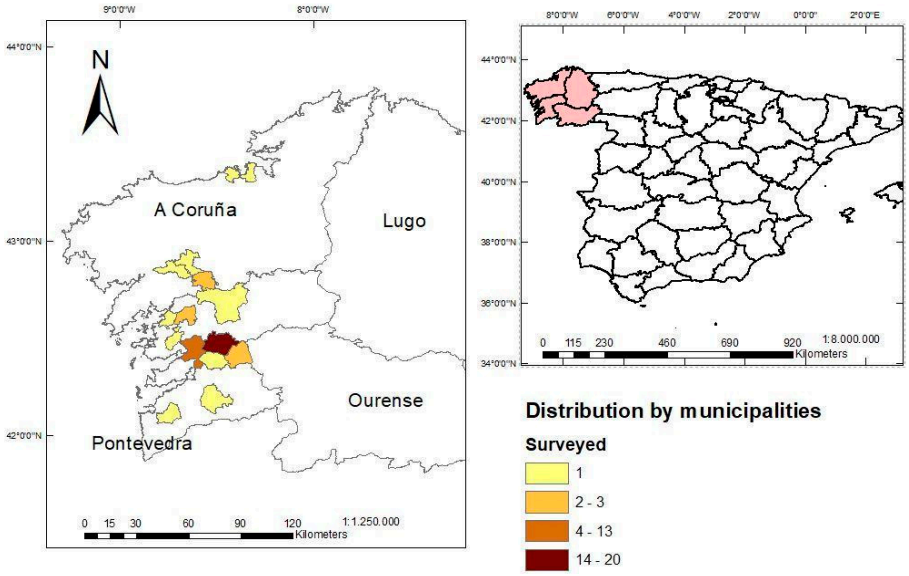


Figure 1. Area of study. Number of surveys carried out per municipality.

A total of 52 surveys were conducted among different key groups: hunters (n = 5, 9.6%), ranchers (n = 13, 25%), land owners (n = 1, 1.9%), locals (n = 10, 19.2%), wolf experts (n = 10, 19.2%) and administration employees (n = 13, 25%). These groups were chosen because of the role they play in managing and conserving natural resources, and because they are the most affected by the presence of wolves in Galicia. Some interviewees belonged to more than one group, as may be the case of ranchers who are also land owners, or hunters that live in the study area. In these cases, the interviewees were assigned to the sector whose livelihood was affected the most.

The questionnaire was designed by experts in the fields of wildlife management and conservation and protected areas and habitats. The anonymity of the surveyed individuals was maintained. The questionnaire consisted of a total of 20 questions: those regarding tolerance towards wolves (1, 2, 3, 4, 15, 16, 17), questions regarding compensation programmes (5, 6, 7, 8, 9, 10, 11, 12, 13, 14), and questions addressed only to ranchers regarding attacks on livestock (18, 19, 20). The questions were structured in 16 one forced-choice questions, a four-answer question to order according to the degree of importance, and three multiple-choice questions only aimed at ranchers. For better readability and analysis, questions were abbreviated to Q + the question number; a full list of questions and their abbreviations can be found in Appendix A. The main objective of this questionnaire was to check the degree of acceptance towards wolves in this region, and to examine if this acceptance improved with financial aid to the most affected sectors, or if, on the contrary, the idea of aversion towards wolves predominated.

2.2. Statistical Analysis

Analyses were carried out using R, a programming language for statistical computing and graphics [31]. We performed a correlation matrix using Cramer's V values between all survey questions to select only those that contribute to the overall model. Cramer's V

is a statistic that transforms chi-square (for a contingency table larger than two rows by two columns) to a range of 0–1, where unit value indicates complete agreement between the two nominal variables [32]. A variable selection process helps to decrease the risk of overfitting the model by reducing the number of independent variables in the model, therefore, we dropped all survey questions for which Cramer's V was higher than 0.55.

A 3-point response scale was used to capture participant opinions: (1) negative, (2) neutral, or (3) positive. After that, we performed Ordinal Logistic Regressions to predict the importance of the relationship between sectors where the interviewed worked, as well as the municipality where they belonged (dependent variables), and the type of answers provided (independent variables). Ordinal Logistical Regressions (OLR) are an extension of a logistic regression that is particularly used to analyse nominal or ordinal data. The OLR method is the most appropriate and practical technique to analyse the effect of independent variables on a rank order dependent variable because the dependent variable cannot be assumed as normally distributed or as interval data [33]. The OLR model fit depends on the number of independent variables and the selected link function that are decided during the model-building phase. The selected link function in the model describes the effect of the independent variables on the rank order dependent variable. The data used in this analysis on the number of wolf attacks and their associated costs have been provided by the Dirección Xeral de Conservación da Natureza, an entity dependent on the Consellería de Medio Ambiente, Territorio e Infraestructuras [29]. These consist of a database with 2614 records corresponding to reports of wolf attacks on livestock in the province of Pontevedra (Galicia). The livestock analysed consisted of cattle, sheep, goats and horses. The data provided covers the period from 2005 to 2015, inclusive.

