



Applying Participatory Processes to Address Conflicts Over the Conservation of Large Carnivores: Understanding Conditions for Successful Management

Valeria Salvatori^{1*}, Estelle Balian², Juan Carlos Blanco³, Paolo Ciucci⁴, László Demeter⁵, Tibor Hartel⁶, Katrina Marsden⁷, Stephen Mark Redpath⁸, Yorck von Korff⁹ and Juliette Claire Young^{10,11}

OPEN ACCESS

Edited by:

Sumeet Gulati,
The University of British Columbia,
Canada

Reviewed by:

Carol Bogezi,
University of Washington,
United States
Ricardo Baldi,
Centro Nacional Patagónico,
Argentina

*Correspondence:

Valeria Salvatori
valeria.salvatori@gmail.com

Specialty section:

This article was submitted to
Conservation,
a section of the journal
Frontiers in Ecology and Evolution

Received: 30 August 2019

Accepted: 22 May 2020

Published: 30 June 2020

Citation:

Salvatori V, Balian E, Blanco JC, Ciucci P, Demeter L, Hartel T, Marsden K, Redpath SM, von Korff Y and Young JC (2020) Applying Participatory Processes to Address Conflicts Over the Conservation of Large Carnivores: Understanding Conditions for Successful Management. *Front. Ecol. Evol.* 8:182. doi: 10.3389/fevo.2020.00182

¹ Istituto di Ecologia Applicata, Rome, Italy, ² FEAL – Facilitation for Environmental Action and Learning, Peyrus, France, ³ Consultores en Biología de la Conservación, Madrid, Spain, ⁴ Department of Biology and Biotechnologies ‘Charles Darwin’, Sapienza Università di Roma, Rome, Italy, ⁵ Filiala Asociației Microregionale Pogány-havas, Administrația Natura 2000, Harghita, Romania, ⁶ Hungarian Department of Biology and Ecology and Center of Systems Biology, Biodiversity and Bioresources (Center of “3B”), Babes-Bolyai University, Cluj-Napoca, Romania, ⁷ Adelphi Consult GmbH, Berlin, Germany, ⁸ Institute of Biological and Environmental Science, University of Aberdeen, Aberdeen, United Kingdom, ⁹ flow-ing SASu, Montferrier sur Lez, France, ¹⁰ UK Centre for Ecology and Hydrology, Penicuik, United Kingdom, ¹¹ Agroécologie, AgroSup Dijon, CNRS, INRAE, Univ. Bourgogne, Univ. Bourgogne Franche-Comté, Dijon, France

Social conflicts over large carnivores are becoming more frequent following the general recovery of large carnivores in human shaped landscapes in Europe. To manage conflicts over large carnivores a detailed knowledge is necessary on the social, economic, cultural but also interpersonal dimensions of the conflicts. This can be achieved through a participatory engagement of all stakeholders within a procedure tailored to local contexts. We looked at conditions necessary for implementing the above approach in areas of intense large carnivores-human conflict across Europe (bear and wolves), and where traditional management conflict policies do not appear to be successful, as often based on urgent responses to emergency situations. We focussed on four areas in Europe where we interviewed stakeholders to characterize the conflicts and assess the potential for mitigation interventions through participatory processes. We focused on four key aspects related to social conflicts: (a) perception of the current situation and relationship with other stakeholders; (b) availability and accessibility of information and communication; (c) economic, ecological and social impacts; and (d) promotion of coexistence and participatory processes. We show that (lack of) trust between stakeholders and the relevant authorities as well as the lack of genuine communication among stakeholders were the key features that characterized social conflicts related to large carnivores. With specific reference to large carnivores, the lack or inaccessibility of reliable information was reported in all cases by all stakeholders, as well as the need for proactive and inclusive policies developed and implemented by the relevant authorities. A consistent message was that

support and engagement from relevant management institutions was pivotal for effective management of conflicts over large carnivores. Our findings highlight the importance for conflict mitigation of a deeper and mutual understanding of issues prior to the implementation of participatory processes.

Keywords: conflict, wolf, bear, stakeholders, management

INTRODUCTION

The conservation and sustainable management of large carnivore populations including bears, wolves, lynx and wolverines, is one of the most challenging tasks facing conservationists and decision-makers in Europe. After centuries of persecution, large carnivores are now recovering across many areas of Europe following the recovery of prey species, enhanced public support, and a protective legal framework (Chapron et al., 2014). Part of the challenge, however, is that most European landscapes have been shaped by human activities for millennia and large carnivores occur in, and impact on, human dominated, or cultural, landscapes.

