Research Article

PERFORMANCE OF TWO INSURANCE-BASED COMPENSATION SYSTEMS FOR WOLF DAMAGES IN ITALY AND SPAIN

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1. Introduction

Livestock depredation is one of the most important factors triggering conflicts between people and wolves (*Canis lupus*) (Newsome et al., 2016; Woodroffe et al., 2005). When conflicts are especially intense, functional coexistence with wolves relies on the ability of managers to devise conflict mitigation strategies that are transparent, have clear goals and are receptive to livestock owners' needs and contexts. Such strategies are expected to build trust between livestock owners, funders, managers and the general public and to engage livestock owners by promoting a sense of shared responsibility (Redpath et al., 2017).

Typically, mitigation strategies have focused on preventing livestock depredations, through lethal and non-lethal interventions (Eklund et al., 2017), and on alleviating the economic burden of coexisting with wolves by compensating the damages they cause (Blanco, 2003; Boitani et al., 2010; Nyhus et al., 2005; Ravenelle and Nyhus, 2017). Insurance-based compensation is one such model (Dickman et al., 2011; Ravenelle and Nyhus, 2017), which requires livestock owners to pay all or part of an insurance premium in order to receive compensation. Other systems include ex-post compensation, paid after the damage has occurred, and ex-ante compensation, consisting of payments made to farmers that coexist with wildlife regardless of whether they experienced damages. Ex-ante compensation is sometimes conditioned to specific conservation outcomes such as the species' reproduction.

Relative to other compensation models, insurance-based compensation has been proposed as a more economically sustainable and therefore secure source of compensation, giving farmers autonomy and ownership of the issue while also increasing their accountability (Hussain, 2003; Nyhus et al., 2003; Psaroudas, 2007). Site specificity is likely to influence the effectiveness of compensation as a conservation tool (Nyhus et al., 2003). Given the high economic, social and conservation stakes involved, there is therefore an

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urgent need to assess what works in different contexts and under which conditions.

Here, we examine the functionality of two insurance-based compensation models: in the Province of Grosseto, Italy, where the LIFE MEDWOLF project (LIFE11NAT/IT/069) is being carried out (www.medwolf.eu), and in a portion of the communal hunting grounds in the Province of León, which is representative of the compensation system used in most of the wolf range in Castilla y León region, Spain. Marked differences characterise the two areas in terms of wolf population management, history of the species' presence and land ownership systems. This helps explain some of the differences in how the systems operate and sheds light on the conditions under which insurance-based compensation might fall short of its conflict mitigation purpose.

2. Case Study I: The Province of Grosseto, Italy

2.1. Background

In the Tuscany region, of which the Province of Grosseto is a part, different compensation models have been used over time (Fig. 1). Compensation was first adopted in 1982 in the form of ex-post compensation covering up to 80% of the market value of livestock depredated by wolves and up to 60% of the value of livestock depredated by dogs. In 1994 the system was revised in order to cover the full market value of livestock lost. The distinction between wolf and dog damage was removed, but compensation was made conditional on the adoption of at least one type of damage prevention measure (stables, fences, livestock guarding dogs, acoustic deterrents or video surveillance), which, however, did not need to be in use when damage occurred. These two clauses have been maintained in posterior compensation systems. In 2005, the regional authorities switched to an insurance compensation system, claiming that ex-post compensation is incompatible with EU guidelines on state aid to the agricultural sector (Gazzola et al., 2008). This was the first time that an insurance system was used to compensate damages caused by large carnivores in Italy. Subscription was voluntary (i.e. not required or mandated) and the amount compensated was lowered to 70% for killed or euthanized sheep, goats, and cattle, 50% for killed or euthanized horses and 30% for abortions or missing livestock (Fig. 1). Eighty per cent of the basic premium was subsidised by the regional government and 10% by an insurance consortium, while the remainder was covered by farmers. On a yearly basis, regional funding for insurance premiums in the Province of Grosseto amounted to 33,051 EUR (SD=5,746) and the insurance consortium's funding amounted to 4,132 EUR (SD=718) (data from years 2010-2013). On the other hand, farmers' total contribution amounted to 6,605 EUR (SD=1,110) (data from years 2010 and 2012). Individual farmers invested an average of 90 EUR (SD=73) per year on the insurance premium, plus a 20 EUR subscription fee. The insurance premium depended on the value of the insured livestock and, since 2010, compensation was reduced (to a minimum of 10% of the value of killed/euthanized livestock) and premiums were increased (up to 80%) for livestock owners that experienced substantial damages in the previous years (Ricci, 2014). Each year was divided into four-month periods and payments were made within 60 days after the end of each period. Then, in 2014, under pressure from professional livestock associations, the ex-post compensation model was rein-

