

## RESEARCH ARTICLE



# Conflict and cooperation in the management of European rabbit *Oryctolagus cuniculus* damage to agriculture in Spain

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## Abstract

1. Conflicts over the management of wildlife species that impact human livelihoods are increasingly frequent. In Spanish farmland areas, the European rabbit, one of the most important game species, can cause considerable crop damage. Tensions typically emerge between farmers who advocate rabbit reduction and hunters who are responsible for controlling populations when crop damage occurs but wish for healthy rabbit populations for shooting.
2. In this study, we used in-depth interviews and small group discussions with farmers, hunters and representatives of the governmental environmental and agricultural agencies to assess their positions in this conflict.
3. Our results showed tensions between and within groups, and that the conflict is influenced by leadership, distrust and past decision-making issues, and by differences in beliefs among groups. Positions of farmers and hunters are also relatively rigid, which may make difficult their engagement in collaborative processes. To be effective, such processes would demand that local leaders were empowered and likely also that external neutral mediators were involved.
4. Our study highlights the complexity and dynamic nature of the conflicts associated with wildlife species causing damage to human livelihoods and provides new insights that may be useful to facilitate dialogue and negotiation between stakeholders and to aid management and governance.

## KEYWORDS

environmental governance, human–wildlife conflicts, hunting, pest management, qualitative research, small mammals

## 1 | INTRODUCTION

In Europe, people often interact with wildlife as most of the land is used for human activities (e.g. farming or recreational activities). Human–wildlife interactions can be negative when wildlife impact human safety or livelihoods (e.g. damaging crops or livestock; Gontse et al., 2018). In this context, conflicts typically emerge between those

advocating a control of the species creating impacts and those defending its protection or even promotion (Redpath et al., 2013). The conflict between wolf *Canis lupus* advocates and detractors is a paradigmatic case (Bruskotter, 2013). These conflicts are generally damaging to both wildlife conservation and the livelihoods and well-being of the people involved (Dickman, 2010; Redpath et al., 2013), and understanding them is paramount to achieving their effective management.

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Conflicts over the management of wildlife are complex and depend on factors like the level of impact and the ecological value of the species, but also on economic interests, political and historical settings or social and psychological considerations (Dickman, 2010; Heberlein, 2014). Most research about human–wildlife conflicts focuses on wildlife impacts on food resources for humans and, to a lesser extent, on human safety and property (Peterson et al., 2010). Social studies typically focus on quantifying perceptions, opinions and attitudes towards the wildlife or towards management actions (e.g. Gamborg & Jensen, 2017; Garrido et al., 2017; Lindsey et al., 2005), but analyses of the deeper social conflict dynamics between the groups involved in these disputes are less frequent (Madden & McQuinn, 2014).

Many conflicts over wildlife management occur in farmland areas and involve herbivores causing crop damage or predators killing livestock (e.g. Dhakal & Tapa, 2019; Redpath, Bhatia, et al., 2015; Redpath, Gutiérrez, et al., 2015). Most studies dealing with these conflicts focus on large mammals (Anand & Radhakrishna, 2017), either because of their potential to cause large-scale damage and to threaten human safety or because these are more charismatic species, eliciting a stronger attention and demand for their conservation by certain societal sectors. In contrast, conflicts over the management of small mammal pests have received scant attention, although these species may cause severe agricultural damage that is at the root of widespread social conflicts worldwide (e.g. Delibes-Mateos et al., 2011; Singleton et al., 2010). One of these small mammals whose management is conflictive is the European rabbit *Oryctolagus cuniculus* in southern Europe (Delibes-Mateos et al., 2014).

The European rabbit is native to the Iberian Peninsula, where it plays major ecological roles in the Mediterranean ecosystem (Delibes-Mateos et al., 2008). Since the 1950s, Iberian rabbit populations sharply declined mainly as a consequence of habitat loss and the impact of viral diseases (Delibes-Mateos et al., 2009), and the species was recently classified as endangered by the International Union for Conservation of Nature (Villafuerte & Delibes-Mateos, 2019). However, some rabbit populations experienced substantial growth in the 2000s, particularly in farmland areas outside the historical high rabbit density areas (Barrio et al., 2010). In those areas, farmers increasingly report damage to crops, demanding a reduction in rabbit numbers. Rabbits are one of the main game species in the Iberian Peninsula (Ríos-Saldaña, 2010), and farmers' claims for controlling rabbits often cause tensions with hunters, who promote healthy rabbit populations for shooting (Delibes-Mateos et al., 2014). This is further complicated by the fact that Spanish legislation states that holders of hunting rights are responsible for crop damage caused by game species, and thus for their control, and that land property and hunting rights are frequently separated: in such cases, game managers must respond to the demands of the landowners, usually farmers, in relation to rabbit control (for more details see Section 3).

In the Iberian Peninsula, most research on rabbit crop damage has so far focused on describing the areas where it occurs and on the analysis of the main ecological drivers of such damage (Barrio et al., 2011, 2013; Delibes-Mateos et al., 2018; Ríos-Saldaña et al., 2013). In

addition, some studies aimed to assess the effectiveness of technical solutions to reduce rabbit impacts on agriculture (e.g. providing diversionary feeding or refuge for rabbits; Barrio et al., 2010, 2012). Although some of these technical solutions may be effective, it is widely accepted by environmental conflict researchers that tackling the underlying human–human conflict by working with the affected parties is needed to deliver long-term solutions for the benefit of wildlife and people involved (Gregory, 2000; Redpath, Bhatia, et al., 2015; Redpath, Gutiérrez, et al., 2015). Therefore, our main goal in this paper was to explore the views and positions of farmers and hunters, who are the main actors involved in the conflict regarding rabbit damage in farmland areas (Delibes-Mateos et al., 2014). We were particularly interested in how farmers and hunters framed the problems caused by rabbits to agriculture and how these parties perceived the potential management interventions to reduce rabbit damage to crops. In addition, we also assessed how governmental agencies position themselves in relation to this issue, as they are responsible for the legal framework that guides rabbit management in Spanish farmland areas. More broadly, we aimed to increase knowledge about the complex conflicts over different land uses (i.e. farming and hunting) in farmland areas, paying particular attention to the role of hunting in the management of wildlife species that cause important crop damage.