Large carnivores are protected by the European Habitats Directive. Most populations of bears and wolves are strictly protected under Annex IV and require the designation of protected areas under Annex II. Some populations are included in Annex V, which means that they can be sustainably exploited so long as this does not affect their conservation status. However, European and national administrators recognize that imposing protection in a top-down manner may not be the most effective means of reaching the conservation goals of the Directive.

Coexistence between large carnivores and humans is complex, and with on-going recovery of large carnivores, their impacts on a wide range of human activities have intensified, in particular depredation of livestock and pets (Linnell and Cretois, 2018). Hunters may perceive large carnivores as competitors for shared prey species (López-Bao et al., 2015) and, in some situations, the impact of large carnivores on prey populations can influence traditional game harvests and hunting (Wikenros et al., 2015). In some cases, large carnivores in Europe (mainly bears) can be a risk for human safety (e.g., Bombieri et al., 2019), and fear of both bears and wolves is often expressed by rural residents in areas of recent recolonization (Johansson et al., 2016). Although the impact of large carnivores on livestock can be mitigated through the adoption of protection measures (e.g., fencing and guarding dogs – see Gehring et al., 2010; Ricci et al., 2018a), leveraging large carnivore conservation in human shaped landscapes requires an additional workload from farmers (Widman et al., 2019). This requires a need to understand the perceptions of farmers toward large carnivores, as well as their capacity and willingness to change traditional and often economically convenient husbandry practices for large carnivores (Lance et al., 2010; Hartel et al., 2019). In addition, the disagreement among different sectors of the society about how large carnivores and their impact should be managed can result in conflicts among and between different societal groups (Redpath et al., 2013; Lute et al., 2018; Hartel et al., 2019).

The most common approach to mitigate human-large carnivore conflicts over the last decades has been based on damage compensation programs to mitigate economic losses, but this approach has failed in terms of addressing the conflicts (Boitani et al., 2010; Marino et al., 2016; Bautista et al., 2019). Although the depredation of livestock in itself could be treated as a mainly economic issue, many conflicts generated by the presence of large carnivores are social and are often related to values that shape cultures, power relationship, and world views (Madden, 2008; Teel and Manfredo, 2010). In this respect, conflict can be viewed as a situation where different groups have points of views that clash on aspects related to the presence and/or management of large carnivores (Redpath et al., 2013). This definition focuses on the relationship between humans over conservation and management issues, rather than between humans and carnivores (Young et al., 2010; Redpath et al., 2013, 2015, 2017; Mishra et al., 2017). Large carnivores can therefore sometimes become a means to channel or express deeper cultural divides and differences in paradigms and world views (Madden and McQuinn, 2014). As such, an alternative method to mitigate human-human conflict over conservation is increasingly to engage the involved parties in participatory processes (von Korff et al., 2010; Frank and Glikman, 2019), whereby different stakeholders (including academia) work together and co-create solutions through a facilitated open dialogue approach (Creighton, 2005; Bixler et al., 2015). As a first step, however, in managing conflicts around large carnivores in a participatory approach would be the greater understanding of the nature of the conflicts and the context in which they have developed and persist (Altwood and Breck, 2012; Redpath et al., 2013; Hartel et al., 2019) – and in the case of large carnivores in Europe to explore the nature of conflicts across different regions to explore the potential for participatory processes.

On the European Union (EU) level, the Commission has made significant efforts in recent years to engage stakeholder representatives in discussion regarding conflict species. In 2014, the Commission worked with stakeholder representative organizations to establish the EU Platform on coexistence between people and large carnivores, a grouping of seven organizations representing different interests groups with a joint mission to try to minimize large carnivore related conflicts¹. The EU Platform has provided a means of sharing views and issues at a higher level, but the Platform members also recognized that conflicts on large carnivores varied significantly across the EU, depending for example, on the socio-economic activities

¹http://ec.europa.eu/environment/nature/conservation/species/carnivores/coexistence_platform.htm

in the areas which large carnivores are returning to and the biogeographic and natural conditions (Sjölander-Lindqvist et al., 2015; Morehouse et al., 2020). The Platform therefore supported the establishment of regional or local platforms following a similar model in different localities across the EU.

Although the EU is diverse in biocultural regions with large carnivores, research on case studies to compare how stakeholders perceive the presence of large carnivores in their landscape are scarce.

The overarching goal of the present study is to plug both these policy and academic knowledge gaps at the EU level, to provide a broad understanding of the social dimensions of the human-large carnivore conflicts in four cultural regions of the EU in order to establish the potential for participatory approaches to mitigate the conflict. In this paper, we test the hypothesis that even if social and cultural conditions vary significantly, the main issues related to the presence of large carnivores are coherent across different areas and all relate to issues of relationships between different groups.