3. Results

3.1. Comparison of Patterns of Attitude, Opinion and Consideration between Stakeholder Groups

In general, interviewees gave similar answers regardless of their profession (Figure 2). Private owners tended to have a different opinion than the other interviewees in questions regarding compensation (Q7, Q8, Q9), and were the only group to not recognise the ecological importance of wild horses (Q4). People working in the public administration had mostly a positive attitude towards wolves: they were the only ones to completely disagree with the claim that there are too many in the territory (Q1), had only positive views regarding them (Q3), and completely disagreed with the idea of establishing a hunting ban.

When asking if the population of wolves is greater than the capacity of the territory, most sectors do not agree with this statement. However, 54% of stakeholders surveyed belonging to the hunter sector do believe that wolf populations exceed the size of the territory (Figure 2); most of the agreements occurred in the municipality of Teo (67%) and Cotobade (51%) (Figure 3). Naughton-Treves et al. [11], studied public tolerance towards wolves and found that 47.8% of hunters believed that wolf populations should be reduced, while 71.7% thought wolf populations should be kept below 100 individuals. Ericsson and Heberlein [34], determined that hunters' support of wolves decreased from 63 to 40% when wolves were introduced in their hunting areas. When the interviewees were asked if damages produced by wolves were numerous in their community, the data changed considerably if we filtered them by sectors: 62% of respondents within the hunter sector believe that the damages produced by the wolf are numerous, and this opinion was unanimous in the municipalities of A Estrada and Brion (Figure 3). By contrast, 80% of wolf experts and private owners disagree with this statement. Negative perceptions towards wolves were mostly shown by hunters (62%) followed by ranchers (36%) (Figure 2), and only in Brión (100%) and Cotobade (31%) (Figure 3). Almost all interviewees agreed on recognising the ecological importance of wild horses and on recognising the bad management of the situation by the public administration. This is worthy of note, as since some experts consider that horses could be a useful tool to reduce the damage produced by wolves. Grönemann et al. [35], suggested that, although wolves prefer sheep and goat because of their size, due to their ability to size up the cost-benefit ratio of each hunt, they could also feed on horses

if conditions were favourable. Duyne et al. [36], found that wolves favour the latter more than other livestock in Hustai National Park (Mongolia), an area known for its population of wild horses.