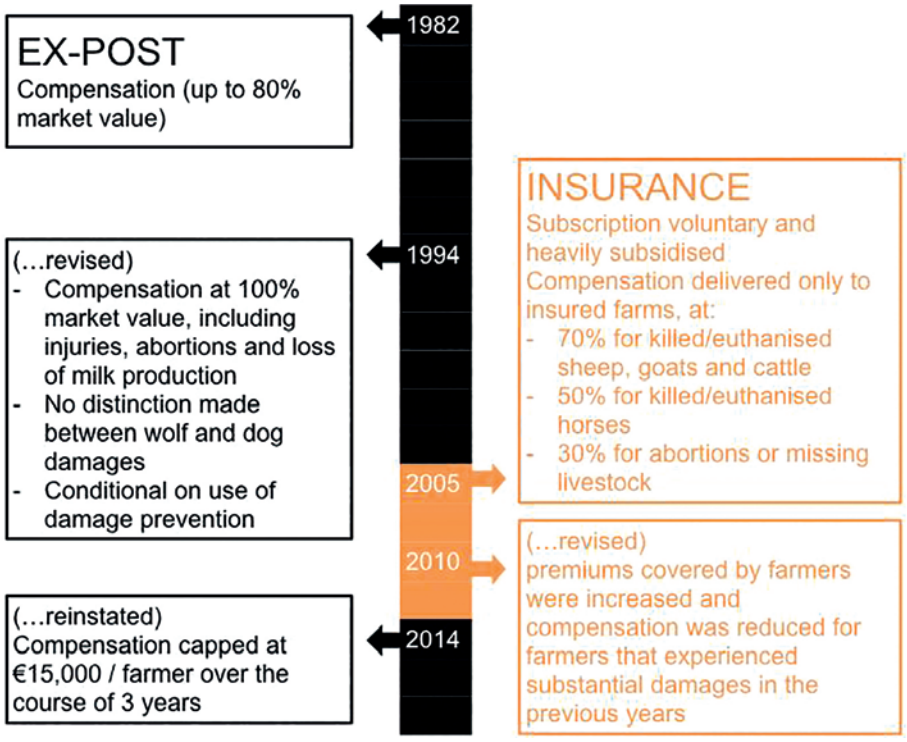

Fig. 1. Chronology of damage compensation systems implemented in the Province of Grosseto.

Sheep flocks in the Province of Grosseto, Italy. Photos: Luisa Vielmi.

stated, but the total amount issued in compensation to each farmer was capped at 15,000 EUR over the course of three years, falling under the EU *de minimis* aid regime (not considered state aid[1]).

2.2. Study area

The province of Grosseto (4,479 km^2) is an area where wolves re-established a stable presence since the 1980s (Boitani and Ciucci, 1993). Activities to estimate the wolf population are underway under the MedWolf project (LIFE11NAT/IT/069). As in the rest of Italy, the species is listed as strictly protected in Annex IV of the European Union (EU) Habitats Directive. There is a human-dominated landscape of privately owned, mostly agricultural land, with dairy sheep being the main species of livestock bred following a semi-extensive herding practice where sheep graze in nearby pastures throughout the year. Having abandoned traditional herding systems once employed to prevent damages, farmers are now having to adjust their herding practices to the wolf's return by adopting livestock guarding dogs and predator-proof night shelters. Intense social conflicts surround the presence of wolves in the area and in recent years

[1]http://europa.eu/rapid/press-release_IP-13-1291_en.htm.

these have escalated into various episodes of poaching where carcasses have been exposed on roadsides along with menacing signs directed towards conservationists and managers. Moreover, in 2013 a request was made to the Ministry of Environment to obtain derogation to the wolf's protected status, but so far this has not been granted.