## 2 | BRIEF OVERVIEW OF ENVIRONMENTAL CONFLICT DYNAMICS AND COMPLEXITY AND DEFINITIONS OF TERMS USED

The dynamic nature of conflicts has been widely recognised in the literature, with several authors describing different phases (Lund, 1996; Sidaway, 2005). While simplistic, these models provide operational tools for mapping the dynamics of conflict processes, and help to design and apply appropriate strategies for each stage of conflict. Sidaway (2005) described four phases in conflicts: latent, escalation, active and aftermath. The aftermath circumstances condition the following episode of conflict, and this process of aftermath–episode–aftermath may continue in a repeating pattern. Latent conflict exists whenever individuals or groups have differences that bother the other party, but those differences are not overtly or unequivocally expressed (Yusran et al., 2017). Differential power, resources, differing interests or values all have the potential to spark conflict if a triggering event occurs (Brahm, 2003). A conflict can be escalated by a particular action taken by one of the parties or by some other external events (Sidaway, 2005). In the active phase, differences become manifest and parties often take a confrontational stance (Sidaway, 2005).

Typically, conflicts arise from misunderstandings between different parties, from their competing interests or from their opposing beliefs (Sidaway, 2005). These three categories are not mutually exclusive, and elements of each can simultaneously apply within a single conflict. Addressing positions, concerns, interests, values and beliefs of different actors is therefore fundamental in any conflict analysis (Bowonder, 1986). In the context of conflict negotiation,

positions are described as negotiating stances expressed as claims, demands or solutions (Sidaway, 2005). Negotiating over positions is often futile and obscures what people are really seeking: the satisfaction of interests that can probably be met in a number of ways (Sidaway, 2005). People's concerns include needs and fears (i.e. perceived risks to the satisfaction of the needs) and provide the clues to identifying interests, which are often hard to detect and may be negotiable. Finally, values and beliefs refer to views on what is right or wrong and how the world should be, which reflect personal or group identity (Sidaway, 2005). Values and beliefs remain often unchanged, being therefore non-negotiable (Acland, 1995).

Natural resource management draws on knowledge from multiple sources, and such knowledge is inherently uncertain. Indeed, the knowledge of the research system is often incomplete (i.e. scientific uncertainty), and there is also political and administrative uncertainty related to power relationships, values, costs and responsibilities (Pollard et al., 2019). Parties involved in environmental conflicts often use uncertainty to their advantage (Hodgson et al., 2018; Sidaway, 2005), which might potentially fuel the disputes. In addition, high levels of uncertainty may compromise effective conflict management (Pollard et al., 2019). In contrast, trust allows for emergence of cooperative behaviour (Emborg et al., 2020). Boon and Holmes (1991) define trust as 'a state involving confident positive expectations about another's motives with respect to oneself in situations entailing risks'. In most situations trust is a blend of affective and cognitive judgements (Lewis & Weigert, 1985).

### 3 | MATERIALS AND METHODS

#### 3.1 | Context: The European rabbit as a farmland pest in its native range

In Spain, farmers' complaints for rabbit damage to crops are spatially widespread and have steadily increased since early 2000s (Delibes-Mateos et al., 2018). Most rabbit damage is reported for vineyards and cereal crops (Delibes-Mateos et al., 2018; Ríos-Saldaña et al., 2013), where it may potentially cause severe yield reductions (Barrio et al., 2011). In some areas, agriculture intensification may have reduced the availability of natural food resources for rabbits, forcing them to feed on crops (Barrio et al., 2013). In general, greater damage is found in farmland areas where motorways and railways are present; verges and embankments offer ideal conditions for rabbit warren building and provide rabbits with refuge against hunters, as shooting is banned in these areas (Delibes-Mateos et al., 2018). The outbreak of a new variant of rabbit haemorrhagic disease in the early 2010s decimated most Iberian rabbit populations (Monterroso et al., 2016), and this was associated with a decline in farmers' complaints about rabbit damage (Delibes-Mateos et al., 2018). However, such complaints did not entirely disappear and even have increased again in recent years (Delibes-Mateos et al., 2018).

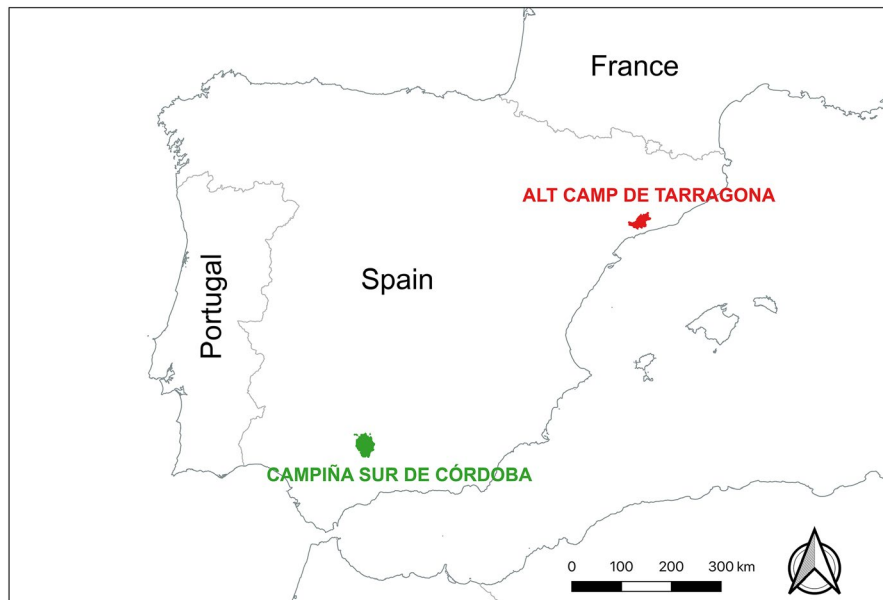
Hunting in Spain is practised in >85% of the territory (MAGRAMA, 2015). Landowners may create a hunting estate in their

land or grant permission to hunt on their lands to a game manager or a hunting association (usually against the payment of a fee), who create a hunting estate including land belonging to a number of landowners. Individual game managers or representatives of hunting associations (hereafter both referred to as 'game managers') make decisions as regards hunting (Arroyo et al., 2012). 'Regular' hunters are those who do not hold direct responsibilities in decision-making (hereafter referred to as 'hunters'). Additionally, it may also occur that farmers practice hunting even if they are not owners of the hunting rights.