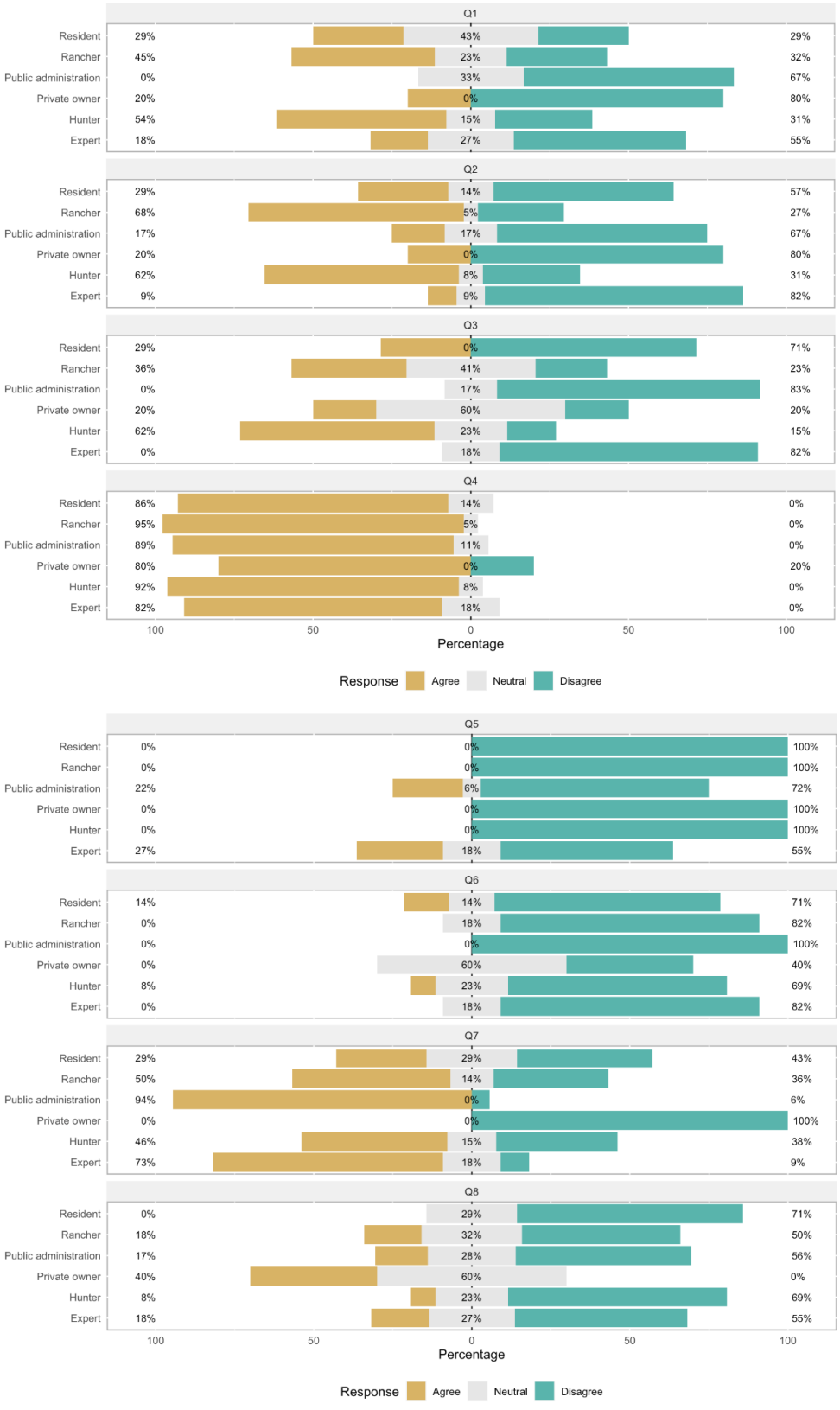


Figure 2. *Cont.*

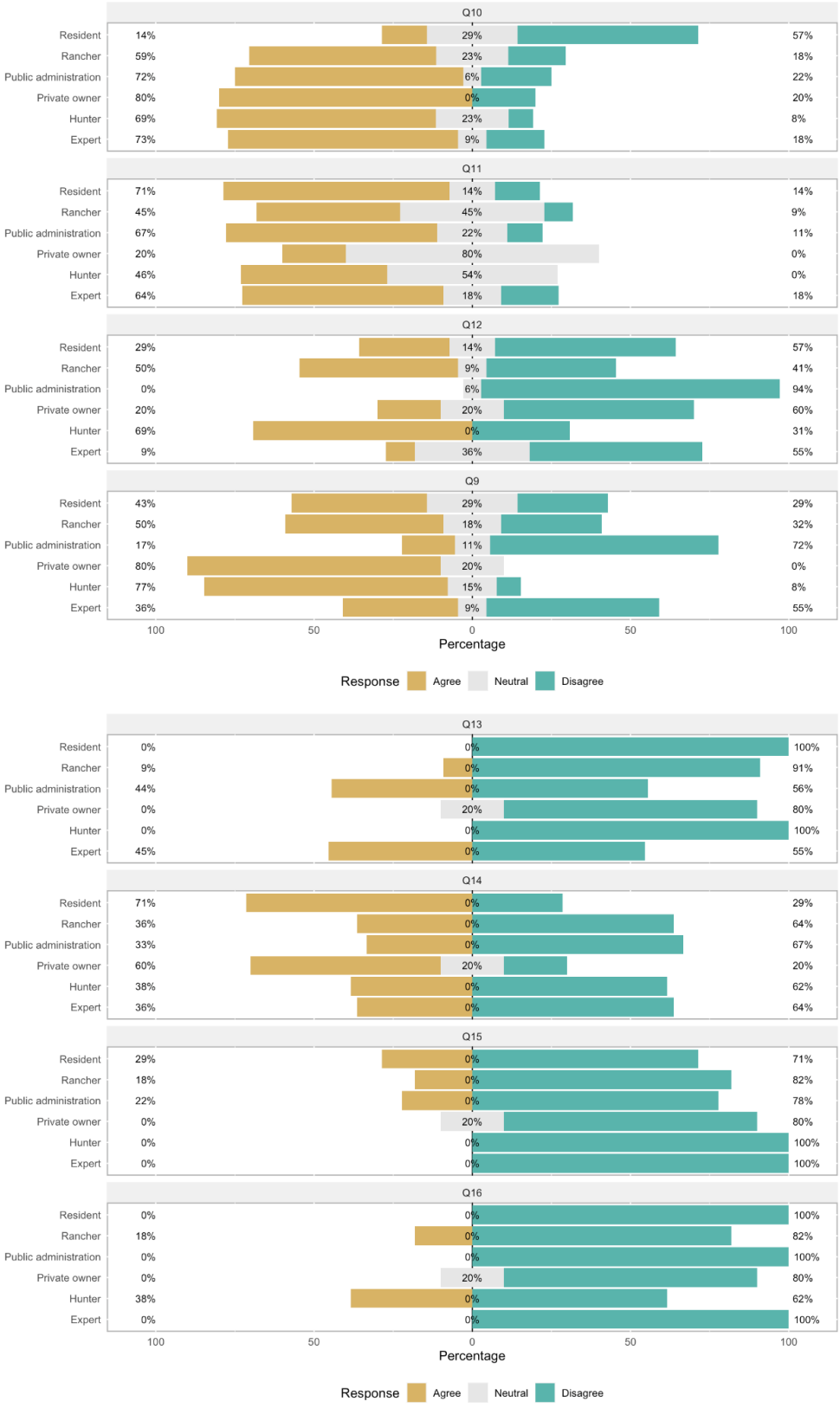


Figure 2. Interviewees' responses (agree, disagree or neutral) regarding tolerance towards wolves based on their profession.