The results of this research can be used in guiding further steps for establishing regional participatory large carnivore platforms in the EU and better understand the conditions for successful implementation of participatory processes for large carnivore conservation. In order to achieve this long-term goal, we carefully selected the regions being guided by the presence of large carnivores in the regions as well as by the willingness of stakeholders to allocate substantial time and effort to collaborate with the partners of this project as well as with each other in order to co-identify challenges and solutions for human-large carnivore coexistence. More specifically, this study assesses the main features that characterize conflicts in the four case studies and highlighting commonalities across different biocultural regions when dealing with large carnivores. We conclude with the identification of key elements that are needed for successful engagement and those that represent a desired added value based on the local conditions.

METHODS

Case Studies

The case studies were selected from a list of potential regions in countries where the increasing population of large carnivores in recent years had been reported (Chapron et al., 2014). The long list was drafted by local institutions involved in large carnivore management and selection was driven by three main criteria: (a) reported difficulties in managing increasing large carnivore population as assessed by the contacts made with the European Commission (which commissioned the project); (b) level of knowledge of the area and feasibility of future development of a participatory process as assessed by the previous work done; (c) potential for transferability to other regions. The four regions selected (Figure 1) have common features such as increase in presence of large carnivores in the 5 years preceding our study, administrative units, comparable sizes and significant part of the territory used for agriculture or other human activities. They are described below.

Province of Ávila (Spain)

The Province of Ávila (8,050 km²) is in the southern part of Castile and Leon Autonomous Region. It is characterized by pastures and grasslands (41% of the provincial territory) and small remnant patches of evergreen oak (*Quercus ilex*, *Q. faginea*) and coniferous (*Pinus pinaster*, *P. pinea*) forests. Ávila is characterized by extensive cattle breeding (mainly of the local Ávila breed) for meat production. Over 50% of the Spanish wolf population is distributed in Castile and León, mainly north of Duero river (Blanco and Cortés, 2002). Wolves reproduced for the first time in Ávila in 2001, and in 2017 official figures reported 10 packs in the Province, with 944 reported attacks (Junta de Castilla y León, 2017; Sáenz de Buruaga, 2018). Wolves are strictly protected in Castile and Leon south of Duero River (Annex II and IV of the Habitats Directive), while they are managed as a game species north of the river (Annex V of Habitat Directive). The Regional Administration has used derogations to provide permits for the removal of a limited number of individual wolves in Ávila (Junta de Castilla y León, 2017), but environmental organizations have argued that the conditions for derogation to strict protection are not fulfilled.

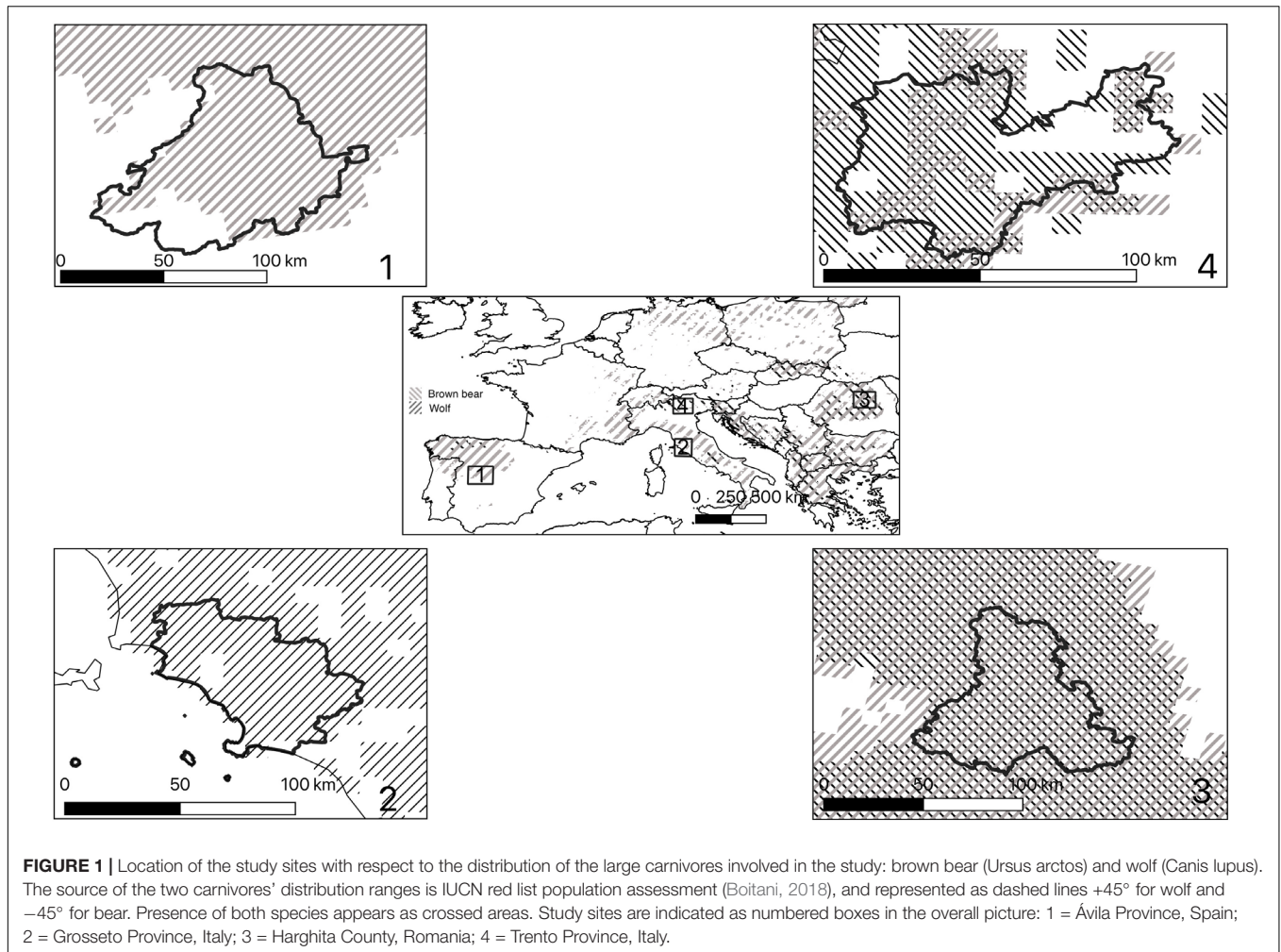
Province of Grosseto (Italy)