Rabbit control refers to practices used to reduce rabbit numbers (i.e. shooting and ferreting) to reduce agricultural damage (Ríos-Saldaña et al., 2013). Actions for rabbit control can only be carried out if they are included in a hunting estate's management plan and if game managers have applied for administrative authorisation once crop damage is notified by farmers (Ríos-Saldaña et al., 2013). Recently, some regional governments have approved exceptional management plans to control rabbits in response to concerns about excessive crop damage. Such plans determine the target areas (usually known as 'emergency areas') in which intensive rabbit control by hunters is promoted (Delibes-Mateos et al., 2014). In these areas, it may not be necessary to apply for administrative authorisation to control rabbits in a given year. Given that holders of hunting rights are legally liable for crop damage caused by game species, game managers have to compensate farmers financially if they are not able to reduce rabbits and associated damage; alternatively, game managers can buy insurance policies to avoid having to pay these compensations (Delibes-Mateos et al., 2014).

#### 3.2 | Study areas

Our research was conducted in two study areas: Campiña Sur de Córdoba (CSC) in Andalusia, southern Spain, and Alt Camp de Tarragona (ACT) in Catalunya, northern Spain (Figure 1). CSC and ACT comprise 11 and 23 municipalities, respectively, the former being larger than the latter (1,100 km<sup>2</sup> vs. 538 km<sup>2</sup>) and including more inhabitants (105,000 vs. 44,000 inhabitants). These areas were selected due to similarities in the global context regarding rabbit damage to crops. The presence of vineyards is notable in both areas and there is significant rabbit damage to vineyards in both: indeed, both were included in the rabbit emergency areas declared by their respective regional governments in response to farmers' complaints. We did not have precise estimates of rabbit population trends, information about the evolution of the magnitude of rabbit damage (e.g. how requests for rabbit control had evolved over time) nor the level and/or evolution of the conflict in the study areas when we initiated the study. Nevertheless, we selected these two areas as they differ in certain aspects that we thought might help capture a higher diversity in stakeholders' views and opinions. For example, Catalunya is one of the regions with highest GDP per capita in Spain while Andalusia is one of the regions with lowest GDP per capita. Hunting is much more rooted in the society in the latter than in the



**FIGURE 1** Location of both study areas

	Campiña Sur de Córdoba		Alt Camp de Tarragona		Total
	Interviews	Discussion groups	Interviews	Discussion groups	
Farmers	4	4 (1 group)	3	7 (2 groups)	18 <sup>a</sup>
Hunters	3	8 (2 groups)	3	4 (1 group)	18
Government	7	—	12	—	19 <sup>b</sup>
Total	14	12	18	11	55

**TABLE 1** Total number of participants in interviews and discussion groups in each study area and for each stakeholder group

<sup>a</sup>Five farmers practised hunting (two in ACT and three in CSC).

<sup>b</sup>Three representatives of the government practised hunting (one in ACT and two in CSC) and two in CSC farmed as a secondary activity.

former. In addition, there are some variations in the governance systems between areas, as the structure and policies of regional autonomous governments varies strongly between regions. An example of this is the existence in ACT of a council named '*consell comarcal*' that brings together the representatives of all the municipalities in the area; this type of council does not exist in southern Spain.

### 3.3 | Qualitative survey

We used qualitative techniques to understand the perspectives and views of the main stakeholders involved in our study conflict. Globally, the key stakeholder groups associated with crop damage by rabbits include farmers, hunters and people working for governmental agencies in charge of wildlife management (Delibes-Mateos et al., 2014). Among the latter, we interviewed key representatives of the agriculture and natural environment departments of the regional governments of the study areas, and field technicians and rangers working for those departments. In ACT we also interviewed a representative of the '*consell comarcal*' (see above). Interviewed hunters included both 'regular'

hunters and game managers. The latter were members of the board of hunting associations that lease hunting rights to a number of landowners, and that were legally responsible of hunting and management decisions in their hunting estate. We also interviewed representatives of the Regional Hunting Federations of the study areas. Most farmers who participated in our survey cultivated their own land, and some farmers also practiced hunting in their local areas. Some of the interviewed farmers were representatives of agricultural cooperatives or managers in relevant farming associations. Even if conservation NGOs are active in rabbit management in Spain in other contexts (e.g. conservation management of protected predators), they are not key actors within the context of the study conflict.

Participants were selected using contact information provided by key informants in both study areas (i.e. snow-ball sampling; Young et al., 2018). The total number of participants in each study area and for each stakeholder group is shown in Table 1. We used personal interviews to gather the opinion of key informants; that is, managers in relevant farming associations, game managers and people working for environmental agencies. To assess the opinion of 'regular' hunters and farmers, we used small discussion groups

with three or four participants (Ruiz, 2012, 2017). In general, these people are not used to expressing their opinions in a relatively formal context such as a personal interview, and the small group provides a more conducive situation to share their views more openly and fluently. In addition, mutual reinforcement in a small group situation usually helps participants to gain self-confidence (Ruiz, 2012, 2017).

Interviews and small discussion groups were conducted between 15 October 2015 and 16 December 2015. We stopped data collection when we observed that no new key themes emerged with further data, as is usual in qualitative studies (e.g. Vernon & Clark, 2015). Both the interviews and the small discussion groups were conducted in such a way that a space was created for the open expression of the positions and criteria of the interviewees, that is, in a non-directive and conversational manner (Ruiz, 2017). The discussion groups present the risk that an 'opinion leader' may dominate the conversation, thus conditioning the interventions of the rest of the participants in the group. In our study, the moderator (J. Ruiz) has long experience in these techniques, and managed this potential limitation seeking a balanced contribution of all the participants in the conversations, which was particularly manageable given the reduced size of the discussion groups.

The interviews and small discussion groups were conducted following a script of issues to be addressed. Nevertheless, this was adapted to the characteristics of the participants and the own development of the interviews and discussion groups (e.g. Garrido et al., 2020). The script addressed three main topics: (a) participants' perceptions about rabbit populations and rabbit damage to crops both in the recent past and when the survey was done; (b) opinions about rabbit management conducted in the study area and (c) the relationships between stakeholders involved in the problems caused by rabbit damage to crops as well as participants' attitudes towards other collectives or groups (for more details see Appendix S1).

Interview duration ranged between 15 and 120 min, while groups ranged between 45 and 150 min. Both were digitally recorded and transcribed verbatim. Data from interviews and small groups were analysed jointly since both addressed the same key issues and had the same informative and opinion nature. Data analysis consisted of reading iteratively each text to identify main ideas and topics, pursuing an understanding and sociological interpretation of the data (Ruiz, 2009; Ruiz & Alonso, 2019), checking interpretations among co-authors to create added awareness of certain dimensions in the data (Bazeley, 2009), and thus to identify properly the main themes.