2.3. Methods

We analysed several sources of information on livestock damages and damage mitigation policy, spanning the period from 1999 to 2016. These consisted of: a) verified compensation claims under the first ex-post compensation regime (1999-2005) and under the insurance regime, limited to livestock owners that subscribed to the insurance (2007-2013); b) a questionnaire survey conducted through face-to-face interviews in 2013 with a randomly sampled group of 134 sheep owners with more than 50 sheep heads (11.1 % of those active in the Province in 2013; Banca Dati Nazionale); and c) depredations declared to the Regional Veterinary Service, regardless of whether or not farmers subscribed to the insurance scheme (spanning both the insurance-based system and the reinstated ex-post system: years 2012-2016). Here, we summarise the findings of a previous publication (Marino et al., 2016) and update them with data from the recently reinstated ex-post compensation system.

2.4. Results

The results are mostly based on sheep depredations, as these constituted between 95-100% of the livestock depredated in the Province. Overall, we recorded a decline of 81% in the amount compensated annually during the insurance-based period (mean: 33,296 EUR) compared to the old ex-post compensation period (mean: 176,218 EUR) (Marino et al., 2016). Focusing on the insurance period (2007-2013), we found that, annually, only 5% (SD=1) of all the sheep owners officially active in Grosseto subscribed to the insurance (Fig. 2; Marino et al., 2016).

The reasons behind this low level of uptake were elucidated through our interviews with sheep owners (n=51 as not all farmers answered this question), in which most mentioned the cost of the insurance premium, considering also that, when farmers claim damages, they are required to follow costly procedures to dispose of livestock carcasses (Fig. 3). Other factors included lack of awareness regarding the system and, in a minority of cases, questions of principle as farmers felt it was unfair for them to have to insure themselves against something they perceived to be the responsibility of the state. In this respect, it is important to note that only 7% of those that were never insured claimed to be aware of the insurance system's terms and that the average insurance premium covered by livestock owners was not especially costly (Marino et al., 2016).

Finally, we found that 50% of the interviewed farmers claimed to have suffered depredations, while official registries reported damages affecting only between 2% (SD=0.7) and 6% (SD=0.8) of the farmers present in the province, based on data from the insurance system and the veterinary service, respectively (Marino et al., 2016). These results highlight how official figures available from the insurance period largely underestimate the true proportion of afflicted sheep owners and the real impact of wolves in the area.

To estimate the extent of this phenomenon, we extrapolated the proportion of interviewed farmers that declared damage to the veterinary service to the total number of sheep farmers in Grosseto. We found that as many as 34% of all sheep owners in Grosseto may have actually experienced depredations (Marino et al., 2016). Data from the current ex-post compensation system, which was reinstated in 2014, show that the yearly proportion of farmers from the Province of Grosseto declaring damages to the veterinary service had risen considerably from 6% during the

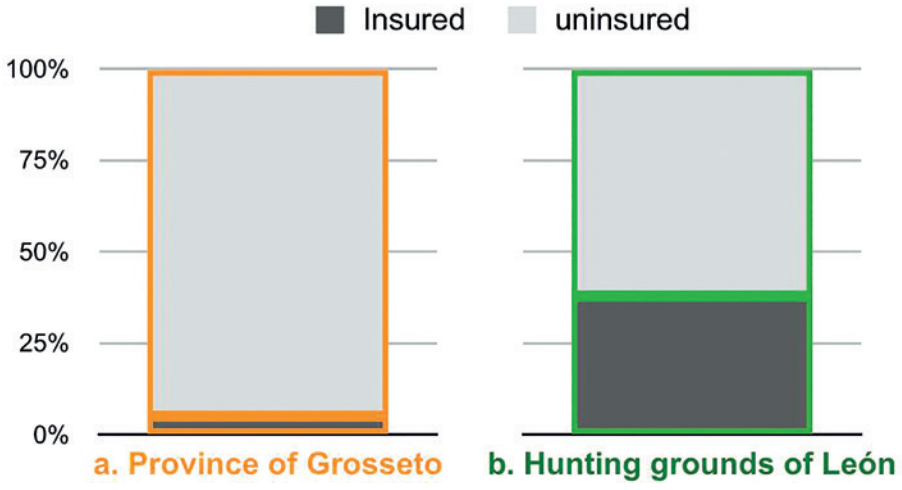

Fig. 2. Percentage of insured livestock owners in a) the Province of Grosseto (data taken from the insurance and official sheep registries) and b) the hunting grounds of León (data taken from a representative sample of livestock owners in the study area).