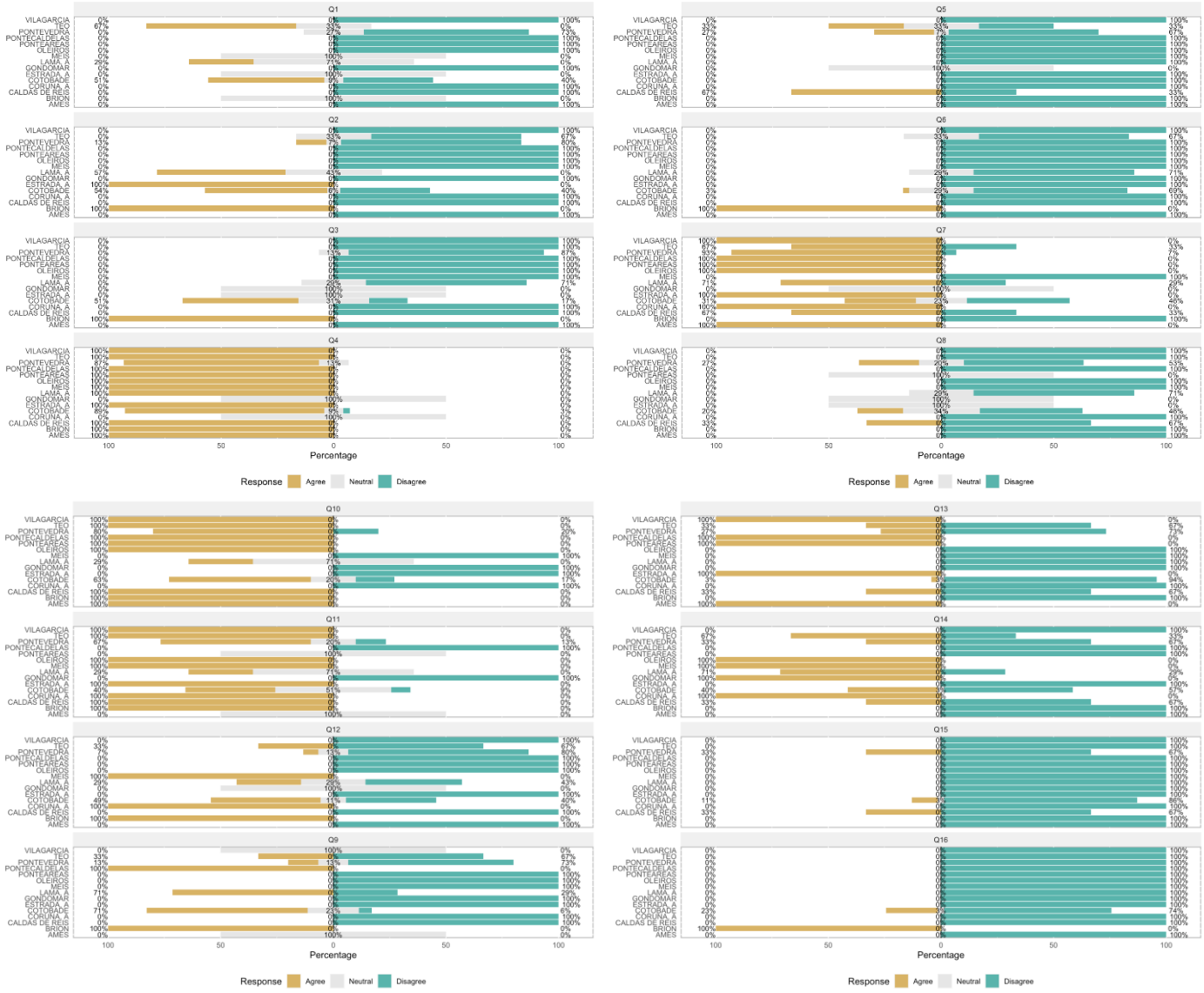


Figure 3. Interviewees' responses (agree, disagree or neutral) regarding tolerance towards wolves based on the municipality where they live.

Answers were balanced when asked whether public compensations should continue even when no attacks occur, as only experts and members of the public administration almost completely agreed (73% and 94% respectively), while private owners disagreed at 100% (Figure 2). The disagreement happened mostly in the localities of Meis and Brión (Figure 3). It is important to highlight this when analysing whether tolerance towards wolves would decrease in the absence of compensation measures. Hunters, ranchers and locals unanimously believe that the current tools used by the Galician Administration to palliate the damages produced by wolves are neither sufficient nor effective. The fact that a high number of administration employees interviewed consider the current tools not to be enough highlights the fact that the regional government itself recognizes the lack of resources available. In general, most of the stakeholders surveyed agree with compensation; they believe that losses and damages caused by wolves should be compensated, that it is necessary to create a fund to compensate ranchers for their losses, they consider it necessary to reimburse ranchers for the preventive measures established by them to avoid wolves' attacks, and they believe that compensation programmes should continue even when the wolf no longer poses a threat. All groups disagree with the idea that damages and losses caused by wolves are part of raising cattle and should therefore not be compensated.

Therefore, results might suggest that although people affected by wolf damage agree with compensation measures when a domestic animal is killed by a wolf, the attitudes, however, might not change. Similar findings are found in the available literature. Naughton-Treves et al. [11], obtained similar results in a survey carried out among rural citizens, and a majority of respondents agreed with payments for livestock losses due to wolf attacks. However, ranchers and hunters were more likely than other groups to agree to compensation for animal losses regardless of management practices and of whether proof of a wolf attack was provided. In addition, this study also reported that ranchers and hunters who have been compensated for losses were not more tolerant than people who have experienced a loss but were not compensated. Also, a survey carried out by Agarwala et al. [12] among rural residents showed that although they supported the existence of compensation programmes, they did not show a change of attitude towards wolves as a result of compensation. Similar results were revealed by Naughton-Treves et al. [11]. A survey carried out by Milheiras and Hodge [37], reported that the majority of people interviewed were in favour of compensation payments due to livestock losses caused by wolves. However, the general public were in disagreement with this if preventive measures were not in place. Although there is unanimity among sectors that wolf damages should be compensated, hunters and ranchers, along with locals, do not consider the current tools used by the Galician administration to be sufficient and effective to palliate the damages produced by wolves. Even though compensation payments might be as high as 1800€ for a cow, receiving financial aid can sometimes be difficult, as evidence of the attack must be found by the pertinent authorities and this does not always occur. Bad weather conditions such as rain might erase the animal's tracks, and many ranchers do not always go to see the cattle every day, thus proof of attack might be not be possible to provide or to find.