At the time of data collection, CSIC projects entailing this type of studies were not (yet) required to undergo formal evaluation by an ethics committee. Nevertheless, our study adhered to the basic ethical principles for conducting research that involves human subjects described in the Belmont report (National Commission for the Protection of Human Subjects of Biomedical & Behavioral Research, 1979). The first principle refers to *respect for persons*, which demands that people enter into research voluntarily and with adequate information. In this sense, we explained to participants all aspects of the research both when they were contacted

by phone and before the start of the interviews and group discussions. In particular, we gave them information about the purpose, methods and intended uses of the research prior to any information collection. In addition, each participant was informed about the safeguard of the privacy, confidentiality and anonymity of all the information that they could provide, according to Spanish law of data protection (i.e. Royal Decree-Law 5/2018, of 27 July, on urgent measures for adaptation of Spanish Law to European Union regulations on data privacy). Importantly, our research did not concern personal data and the facts and opinions collected about the issues investigated could not be linked to any physical person. After that, all participants gave their verbal consent to be interviewed. Therefore, their participation was voluntary and free from coercion, and they were informed of their right to withdraw at any time. The second Belmont report's ethical principle, *beneficence*, is the recognition that people are treated in an ethical manner not only by respecting their decisions and protecting them from harm, but also by making it an obligation to secure their well-being. In our study, the rights and well-being of participants were respected in every moment and participants did not express any complaint or concern on this matter during the study. The third ethical principle, *justice*, advocates fair treatment for all people and a fair distribution of the risks and benefits of the research. We followed a fair procedure in the selection of the participants who did not include vulnerable people. In addition, all people were treated equally in the interviews and small discussion groups, and we did not expect that potential burdens and benefits of the research were unequally distributed.

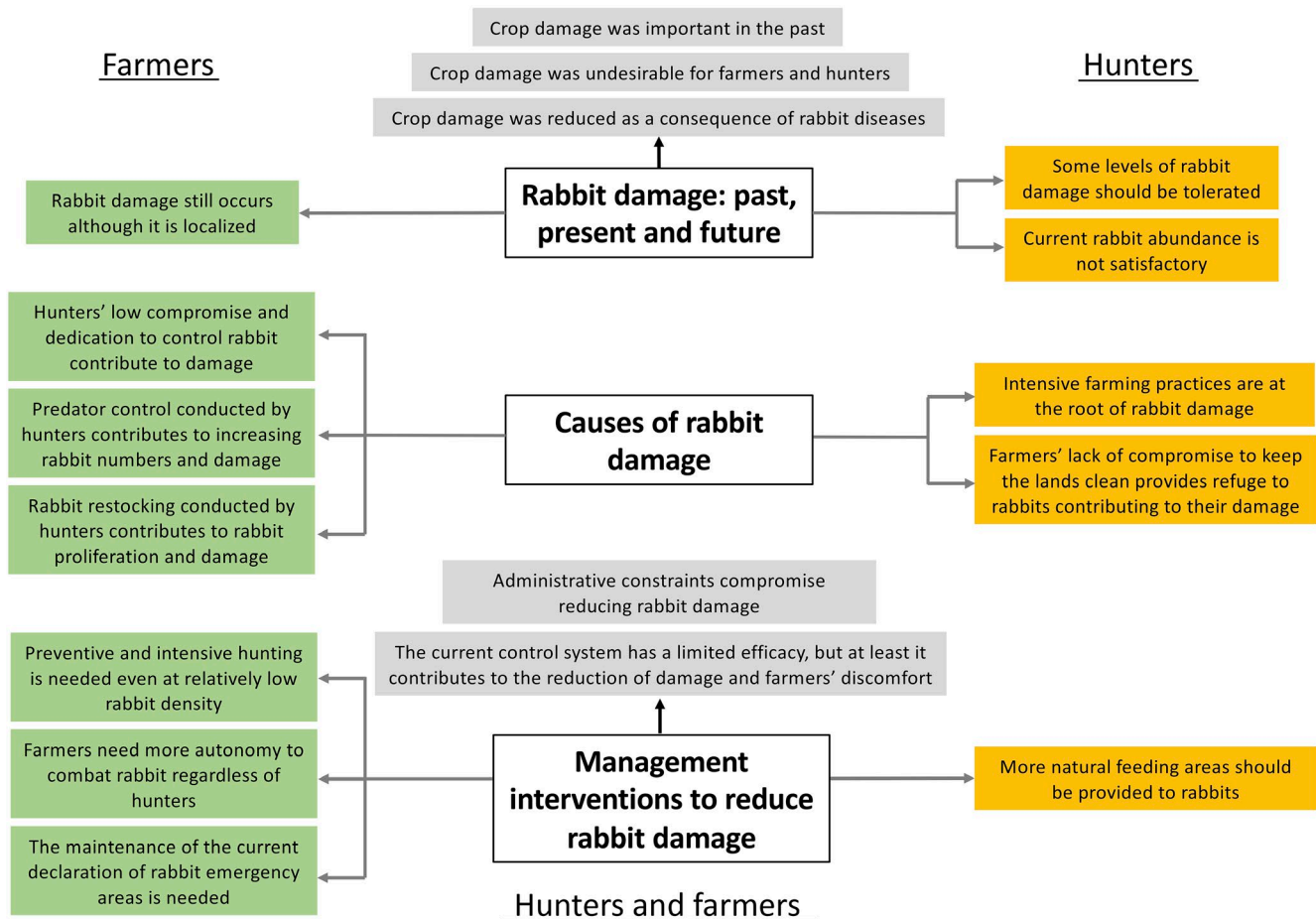
## 4 | RESULTS

Our main results have been summarised in four blocks. The first three blocks are related to rabbit damage and how the problem was viewed by the main stakeholders; perceived causes originating rabbit damage; and views about potential management interventions to reduce rabbit damage. The last part is specifically devoted to the conflict between farmers and hunters over rabbit management. Although the two study areas had their own peculiarities (see above), the main issues that emerged in the interviews and small discussion groups were similar between ACT and CSC. Only a few specific points were highlighted by participants of only one of the study areas, and those cases are detailed below.

### 4.1 | Perception of rabbit damage: Past, present and future

We found both agreements and discrepancies between farmers and hunters about the nature, magnitude and temporal evolution of rabbit damage (Figure 2). There was a general agreement that crop damage caused by rabbits is an important problem in the studied areas. This was not viewed as a historical problem, but something





**FIGURE 2** Diagram showing the main beliefs identified from the analysis, in relation to three overarching themes: rabbit damage, its causes and potential management interventions. Colours denote the allocation of the beliefs: green indicates beliefs held by farmers, orange by hunters and grey by both collectives

that started in the recent past (the 2000s) when an increase in rabbit numbers occurred. This situation was seen as undesirable not only for farmers, but also for hunters (and particularly for game managers; see below): on the one hand, rabbit damage confronted them with local farmers; on the other hand, controlling rabbits was seen by hunters as an obligation rather than as pleasant hunting (see also below in 'Perceptions of management interventions to reduce rabbit damage'). This view was also shared by some farmers (Quotation 1 in Table 2).