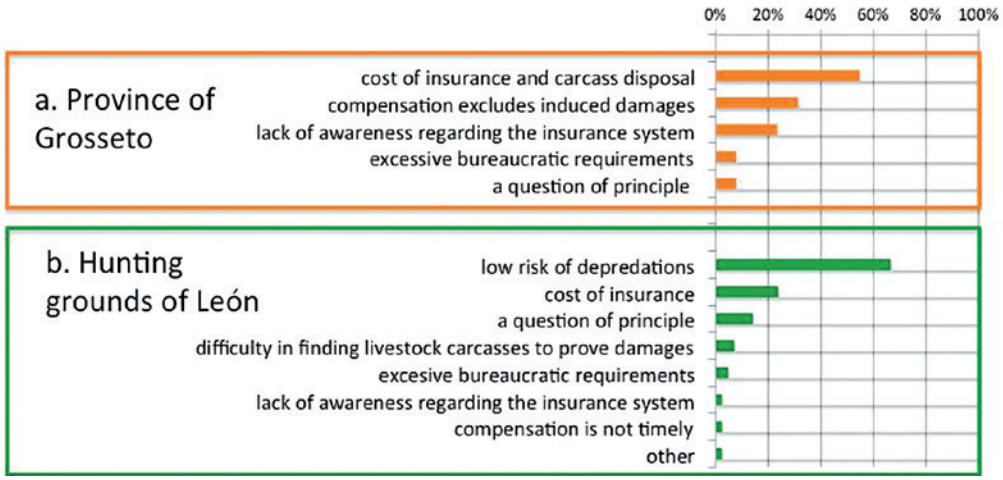

Fig. 3. Reasons given by farmers as to why many of them were not insured against wolf damages in: a) the Province of Grosseto, Italy (n=51); and b) the hunting grounds of León, Spain (n=42).

insurance years to 15% under the reinstated ex-post compensation program (SD=3, referring to the years 2015 and 2016). Since the reinstatement of the ex-post compensation model, each farmer declared, on average, between 7 (SD=11) and 5 (SD=6) livestock heads affected by death or injury due to depredations, per year (data referring to depredations certified by the Veterinary Service in the years 2015 and 2016, respectively). However, considering that compensation is capped to include several other types of subsidies, it is possible that some farmers may not be declaring damages having already reached their compensation limit. Unfortunately, registries are being archived in such a way that it not possible to obtain yearly estimates of compensation paid.

3. Case Study II: The hunting grounds of León, Spain

3.1. Background

In the Province of León in Spain, compensation was first adopted in 1999, providing the portion of damage value not covered by insurance. It was expanded in 2003 to offset other costs related to depredation (such as abortions, loss of milk production and subsidies per livestock head), and was included as a main conflict mitigation tool in the 2008 Wolf Management Plan of Castilla-León (Law BOCYL N.68 09/04/2008). To access this funding, farmers are required to be insured and to have filed a request to the Regional Administration after the damage is verified by local rangers. In addition, state funds subsidise a portion of the livestock insurance premium, which varies slightly from year to year and according to the species of livestock insured. In 2015, the minimum amount subsidised for insurance premiums for cattle, sheep and goats was 22% and the maximum amount was 50%, while the minimum amount subsided for horses was 20% and the maximum amount was 50%. In 2016 the minimum amount subsidised for all four livestock species was 23% and the maximum amount was 51%. Differences between minimum and maximum amounts subsidised depend on characteristics of the farms, whether they are certified organic, if insurance was renewed from the previous year and other features (Entidad Estatal de Seguros Agrarios 2015 and 2016).

Payments from the insurance and regional administration are not conditional on the use of damage prevention measures and include damage from wolves as well as dogs. Depredations are included in a basic livestock insurance package which also covers accidents, loss of many livestock in a single event, loss of production due to any event covered by the insurance and certain diseases, depending on the livestock species insured (Entidad Estatal de Seguros Agrarios 2015 and 2016). Insurance payments are made within two months of a damage claim.