Regarding methods to prevent wolf attacks, 65% of stakeholders agree with the use of non-lethal tools. On the other hand, 69% of hunters and 50% of the ranchers agree with the establishment of a wolf hunting season; this statement was unanimous in the municipalities of Meis, A Coruña and Brión (Figure 3). They were also the only sectors to have some sort of agreement towards killing wolves in case of an attack, instead of being moved or repelled (Figure 2). Therefore, there are alternatives such as surveillance dogs, electric fences and rubber bullets. On the other hand, 31% of people surveyed are in agreement with the establishment of a hunting season, and if it is analysed by sectors, 100% of hunters agree with this.

3.2. Ordinal Logistic Regression Model

Questions 1, 2, 12, 13, 14 and 15 showed a high correlation with a Cramer's V value (Figure 4) of 0.55 or higher and were, therefore, dropped from the subsequent models.

We used our model to predict the answers to the relevant questions, given two independent variables: the number of attacks in the area of the subjects and the sector where they work. Interpreting the estimate of the coefficient for the "Attacks" variable tells us that for one unit increase in the attacks variable the ordered log-odds of agreeing to the question Q3, there is a negative perception toward wolves, which increases by 0.005 with the other factors in the model being held constant. In our model, experts are included in the baseline for the model as sector is a factor variable, so for a hunter his ordered log-odds of scoring in a higher category would decrease by 2.19 over the baseline, which means that they are 2.19 times more likely to disagree than experts. All other factors were not significant with $p > 0.05$ (Table 1). Values statistically significant ($p < 0.05$) are indicated with the * symbol. Only Hunters were much more likely (17.52 more times) to disagree on recognising the ecological importance of wild horses in Q4. On question Q10, 'preventive measures should be financed', for one unit increase in the "Attacks" variable the ordered log-odds of agreeing to the question increased by 0.003 with the other factors in the model being held constant. Question Q16, which asks whether wolves should be killed in the case of an attack, was the most influenced by both factors, the number of attacks and the sector of the subjects. Hunters, private livestock owners and local residents were 10.59, 20.82

and 9.63 times respectively more likely to agree compared to local experts. The increase of one attack yield also coincides with a probability of 0.01 more times to agree with this statement. These results partially agree with those from Naughton-Treves et al., (2003), whose study indicated that people who have experienced the loss of an animal by wolves were in favour or reducing or eliminating the wolf population. Williams et al. [38], also suggested that negative attitudes towards wolves are a result of direct experience, such as is the case of hunters and ranchers. Karlsson and Sjöström [39], found that attitudes towards wolves were strongly associated with distance to the wolf territory. They carried out a survey and found that the further away the interviewees lived from wolves, the more positive their attitudes were towards the preservation of them.