All collectives agreed that rabbits damage not only vineyards, but also other crops including olive trees, fruit trees or cereal crops. However, damage to vineyards was viewed as most important because, in addition to causing yield loss, rabbit grazing affects negatively the plant, compromising its production in future years (Q2 in Table 2). Some interviewees even mentioned the need to replace vineyards with other crops as a consequence of rabbit damage.

The rabbit damage situation led farmers and hunters to label rabbits as 'pests' ('plaga' in Spanish). This term, which in Spanish is also associated with a meaning of 'plague' and 'glut', is used to alert the government and society at large of the problem, and to legitimise the application of drastic management measures, such as intensive hunting and ferreting. In contrast, people working for environmental

agencies of the regional governments were against using the term 'plaga' to refer to damaging rabbits, either because they thought that rabbit densities were not sufficiently high for such consideration or because they believed that this could mean admitting eradication as a solution of the problem (Q3 in Table 2). This position was strongly criticised by farmers, as it was viewed as a sign of certain lukewarmness of the regional government when addressing rabbit damage management.

Both farmers and hunters agreed that rabbit numbers were much lower when this study was done (2015) than in the past, and that this had led to a decrease in rabbit damage, which was at the time of the interviews very localised. Rabbit decline was mostly attributed to a higher incidence of rabbit diseases (and not to the control management), and in particular to rabbit haemorrhagic disease. The situation in 2015 was valued positively compared to previously, although such valuation was weaker and more ambiguous among hunters, because rabbit scarcity was not satisfactory for their game interests (Q4 and Q5 in Table 2). Farmers were obviously satisfied with rabbit damage decline, although they were cautious about considering the problem solved. On the one hand, they thought this situation was very unstable as it depended on the incidence of rabbit diseases, which can be very variable from

TABLE 2 Examples of quotations used to illustrate the main themes identified during the analysis of the text. Quotation reference corresponds to the identifier used in the text. ALT: Alt Camp de Tarragona. CSC: Campiña Sur de Córdoba

Theme	Quotation reference	Stakeholder	Study area	Quotation
Perception of rabbit damage: Past, present and future	Q1	Farmer	ACT	<i>The hunter wants to go hunting; this is the hunter's philosophy, eh: they want to go hunting for leisure...when they want to go, not when they are forced to go. Because then it stops being a hobby; it becomes an obligation</i>
	Q2	Hunter	CSC	<i>The production of a single plant can be 15 or 20 kilos of grapes. (The rabbits) ate 15–20 kilos of grapes, and ate the plant. A plant that is eaten two or three years on a row becomes dry, and then the whole crop was lost, not only one year's harvest, the whole crop. Then, the problem became serious, serious, serious</i>
	Q3	Representative of the regional government of Catalunya	ACT	<i>Here we don't use the word "pest (plague)" as administration in any document. They (the farming association) use it....we are not a company of wildlife species extermination, because we have learnt not to exterminate wildlife species</i>
	Q4	Hunter	CSC	<i>The rabbit has declined 80% [from its previous levels]; it's overwhelming. The rabbits when they become middle age start dying. Practically only the old [rabbits] remain nowadays....</i>
	Q5	Hunter	ACT	<i>The partridge has declined a lot, not just us, but in general, in all villages, and why? Because the rabbit has declined. The eagle hunts, the foxes hunt, the dogs, the snakes, the genets, all of them! There is no rabbit. Before, where there were so many rabbits, they died and they [the predators] had their food. They left the partridge because it is easier to eat a dead rabbit than to go hunting. But this year, what happened? As there are no rabbits, they go for the partridges.</i>
	Q6	Farmer	CSC	<i>The problem of rabbit damage is largely controlled through the actions of the hunting society, but obviously there can always exist localized foci that cannot be controlled as would be appropriate, I say, in a stream where scrub or bramble prevents hunters accessing with the ferrets, one would need to clean the area to be able to access, but as the stream cannot be touched [according to the legislation], then (hunters) cannot do anything there...</i>
Perceived causes of rabbit damage	Q7	Hunter	ACT	<i>Well, they (the farmers) went to the bar and would say: "what are you doing here? (go) kill rabbits now that you can" ...Or you would go with the wife and he would say: "what are you doing that you are not killing rabbits?" "No, I like going out for a walk with my wife, don't I?" ...Those were years a bit... I think that for them we have never done enough, that's the way I see it</i>
	Q8	Game manager	CSC	<i>We should collaborate with the farmers, we depend on..., our estate depends on the farmer, and then...of course! if the farmer needs you, you have to support him/her in all the moments...</i>
	Q9	Member of the directive of a hunting association	ACT	<i>The situation was formerly very good for the hunters, because you went out with the dogs and enjoyed it a lot... There was a lot of game (animals). Now...now... for example, the Board of Directors (of the game association) is receiving a lot of knocks on the head by the associates because there are not as many rabbits as before. They think that we don't currently have the rabbits we had because of the interventions we have done</i>
	Q10	Farmer	ACT	<i>They (the hunters) kill foxes, yes. Because...the hunter who is just a hunter, that doesn't own land, isn't damaged by rabbits, what he wants is many rabbits</i>
	Q11	Farmer	ACT	<i>You could notice...I'm also a hunter, and you could notice that it was a different rabbit, wasn't it? it was bigger and larger, its habitat, even its attitude ...because this rabbit climbed up trees, up olive trees. The rabbit that has been always here didn't...I had never seen that. And...climbing up the grapevines, mainly up the grapevines...From the regional administration they would not offer any explanations. We would say that we were sure that this rabbit was different. I don't know from where this rabbit came from. But it was different. Here, there were many rumours...</i>
	Q12	Farmer	CSC	<i>It is a rodent, so it is going to gnaw. It is a rodent and doesn't like grass...the hunting society says: "it's just that...you don't leave grasses in the field". Lie, you can leave grasses, different plants, whatever you want, but no, they are going to gnaw and cause damage, even to the buds, to the buds of the olive trees 70 or 80 years old...</i>

(Continues)

TABLE 2 (Continued)