The Province of Grosseto extends over 4,479 km² in central Italy. It is characterized by largely agricultural landscape (53.7% of the area), featuring a mosaic of extensive cultivation, shrubs, fallows and pastures, interspersed with broad-leaved forest patches (43.3% of the area), dominated by holm oak (*Quercus ilex*), cork oak (*Quercus suber*), beech (*Fagus sylvatica*) and chestnut (*Castanea sativa*) in mountainous areas (Selvi, 2010). The landscape is mainly hilly, with highest areas reaching 1,738 mt in the northern part of the provincial territory. The climate is mainly Mediterranean, with hot summers and wet winters, often associated with floods. The Province of Grosseto features one of the lowest human population densities among Italian provinces (<50 inhabitants/km² – ISTAT, 2013), and has been historically shaped by agriculture and farming which play an important role in the local economy. Livestock production is an important economic activity together with rural tourism, often associated to agricultural production.

Wolf occurrence in the area has been continuously recorded since the early 1980s (Boitani and Ciucci, 1993). In 2012–2014 a minimum of 13 packs were estimated in the area (Salvatori et al., 2019), while in 2017 the population was estimated at ca. 100 wolves and 22–24 packs (Ricci et al., 2018b), with an average of 330 depredation events/year reported in 2014–2017 (Ricci et al., 2018a). The regional government and EU-funded projects have provided compensation and prevention for livestock losses to wolf attacks, but these solutions have not been considered satisfactory (Marino et al., 2016) and conflicts have arisen among interest groups.

Province of Trento (Italy)

The Autonomous Province of Trento covers 6,027 km² in the Central Alps of northern Italy. The region is characterized



by high mountains and valleys with elevations ranging from 100 m.a.s.l. to over 3,500 m. The forest cover (extending on 50% of the provincial territory) is dominated by deciduous trees (mainly *Fagus sp.*, *Carpinus betulus*,) below 1,000 m but at higher elevations (1,000–2,000 m) conifers are dominant. Woodlands are replaced by shrubs and herbaceous plants above 2,000 m. Mid altitude areas (500–1000 m) are characterized by diffuse farming and livestock grazing as well as fruit production, covering 25% of the provincial territory. It is the only Alpine area in which brown bears have never disappeared and in the late 1990s the provincial administration supported a restocking project that brought nine individual bears from Slovenia (Preatoni et al., 2005). Since then, the bear population has increased and in 2018, a minimum number of 39 individuals was recorded (Groff et al., 2019). The increase in numbers has also been associated with an expansion of the range and increasing impact on human activities such as bee keeping, fruit production and livestock breeding (Groff et al., 2019). Bears are strictly protected in Italy and Trentino hosts nearly the entirety of the Alpine bear population.