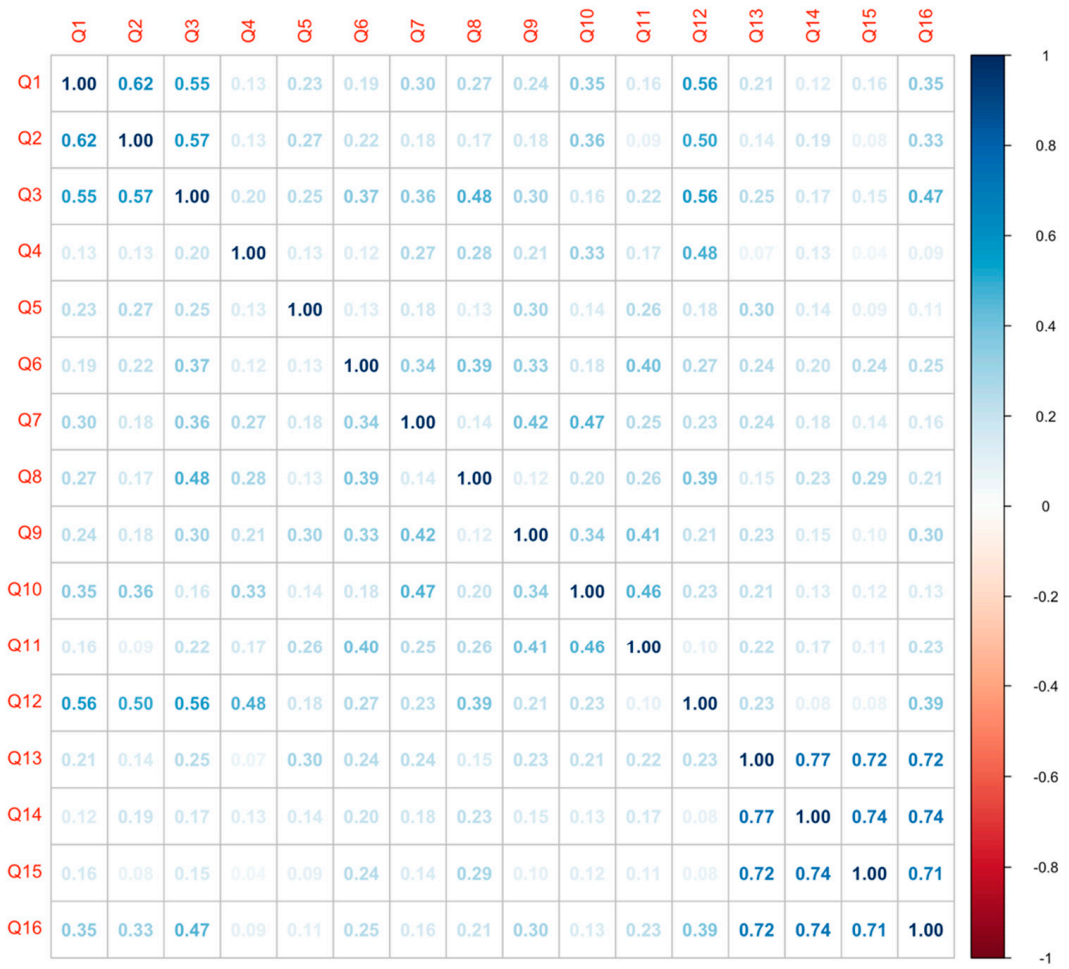


Figure 4. Cramer's V correlation matrix. Color intensity and values are proportional to the strength of the correlation measure between the survey questions.

Table 1. Summary of ordinal logistic regression analyses of predictors and criteria.

Question	Coefficients	Value	Std. Error	T Value	*p*
Q3	Attacks	5.16×10^{-3}	2.47×10^{-3}	2.09	0.037 *
	Sector: Hunter	−2.19	0.97	−2.26	0.024 *
	Sector: Private owner	0.39	1.15	0.33	0.736
	Sector: Public administration	−0.39	0.79	−0.50	0.619
	Sector: Rancher	−0.93	0.83	−1.12	0.263
	Sector: Resident	−1.37	0.96	−1.43	0.153

Table 1. *Cont.*

Question	Coefficients	Value	Std. Error	T Value	*p*
Q4	Attacks	-2.93×10^{-3}	5.47×10^{-3}	−0.54	0.592
	Sector: Hunter	−17.52	3.38×10^{-7}	−0.52	0.000 *
	Sector: Private owner	−0.58	1.40	−0.41	0.679
	Sector: Public administration	−1.07	1.13	−0.95	0.344
	Sector: Rancher	−2.00	1.35	−1.48	0.138
	Sector: Resident	−0.88	1.37	−0.64	0.522
Q5	Attacks	2.4×10^{-3}	1.5×10^{-3}	1.23	0.653
	Sector: Hunter	0.99	1.31	0.76	0.450
	Sector: Private owner	0.99	1.72	0.58	0.565
	Sector: Public administration	−0.44	1.10	0.84	0.689
	Sector: Rancher	0.99	1.18	0.84	0.403
	Sector: Resident	0.99	1.54	0.64	0.522
Q6	Attacks	3.1×10^{-3}	2.5×10^{-3}	0.39	0.544
	Sector: Hunter	−0.09	1.04	−0.09	0.929
	Sector: Private owner	1.84	1.18	1.57	0.117
	Sector: Public administration	−1.44	1.11	−1.29	0.198
	Sector: Rancher	-9.00×10^{-5}	0.91	-9.93×10^{-5}	1.000
	Sector: Resident	−1.44	1.53	−0.94	0.347
Q7	Attacks	0.91	1.06	0.86	0.388
	Sector: Hunter	1.63	1.14	1.42	0.155
	Sector: Private owner	−2.19	1.36	−1.62	0.105
	Sector: Public administration	0.77	0.99	0.78	0.435
	Sector: Rancher	1.52	1.14	1.33	0.183
	Sector: Resident	-2.8×10^{-3}	2.8×10^{-3}	−0.99	0.324
Q8	Attacks	0.01	4.9×10^{-3}	1.72	0.086
	Sector: Hunter	−0.35	0.99	−0.35	0.724
	Sector: Private owner	0.01	1.33	0.01	0.992
	Sector: Public administration	−0.31	0.94	−0.33	0.744
	Sector: Rancher	−0.57	0.92	−0.62	0.535
	Sector: Resident	0.20	1.04	0.19	0.847
Q9	Attacks	3.4×10^{-3}	1.3×10^{-3}	0.26	0.796
	Sector: Hunter	−1.33	1.05	−1.27	0.205
	Sector: Private owner	−1.18	1.33	−0.89	0.374
	Sector: Public administration	0.72	0.80	0.89	0.371
	Sector: Rancher	0.07	0.81	0.09	0.931
	Sector: Resident	0.58	1.01	0.57	0.570
Q10	Attacks	2.8×10^{-3}	1.33×10^{-3}	2.08	0.038 *
	Sector: Hunter	−0.50	1.01	−0.50	0.620
	Sector: Private owner	−1.26	1.33	−0.95	0.344
	Sector: Public administration	−0.95	0.93	−1.01	0.311
	Sector: Rancher	−0.29	0.87	−0.33	0.739
	Sector: Resident	1.21	0.97	1.25	0.213
Q11	Attacks	-3.50×10^{-3}	2.52×10^{-3}	−1.38	0.166
	Sector: Hunter	1.57	0.96	1.63	0.103
	Sector: Private owner	2.48	1.33	1.85	0.064
	Sector: Public administration	−0.02	0.88	−0.02	0.982
	Sector: Rancher	1.05	0.85	1.24	0.215
	Sector: Resident	−0.41	1.09	−0.38	0.704
Q16	Attacks	0.01	5.39×10^{-3}	−2.27	0.023 *
	Sector: Hunter	10.59	1.12×10^{-3}	9406.32	0.000 *
	Sector: Private owner	20.82	2.85×10^{-3}	7314.22	0.000 *
	Sector: Public administration	0.15	0.98	0.14	0.882
	Sector: Rancher	5.09	2.79	1.83	0.067
	Sector: Resident	9.63	1.1×10^{-3}	8493.07	0.000 *