Hunting grounds are supposed to reimburse livestock depredations (Article 12 of the1996 Regional Hunting Law, and Article 33 of the 1970 National Hunting Law) but in reality they seldom do so. Instead, damages occurring inside regionally managed hunting reserves, such as the reserve of Riaño to the north of the study area, are currently fully compensated by the regional administration (according to fixed amounts set by the compensation rules: Law BOCYL-D-25042017-6).

3.2. Study area

The study area is comprised of 11 municipalities (1,053 km^2) in the eastern portion of León, an area in N Spain were wolves have always been present (Chapron et al., 2014). In 2012-2013, 0.8 packs/100 km2 were estimated to be present in the area (Sáenz de Buruaga et al., 2015). Wolves in this area are included in Annex V of the Habitats Directive and listed as a game species, with the Autonomous Region of Castilla-León setting

Mountain pastures in the private hunting grounds of León, Spain. Photo: Anna Planella Bosch.

a yearly hunting quota for each of its administrative districts. Within these districts, quotas are allocated by giving priority to hunting grounds with greater livestock damages and greater chances to fulfil the quotas (Law BOCYL-D-23052016-2). In the whole province of León, home to 59 wolf packs in 2012-2013 (Sáenz de Buruaga et al., 2015), hunting quotas amounted to 50 wolves in the season 2015-2016.

The landscape is composed of agricultural lands at lower elevations, and mountainous, forested areas. The mountainous area is subdivided into communally owned grounds whose hunting rights, including wolves, may be auctioned off to private holders.

3.3. Methods

We obtained data on livestock depredation by wolves declared to the regional administration (2013-2015) and, in 2017, we carried out 71 interviews with local livestock owners in order to evaluate the representativeness of the official damage registries (collecting data on self-reported, unverified damages from 2015-2016). We randomly sampled 47% of livestock owners in the study area who received subsidies from the Common Agricultural Policy (Fondo Español de Garantía Agraria, 2016). Of the interviewed farmers 58% owned beef cattle, 11% dairy cattle, 33% meat sheep, 4% dairy sheep, 7% meat goats and 6% owned horses. All of them practiced extensive or semi-extensive livestock breeding: grazing livestock throughout the warmer seasons either in mountain pastures or in pastures near their stables. Few farmers, usually sheep owners, kept their livestock in night time enclosures during the warmer season.

3.4. Results

Out of the farmers who claimed to have suffered damages in 2015 or 2016 (18/71 and 21/71 of those interviewed, respectively) most owned beef cattle (56 and 57%, respectively) or meat sheep (28 and 30%); the rest owned meat goats (4 and 11%), horses (0 and 9%) or dairy sheep (0 and 6%). Self-declared estimates of farmers who claimed damages ranged between 5 (SD=4) and 6 (SD= 9) livestock heads affected by death or injury due to depredation per year, referring to 2015 and 2016, respectively. These represent on average 3% (SD=3) of stock owned by each damaged farmer at the time of the interview.

Overall, 38% of interviewees were insured against livestock depredations (Fig. 2). Only 20% of them (and 30% of insured farmers) were aware that the re-

gional administration offered match funding to compensate damages suffered by insured farmers. Other than the fact that some farmers considered themselves to be at low risk of depredation, the main reasons cited by uninsured farmers (n=42) for not being insured mirrored those of livestock owners in the Province of Grosseto: farmers lamented the cost of the insurance and felt that insuring their livestock against predators was not their responsibility (Fig. 3). Neither farm size (measured as the total number of livestock owned), whether farmers experienced damage, nor how many livestock they claimed to have lost to depredation significantly influenced the likelihood of being insured (Wilcoxon and Chi-square tests, $0.14 \leq p \leq 0.78$). Similarly, the species of livestock owned did not influence the likelihood of being insured, (Fisher and Chi-square tests, $0.24 \leq p \leq 1$), except in the case of dairy cattle owners (n=8) none of which were insured. Of those interviewed farmers who had claimed damages from insurance at some point in the past, the majority (9/13) were satisfied with the compensation they received, in terms of the amount compensated and the timing of payments.

When asked which types of compensation they would prefer, 74% opted for ex-post compensation funded by the regional administration and 33% were open to prepayment compensation schemes (i.e. farmers that coexist with wolves would receive a fixed annual sum regardless of whether they experienced depredations). It is worth mentioning that less than 3% of interviewees preferred private or co-financed insurance-based compensation, or compensation programmes funded by the hunting grounds. Preference for the type of compensation system was not influenced by whether farmers had experienced depredation or not, or the average number of livestock heads they lost to depredations per year (Chi-square and Fisher tests, $0.36 \leq p \leq 1$).