Theme	Quotation reference	Stakeholder	Study area	Quotation
Perceptions of management interventions to reduce rabbit damage	Q13	Hunter	CSC	<i>They have four rabbits and they want all of them removed, that there is none left, and that's not on either</i>
	Q14	Hunter	ACT	<i>And when there is nothing left, when there is nothing left then they will say: now you can go killing rabbits. But what I am going to kill then?</i>
	Q15	Representative of the regional government of Andalusia	CSC	<i>...well, the logical thing would be for this emergency areas, we mentioned this some time ago, well, that if there is an area where there is no damage, well, we remove it [the emergency area label], no? if we made an analysis to include it (in the emergency area), well let's do the same analyses to remove it, and let's be conscious and mature, mature enough to say "well, well, here...let's go to remove it". But this is rather more complicated than including it...An emergency cannot be per secula seculorum...</i>
Social conflict over rabbit damage	Q16	Ex-representative of a local government, farmer and hunter	CSC	<i>It moved from being an economic agricultural problem to being a social problem. There were serious fights within the villages between hunters, pro-hunters and farmers. And in the middle some conservationists who wanted to protect rabbits as the basis of the food chain for wildlife. As the one with political responsibility, I really feared that it would become a serious social problem</i>
	Q17	Hunter	CSC	<i>Well, this year...we have had already 3 or 4 years where the situation is very very calm...minimum damage or less than the minimum. But clearly...the thing is there...</i>
	Q18	Hunter	CSC	<i>...here, first it is the farmer and then the rabbit. For me, the farmer is essential, they own land and let you go here for hunting, and you have to look for the farmer's interests</i>
	Q19	Farmer	ACT	<i>I'm a farmer and a hunter, but more farmer than hunter, eh! No, man, because if no...if I don't harvest, I don't have money to buy bullets, to kill the rabbits</i>
	Q20	Farmer	ACT	<i>The hunter wants the opposite than the farmer</i>
	Q21	Farmer	ACT	<i>I always say that, as a farmer, I don't want any rabbit, and the hunter wants many</i>

one moment to another. On the other hand, they considered that damage would persist in areas where hunting is not allowed like in the surroundings of motorways or railways, or where killing rabbits is difficult because there is plenty of cover available for rabbits (Q6 in Table 2). Overall, the ideal situation was portrayed in the interviews as chimeric, because the optimum level of rabbit abundance as viewed by farmers and hunters differs largely.

Farmers were concerned about a potential increase in rabbit populations and the return of serious and generalised rabbit damage to crops. In contrast, hunters were concerned about the possibility that rabbit scarcity extended for a long time; some even thought that rabbit populations could never recover to past levels. Hunters' concerns were more frequent in ACT. Nevertheless, the main opinion was that rabbit populations will recover, although without reaching the same levels than in the past, and especially that crop damage would not be so severe in the future.

## 4.2 | Perceived causes of rabbit damage

The perceived causes leading to excessive rabbit numbers, and thus to crop damage, was one of the topics that generated more and stronger discrepancies between farmers and hunters (Figure 2). Farmers, either implicitly or explicitly, blamed hunters for excessive rabbit numbers because of hunters' actions or omissions. The most

frequent reproach of farmers to hunters was their low engagement and dedication to eliminate rabbits when excessively abundant and particularly when there is crop damage. According to this opinion, hunters do not kill rabbits with sufficient intensity to reduce crop damage because they want to leave enough rabbits to continue leisure hunting in the future. Hunters disagreed with their perceived low engagement in rabbit control and even some of them stated that what they do to reduce rabbits is never enough for farmers (Q7 in Table 2).

Game managers were more sympathetic to farmers' complaints and showed a higher willingness to attend their demands to control rabbits than 'regular' hunters, among which the sensitivity was much more variable but, in any case, lower (Q8 in Table 2). In other words, game managers hold an intermediate position between hunters and farmers, which is sometimes uncomfortable to them, because they are accused by some hunters to contribute to rabbit decline through attending farmers' demands (Q9 in Table 2).

Predator control conducted by hunters was viewed by farmers as an additional proof that hunters are not fully engaged in rabbit control (Q10 in Table 2), as predators killed by hunters could otherwise contribute to the reduction of rabbit numbers. In the view of some farmers in ACT, another demonstration of hunters' low engagement to control rabbit damage is that, even in situations of excessive rabbit abundance, local hunters do not allow hunters from other game estates to come and kill rabbits (and thus



to contribute to rabbit reduction). Farmers also stressed, more or less explicitly, that hunters could have contributed to rabbit proliferation through restocking operations. According to farmers, released rabbits would have hybridised with native rabbits generating a new type of much more harmful rabbits. These 'new' rabbits were viewed as more prolific, more immune to diseases, more voracious, bigger and with characteristics that make them more difficult to be hunted, including digging deeper warrens, being more nocturnal and the ability to climb up trees (Q11 in Table 2). Comments about these different rabbits were more frequent in ACT, where farmers also accused environmental agencies and even researchers, whose experiments would have caused this 'transformation' of rabbits.

In contrast, some hunters pointed at intensive agricultural practices as one of the main causes of the increase in rabbit damage to crops. This opinion was shared by people working for environmental agencies in Andalusia. Aggressive farming practices, such as the use of herbicides and pesticides, were viewed by hunters as the root of rabbit damage (but not necessarily of excessive rabbit abundance); the argument was that rabbits graze crops because no natural alternative food sources are available. Farmers rejected this argument, indicating that rabbits prefer crops even when there are alternative food resources (Q12 in Table 2). In addition, hunters often accused farmers, either implicitly or explicitly, for the deliberate introduction of diseases to eradicate rabbits and for not keeping their lands clean, leaving deposits of stones and remains of tree pruning that are used by rabbits as refuge from hunters and predators.

### 4.3 | Perceptions about management interventions to reduce rabbit damage

There were disagreements between hunters and farmers in relation to the potential management interventions to reduce rabbit damage (Figure 1). Farmers were prone to defending preventive and intensive hunting, even when rabbit density is relatively low, and, in some cases, they demanded more autonomy to control rabbits independently from hunters. In contrast, hunters were mostly reluctant to kill rabbits intensively to mitigate their damage to crops (this was referred to as 'to punish rabbits'), because this implies a risk of excessively reducing rabbit numbers, thus compromising future game resources (Q13 and Q14 in Table 2). In addition, rabbit control was viewed by hunters as an unpleasant or even disagreeable activity, an obligation or a job more than a leisure activity, that is aimed at eliminating rabbits (referred to as 'assassinating' rabbits in some interviews) rather than hunting them, and because it has important personal and economic costs (see Q7 in Table 2). These include the cost of the ammunition, ferret caring, the time invested, problems at home as the time invested controlling rabbits is seen as not attending family responsibilities, etc. Hunters often complained about farmers' low consideration of these costs. In the view of hunters, management

interventions to reduce rabbit damage should lay in the provision of more natural feeding areas for rabbits, in addition to providing hunters with a higher capacity of self-regulation to implement control interventions.