There was no significant influence of the number of attacks and the sector to the answering of questions related to compensation: Q5 is related to the public administration doing a good job; Q6 questions whether wolves' damages should not be compensated; Q7 asks whether economical compensations must continue even without attacks; Q8 questions whether compensation programs improve the perception toward wolves; Q9 asks about worries about enough compensation if the attacks increase; and to question Q11 questions whether non-lethal preventive methods are necessary.

4. Discussion

Protecting and restoring the presence of large carnivores in their historical ranges is imperative both for the survival of the species and to protect the ecosystem services they provide. The present research highlights the need to study the conflict between all stakeholders that are directly or indirectly affected by the presence of wolves in the study area. Groups that are not usually included in this type of study, such as the public administration, were included in this work. The opinion provided by all the different stakeholders facilitates valuable information that can be incorporated into conservation plans. Such information, which shows the apparent disconnection between some closely interconnected sectors, would be key to the environmental governance of the northwest Iberian Peninsula.

Overall, the surveyed stakeholders show a positive attitude towards wolves. However, some differences between the sectors investigated can be highlighted. This is in agreement with other studies that assessed attitudes toward wolves of different groups such as hunters, landowners, and the general public, and found that tolerance also varied among sectors [11,40]. In our study, the least tolerant was the hunters' group, followed by ranchers, locals, wolf experts and administration employees. Thus, the data obtained in the present work coincide with Torres et al. [41], where the attitudes of local people and stakeholders in a nearby study area (Montesinho Natural Park, northwest Portugal) were evaluated by means of surveys. In that study it was observed that the attitude towards the wolf is significantly different between groups ($H = 43.655$; $df = 2$; $p < 0.05$), with the general public showing a more positive attitude (attitude score = 3.84) than hunters (3.12) and stockbreeders (3.1). This may be due to the depredation of livestock, which causes one of the main problems associated with the negative attitudes of ranchers and hunters, especially in areas where the wolf population is increasing [12,42,43]. The attitude shown by this sector tends to be expressed in multiple studies, such as those from India [12], Sweden [34], USA [12,21,43] and some areas in Portugal [42,44]. However, the positive attitude shown by hunters in other studies, such as in some areas of northern Portugal [37], is also noteworthy. In contrast to this less positive attitude of the above-mentioned sectors, the positive opinion of the public administration stands out. This difference between sectors may be due to the lower likelihood of contact of the administration with the wolf.

Populations of large carnivores such as wolves have been recovering in places such as the USA and Western Europe, mainly due to changes in legislation, conservation programmes and changes in land use [45]. An increase in the population of predators will eventually lead to an increase in livestock depredation. Therefore, people affected by this will probably have a negative perception towards big predators. Other factors could influence how people see wolves. According to some studies, people with a higher education and income, and those living in urban areas will have a more positive view of wolves than people living in remote, rural areas and those with a more direct contact with carnivores [38,46]. In addition to the levels of study, other works found different levels of acceptance according to gender, with females having lower acceptance due to fear of attack by carnivores [40]. Gender differences in conservation practice are not generally considered, but bringing women into conservation policy can also bring them closer to nature [47]. It is important to take each of these implications into account in the interest of making conservation policies that are accepted and adhered to by the public. In this way,

the support of stakeholders can be secured, and the success of policies and measures for optimal environmental governance can be guaranteed.

Several studies have shed some light on the complex relationship between humans and wolves [6]. This study demonstrates, from the Ordinal Logistic Regression Model conducted, that the education and knowledge of each stakeholder were strong predictors in explaining the acceptance of this important endangered species. The support of these sectors for the measures carried out by the administration, as well as their active participation, is key to the success of the conservation of the species. It is necessary to continue working on mitigating the gap between the sectors that have direct contact with the wolf and may suffer damage caused by the wolf through the economic compensation of damages. It is also necessary to continue training and raising awareness of this species, which plays a fundamental role in the configuration of ecosystems [48]. The results presented here coincide with those obtained in other studies, for example, in Skogen and Thrane [49] in Norway found that cultural patterns such as education, place of residence (urban/rural), and cultural capital could influence how people see wolves. Ericsson and Heberlein [34], found that in Sweden the public opinion of wolves was determined by the damages that wolves might cause to livestock and private animals, and if a wolf lost its fear of humans. Perantoni [50], suggested that in the Italian and Slovenian Alps, personal experiences with wolves such as having had an animal killed by a wolf will shape people's opinion. This work is perhaps limited by a number of factors. As stated earlier, some studies have suggested that attitudes towards predators are correlated with gender and age, and therefore knowing this could give us more information about people's perception of wolves. Nevertheless, the views and opinions of those groups that are directly affected from the impact wolves have on their livestock are vital when it comes to the design and improvement of policies and compensation programmes.