Finally, on average 28% of sampled farmers (SD=3) claimed to have suffered damage per year (18/70 farmers in 2015 and 21/70 farmers in 2016, NA=1 in both years). Of these, 36% (SD=4) had claimed from insurance on a yearly basis and 2% (SD=3) had claimed from the regional administration on a yearly basis but had not received match compensation at the time of the interview. The official records on livestock depredations showed that only one depredation event was declared to the regional administration between 2013 and 2015 in the study area, amounting to an average of 45 EUR (SD=45) per year being paid out to match the insurance compensation.

To obtain a further measure of conflict, farmers were asked whether they thought that wolves were killed illegally in the area. Fifty-nine percent believed that they were and some believed as many as three wolves were killed illegally per year in one municipality of the study area.

4. Discussion

Although data available to us from the two sites are not always comparable, the case studies allow for some general conclusions. Overall, livestock owners from both sites exhibited low levels of support and uptake of the insurance compensation model. Both in the Province of Grosseto and in the hunting grounds of León included in our study, the majority of damages occurring under the insurance compensation system went unclaimed. These results highlight the importance of assessing the functionality of compensation systems (Ravenelle and Nyhus, 2017) and finding ways to ensure that conflict mitigation strategies are accepted by those they are intended to benefit.

Overall, we found higher levels of subscription to the insurance scheme in León than in Grosseto (Fig. 3). This is most likely due to the fact that the insurance's basic package also included other types of accidents and risks, as well as the fact that farmers in León are more accustomed to wolf presence and therefore may be more inclined to consider depredation as one among many other business risks. Moreover, unlike the province of Grosseto, in León other more convenient types of compensation were never available before. However, the fact that a large number of damaged farmers did not claim compensation from the Castilla-León regional administration even though, given the choice, almost all farmers wanted it to fund compensation payments, is evidence that the area is experiencing unresolved conflicts. This is supported by the fact that illegal killing was believed to be widespread, despite the presence of a legal hunting system. The case study of León is interesting as its communally managed wildlife system, as well as its compensation history, should theoretically make it a candidate for a successful insurance scheme (Hussain, 2003). Instead, our results suggest a greater level of government commitment (see also Young et al., 2012) might be necessary if damage compensation is to be understood as a tool meant to alleviate the economic burden of depredations in return for coexistence.

In both study areas, the prevalence of unreported damages may be influencing the perception of wolves' impact on livestock activities and indicates a lack of robust indices against which to measure the effectiveness of conflict mitigation strategies. In the case of León, this is all the more significant given that wolf hunting quotas are officially allocated on the basis of conflict levels and are carried out in order to reduce livestock depredations (Law BOCYL-D-23052016-2). In the case of Grosseto, the lack of robust indices was coupled with a lack of clear management objectives, as the top-down implementation of the insurance-based system was most likely aimed at reducing costs for the public administration. This is not unique to the Tuscany region, as others in Italy have also revoked compensation policies or withdrawn funds to support them due to economic pressures (Boitani et al., 2010).

Our two case studies exemplify what have been termed "conflicts of information", occurring when information is lacking, misinterpreted or misunderstood (Redpath and Sutherland, 2015; Young et al., 2010). Scientists and managers share a responsibility to disseminate objective and transparent information concerning depredation levels and the progress of conflict management strategies, yet the challenge remains that of finding ways to ensure that information is accepted and trusted (Lopez-Bao et al., 2017). In this regard, it is important to recognise that wildlife conflicts are mediated by a range of factors that go well beyond wildlife's material impact. These have to do with the trust and power relations between stakeholder groups (Lüchtrath and Schraml, 2015; Young et al., 2016), people's expectations, interests and priorities (Dickman, 2010; Holland, 2015) as well as their culture and values (Agarwala et al., 2010).

Conflicts over the impact of wildlife are just the tip of the iceberg and even if we are able to accurately estimate depredation levels this does not mean we will achieve conflict mitigation. However, we consider it an important step in order to challenge the status quo that dominates conflicts surrounding wolf depredations in many parts of the species' range.

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