Besides these discrepancies, there was a strong agreement in remarking the progressive improvement in hunters' response towards farmers' demands regarding rabbit control. This improvement was viewed as the result of a learning process based on experience. The management intervention system described in the interviews is simple: affected farmers inform of rabbit damage in their crops and the game estates intervene directly; the declaration of emergency area allowed these interventions to occur without their previous registration in the hunting management plans and without a prior verification of rabbit damage by a representative of the regional government. Both hunters and farmers valued positively these exceptional conditions to allow speedy interventions to reduce rabbit damage. According to interviewees, in most cases rabbit control consists of a combination of shooting and ferreting. In general, hunters, people working for the government and some farmers thought that this system has a limited efficacy (particularly shooting without ferreting). Nevertheless, farmers considered that at least it contributes to the reduction of damage in the intervened plots, although this is not the definitive solution to the problem. Hunters additionally mentioned that these interventions reduce farmers' discomfort, because they perceive that hunters are making efforts to mitigate rabbit damage.

Some farmers and hunters explicitly demanded the perpetuity of the declaration of rabbit emergency areas, which offers the legal framework to control rabbits without many administrative constraints. However, this would mean granting a permanent estate to a management measure that was originally conceived as exceptional (and by extension temporary), which would be contradictory as the original circumstances (i.e. high rabbit damage and strong social tensions) change. In this context, regional government staff felt they hold an uncomfortable position, as maintaining the declaration of emergency areas would likely compromise future rabbit populations, while revoking it would be unpopular among farmers and hunters and could be linked to a potential increase in rabbit numbers and damage (Q15 in Table 2).

Both farmers and hunters criticised the difficulties to obtain permits from the regional government to conduct some management interventions aimed at reducing rabbit damage. For example, farmers claimed that they have to follow a complex administrative process to get permits to burn the remains of the pruning (to avoid leaving areas where rabbits can find refuge), and that there are excessive legal restrictions to shoot rabbits due to security reasons in some refuge areas (e.g. near motorways and streams; see Q6 in Table 2). Also, interviewed hunters often justified their low initial involvement in rabbit control as a consequence of these administrative constraints (but not because they lacked sensitivity towards farmers' problems). Nevertheless, some interviewees stated that these alleged administrative constraints were used by hunters to excuse their lack of intervention.

#### 4.4 | Social conflict over rabbit damage

During the interviews, it was acknowledged that rabbit damage had caused strong social conflicts, but this was seen as something happening mainly in the past (Q16 in Table 2). Social tensions were perceived as having subsequently de-escalated because: (a) rabbit numbers had decreased, mainly as a consequence of diseases, (b) hunting management systems used to attend farmers' demands had improved and (c) the goodwill of farmers towards hunters and the sensitivity of the latter towards rabbit damage had increased. The reduction of the tensions between farmers and hunters was valued positively, although certain scepticism about the definitive solution of the conflict remained (Q17 in Table 2). Some interviewees highlighted the persistence of past wounds, while others doubted that the relative understanding among parties can be maintained indefinitely, particularly if rabbit damage increases again. Overall, the most critical interviewees drew a situation of tense calm that, without being satisfactory, was much better than past conflicts and disputes.

Although participants generally agreed that economic interests of farmers have to prevail over recreational interests of hunters (Q18 and Q19 in Table 2), they also acknowledged that their interests are inevitably opposite (Q20 and Q21 in Table 2). This conditions their different perceptions and valuations of the same realities, which, in addition to the natural variability of rabbit populations, lead to a reciprocal distrust and dissatisfaction that is perceived as unavoidable. This draws a picture of latent, recurrent or structural conflict that could escalate if, for example, rabbit numbers (and thus crop damage) increased. Nevertheless, it was generally thought that disputes would not be as serious in the future as they were in the recent past. On the one hand, rabbit densities were not expected by interviewees to be as high as they were some years ago. On the other hand, interviewees thought that some important lessons had been learnt with past experiences, including better and more flexible rabbit control mechanisms and a higher hunters' awareness of the problem.

## 5 | DISCUSSION

The dynamic nature of conflicts over wildlife management, with the existence of latent and active phases of conflict (sensu Sidaway, 2005) connected by periods of escalation or de-escalation, is well-illustrated by our study. For example, our results show that the strongest tensions between farmers and hunters (i.e. the active phase) arose several years before our study, when rabbit abundance and subsequent crop damage peaked. This was followed by a period of tense calm (i.e. a latent phase) during our study, characterised by persistent controversies among parties in relation, for example, to how rabbit damage has to be managed. It is very likely that the conflict will escalate in the future if rabbit populations grow again as a consequence of the gradual immunisation of rabbits to the new viral disease, or if contextual conditions act as triggering events; the latter could include recurrent pressures from farming organisations

to increase rabbit control, ongoing claims from the hunting sector to include environmental measures aimed at the recovery of small game in the new European CAP or the recent categorisation of the European rabbit as an endangered species by IUCN. In fact, some farming associations strongly opposed to this categorisation (Alba, 2019).

Conflicts over wildlife management are often approached as disputes that can be resolved once common interests are established (e.g. through compensation; Ravenelle & Nhyus, 2017), but such approaches tend to ignore the deeper social and psychological dynamics between individuals and groups (Madden & McQuinn, 2014). Our study describes the complexity of conflicts over the management of small mammals that cause crop damage, which have been overlooked in the literature despite being widespread all over the world (Delibes-Mateos et al., 2011). Such complexity can be illustrated, for example, by tensions between and within groups, as well as distrust, leadership and past decision-making issues, or strong differences in beliefs among groups, identified by our qualitative analysis.

Generally, a deep understanding of why a particular conflict arises is needed to help guide its appropriate management (Redpath, Bhatia, et al., 2015; Redpath, Gutiérrez, et al., 2015). The relationship between property rights regimes and various types of goods is a frequent source of conflict (Acheson & Acheson, 2009). In our study areas, landowners have the right to cultivate the land, while hunting rights are usually held by game managers, which could generate strong conflicts of interests as occurs in other areas (Acheson & Acheson, 2009). However, despite their obvious opposing interests (Delibes-Mateos et al., 2014), our study shows that farmers and hunters in Spanish farmland areas agree that the economic benefit of the former should prevail over the recreational activity of the latter. In addition, our findings suggest that conflicts between farmers and hunters over the management of wildlife pest species are mostly driven by their differences in beliefs. In our study, the greatest discrepancies between farmers' and hunters' beliefs were related to perceived causes of rabbit damage, and to the best management interventions that should be implemented to tackle such damage (Figure 1). This is in alignment with conflicts over the management of wild boar *Sus scrofa* in Latvia (Storie & Bell, 2017). The fact that both parties believed that the other one was at least partly responsible for the situation, and the lack of agreement on the most efficient management interventions, led to mutual distrust, suspicions and dissatisfaction about the other parties' actions.