5. Conclusions

The results showed that although stakeholders show a positive attitude towards wolves, this changes when looking at answers by group. Stakeholders with direct contact with wolves or whose livestock is affected by them, such as hunters and ranchers, were less tolerant than other groups such as administration employees or wolf experts. People who see wolves as a harmful species will likely believe wolf populations are higher than they should be, and the damages caused by wolves too numerous, as well as agreeing to a wolf hunting season. Most respondents consider that wolf damages should always be compensated and that compensation programmes should exist even when wolves no longer present a threat. However, only 13.46% of people consider the current tools to be enough. People affected directly by a wolf attack will probably have a negative perception towards large predators. Furthermore, according to the Ordinal Logistic Regression Model calculation; hunters, private ranchers and local residents were 10.59, 20.82 and 9.63 times, more likely to agree compared to the opinion of local experts, respectively. What this stakeholder gap indicates needs to be incorporated into the development of environmental governance policies and conservation plans for the species. Factors such as income, education, and whether one lives in a rural or urban area could influence people's perception of wolves. Other aspects such as gender and age should be also included in the future in order to have a clear idea of people's views of wolves and to improve policies and compensation programmes. Consideration of this information in the development of conservation policies is key to their success.

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Appendix A

Questionnaire

Q1. Do you consider the wolf population in your area is greater than the territory capacity?
- I agree
- I disagree
- Neither agree nor disagree

Q2. Do you consider the damages caused by wolves in your area are numerous?
- I agree
- I disagree
- Neither agree nor disagree

Q3. Do you consider the wolf as a harmful species?
- I agree
- I disagree
- Neither agree nor disagree

Q4. Do you consider important the presence and management of the Galician Horse as a way to reduce damages produced by wolves?
- I agree
- I disagree
- Neither agree nor disagree

Q5. Do you consider the current tools used by the Galician Administration are enough and effective to palliate the damages produced by wolves?
- I agree
- I disagree
- Neither agree nor disagree

Q6. The losses and damages caused by wolves are part of cattle raising and should not be compensated:
- I agree
- I disagree
- Neither agree nor disagree

Q7. Should compensation programmes continue even when wolves no longer pose a threat or danger:
- I agree
- I disagree
- Neither agree nor disagree

Q8. My tolerance towards wolves would decrease if there were not compensation measures in place:

- I agree
- I disagree
- Neither agree nor disagree

Q9. I worry that as wolf populations begin to settle, it will be too expensive to keep funding compensation programmes:

- I agree
- I disagree
- Neither agree nor disagree

Q10. If a person believes they have lost an animal as a results of a wolf attach, they should . . . (chose only one answer):

- Be compensated regardless of how they manage their livestock
- Be compensated only if they manage their livestock following appropriate practices (ex: correct removal of dead animals)
- Not be compensated

Q11. If a person believes they have lost an animal as a results of a wolf attach, they should . . . (chose only one answer):

- Be compensated only if they show proof of the attack
- Be compensated only if administration employees find proof of the attack
- Not be compensated

Q12. Do you consider it necessary to reimburse farmers for the preventive measure established by them to avoid wolves' attacks on their livestock? (ex: surveillance dogs, electric fences, rubber bullets, etc.):

- I agree
- I disagree
- Neither agree nor disagree

Q13. Do you consider it necessary to create a fund to compensate farmers that suffer losses as a result of wolves' attacks?

- I agree
- I disagree
- Neither agree nor disagree

Q14. What is your opinion in using non-lethal tools such as surveillance dogs, electric fences and rubber bullets to prevent wolves' attacks?

- I agree
- I disagree
- Neither agree nor disagree

Q15. If a wolf kills a livestock animal, authorities should . . . :

- Not take any immediate action but should first monitor the situation
- Try to get the wolf to establish in a wild area
- Try to scare the wolf or to keep it away from the farm
- Kill the wolf

Q16. Do you consider a wolf hunting season should be established?

- I agree
- I disagree
- Neither agree nor disagree

Only for farmers:

- Order from highest to lower, the cause of death of your livestock:
  - ○ Direct predation
  - ○ Indirect predation (as a results of wounds)

- ○ Other causes

- Do you own deterrent tools or methods? (chose all the answers that are applicable to you):
  - ○ Mastiff dogs
  - ○ Fences
  - ○ Electric Shepherd
  - ○ Others
- What are the wolves' attacks you have suffered like? (chose all the answers that are applicable to you):
- Number of attacks per year:
  - ○ 1 attack
  - ○ 2–3 attacks
  - ○ More than three attacks
- Time of the year:
  - ○ Autumn
  - ○ Winter
  - ○ Spring
  - ○ Summer
- Place:
  - ○ Pastures
  - ○ Private property
  - ○ Mountains

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