Our study provides a good example of how the complexity of socioecological systems and associated uncertainty complicates the general difficulty of addressing deep-rooted conflicts (Madden & McQuinn, 2014). In fact, our results reveal that the unpredictability of population dynamics of some wildlife species may constitute a source of uncertainty that compromises effective conflict management. The abundance of some small mammal pest species may peak every few years causing important economic losses (Singleton et al., 2010) and generating strong social tensions (Lauret et al., 2020). When such outbreaks are not cyclic (and hence

more difficult to predict), farmers sometimes hold other parties responsible for peaks of damaging wildlife (e.g. for allegedly releasing rabbits in our study), which leads to distrust hence compromising cooperation (see below). In this sense, establishing population monitoring programs would help reduce ecological uncertainty and help adopt preventive measures in addition to fostering stakeholder cooperation. In addition, the demand of farmers and hunters for the regional government to make the 'emergency areas' permanent might be interpreted as a way of reducing administrative uncertainty, which has been shown to be the source of uncertainty leading to lowest intention to cooperate in other studies (Pollard et al., 2019).

Several collaborative frameworks have been proposed for environmental conflict management. Among these, the collaborative learning method is very useful to account for complexity, controversy and uncertainty associated with environmental conflicts (Daniels & Walker, 2001), and could therefore be a good option to tackle conflicts over wildlife management in farmland areas, as in our study. Briefly speaking, collaborative learning promotes common understanding through exchanging information and sharing concerns and interests regarding the specific problematic situation before implementable improvements are possible (Walker & Daniels, 2019). Leadership is essential in the effective management of environmental conflicts (Almeida et al., 2018), and in particular in the collaborative learning approach (Walker & Daniels, 2019). Our study suggests that identifying leaders among local stakeholders that are legitimised by all the parties to guide a collaborative approach to manage conflicts over wildlife management may be challenging. For example, the fact that game managers (i.e. the leaders of the hunting collective in the study areas) hold an intermediate position between hunters and farmers, and a higher willingness to attend farmers' demands to control rabbits, may place them in a good position to exercise leadership. However, their position was also vulnerable because they received frequent complaints not only from farmers, but also from hunters who perceived that rabbit hunting was excessively intense. Alternatively, it could be worth exploring the assistance from neutral external mediators, who are skilful to traverse the boundaries that separate different worldviews, and their knowledge and abilities are legitimised by multiple parties, which enables them to create shared meanings, enhancing cooperation (Ebbin, 2011). A management strategy that relies on third parties to resolve a conflict over wildlife management may be useful to guarantee the credibility and legitimacy of the parties involved in addition to ensuring fairness in the process and justice in the outcomes (Colvin et al., 2015).

Our study also exemplifies the difficult central role played by policymakers in conflicts over the management of wildlife species causing damage to human livelihoods. In particular, our results reveal that policymakers hold a difficult intermediate position between farmers and hunters who often do not support their actions nor share their opinions, and even hold them as responsible for complicating potential management interventions. For example, both farmers and hunters often criticised legal constraints for rabbit control, which are viewed as the consequence of policymakers being lukewarm

about their evaluation of the importance of the problem. In addition, policymakers are challenged with the task of designing rabbit control programs that ensure farmers' livelihood while not risking the conservation of this endangered species. This is well-illustrated by their designation of rabbit control measures, such as the declaration of emergency areas, as exceptional, which was not endorsed by farmers.

Previous studies have stressed the importance of the use of language in environmental conflicts (Campbell & Veríssimo, 2015). In particular, how the human-wildlife interaction is framed in the media and the vocabulary used may nurture negative thoughts of wildlife (Crow & Doubleday, 2017), justify the use of certain management tools (Miller et al., 2018) and play an important role in the dissemination of the message of one of the parties over that of the others (Webb & Raffaelli, 2008). For example, the term 'pest/plague' is often used by farmers and hunters to refer to wildlife damaging species in many regions (e.g. Campbell-Smith et al., 2010), including our study areas, and it is a way to legitimise intensive population control. In addition, multiple Spanish media articles demand effective responses to crop damage caused by 'rabbit plagues' ('*plagas de conejo*' in Spanish) in farmland areas (Delibes-Mateos, 2017), which therefore disseminate and legitimise the message that farmers expressed in our interviews.

Environmental conflicts are frequent in farmland areas, where contentious issues are multiple and varied, including, for example, carbon and nitrogen emissions, groundwater depletion, impact of agricultural practices on animal species in intensive areas, predation by carnivores on livestock on extensive areas, or crop damage caused by wildlife in all areas (e.g. Lang et al., 2015; Zou et al., 2018). Conflicts over the management of wildlife species causing damage are increasingly investigated, although most efforts concentrate on large and often charismatic animals (Anand & Radhakrishna, 2017). Our study provides new insights into the conflicts associated with small mammal crop-damaging species, highlighting their complexity and dynamic nature, which may be useful to facilitate dialogue and negotiation between stakeholders and to aid management and governance.

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## CONFLICT OF INTEREST

The authors declare no conflict of interest.

## AUTHORS' CONTRIBUTIONS

R.V., F.E.G., B.A., S.R. and M.D.-M. conceived the original idea; J.R. conducted the interviews, guided the group discussions and carried

out the analysis. The rest of the authors contributed to the interpretation of the results providing critical feedback. M.D.-M. led the writing of the manuscript, which benefited from input of the rest of the authors.

## DATA AVAILABILITY STATEMENT

In order to ensure full protection of participants' privacy and compliance with Spanish law of data protection (i.e. Royal Decree-Law 5/2018, of 27 July, on urgent measures for adaptation of Spanish Law to European Union regulations on data privacy), raw data used in the study cannot be made publicly available. A summary of data (in Spanish) is available in the Digital-CSIC online repository linked to this manuscript (<http://hdl.handle.net/10261/219957>). Data may be granted by request to the corresponding author, with permission of all parties involved with the research and in compliance with current legislation on data privacy.

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## SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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