County of Harghita (Romania)

Harghita is situated in the central part of Romania in the Eastern Carpathians, and it is one of the 41 Romanian counties each administered by a county council. It extends over 6,635 km² and is surrounded by the Eastern Carpathians in Transylvania. Elevations range from 490 m to 1785 m.a.s.l., and the terrain is characterized by narrow valleys and steep slopes. The area is covered by 30% of its extension by agricultural land, of which 80% is semi-natural grasslands largely used for extensive livestock and honey production (Scarlat et al., 2011). Forest habitats (dominated by *F. sylvatica* and *A. alba*) cover about 40% of the area. Harghita hosts all three large carnivores (bear, Eurasian lynx and wolf) but the most abundant, and from the perspective of human-large carnivore coexistence the most relevant, is the bear, which was managed as a game species until the country joined the EU in 2007 (Enescu and Hălălișan, 2017). Since then, derogations have been used to control the population and in 2016 a ban was imposed on bear hunting following pressures from environmental associations questioning the reliability of population estimates used to set yearly quotas (Popescu et al., 2019). Bears come close to human settlements and feed on

human-related feed-sources, often resulting in accidents with humans. Overarching management decisions on large carnivore conservation, derogations, hunting, compensation are taken at the national level by the Romanian Ministry of Environment, Water and Forests while the Ministry of Agriculture and Rural Development is responsible for decisions on agricultural financing. There are no schemes yet in place regarding advisory or funding of prevention measures.

Data Collection and Analysis

We used the Redpath et al. (2013) framework in this study, intended to guide effective understanding and management of conservation conflicts and that stresses the need for an interdisciplinary approach in the two major phases of the process: the mapping of the conflict (or understanding the different social, economic, political, cultural etc., elements) and the management of the conflict (identifying solutions and trade-offs, agreeing on, testing and refining resolution mechanism).

The *mapping of conflict* phase foresees five steps, each with a clear aim that needs to be understood before assessing whether the interested stakeholders might be willing to engage in a dialogue process and move to the *managing of conflict* phase. For each of the steps envisaged by Redpath et al. (2013) we developed actions based on the aims of implementing and testing the framework in the four study sites. They are sketched out in **Table 1** and reported on in this section.

Stakeholder Identification (Step 1 – Table 1)

For each of the four areas we carried out a purposive sampling approach (Bryman, 2014), with the aim of identifying the main stakeholders involved in or affected by the management of the large carnivores. We initially identified the main stakeholders in each study site guided by expert knowledge of contact people member of the Large Carnivore Initiative for Europe², an expert group of IUCN Species Survival Commission³. We then followed a snowballing process to identify additional relevant persons to interview (Young et al., 2018), following the suggestions provided by interviewees. **Table 2** outlines the full range of interviewees in each case study.

Mapping of Stakeholder Positions and Goals and Gathering Information to Understand the Wider Socio-Political Context and Willingness of Stakeholders to Engage in a Dialogue Process (Steps 2 and 4 – Table 1)

To gather all scientific evidence, together with gaps and uncertainties and to understand the wider socio-political contexts (i.e., legislation) (Steps 3 and 5 – **Table 1**) we searched for all documents resulting from previous projects and initiatives made with the contribution of local experts and contact people, in order to ensure access to gray literature (see **Supplementary Appendix 3** for the full range).

To map stakeholder positions and goals, we carried out 54 semi-structured interviews with an average of 13.5 interviews

per site, ranging from 9 (Trento) to 18 (Ávila) between May and November 2018 (following the approach described by Vaske, 2008; Young et al., 2018). We identified six main interest groups relevant to large carnivores and these are described in **Table 2**. Higher numbers of interviews were carried out with those groups identified as being more directly interested/affected by the presence of large carnivores in the particular regions.

Interviews lasted 90–120 min and one of the authors was always present (VS), either alone or with at least one of the other co-authors. Interviews were held with a number of interviewees ranging from 1 to 6 (see **Supplementary Appendix 1**). All interviews except four (GRS1, TNI1, AVS1, AVS2) were held face-to-face. The four interviews held by telephone were with persons who had already collaborated with the authors, thus not affected by the lack of *de visu* interaction.

The interview guide (see **Supplementary Appendix 2**) focussed on three main aspects related to the presence and impact of large carnivores in the study areas:

1. Characteristics of the current situation regarding the large carnivores and humans, including key elements and system features that had contributed to it and how it was perceived by each of the interviewees;
2. Perceptions of past and future interventions with relevance to carnivores, including perception of urgency, impacts and responsibility;
3. Perceptions of stakeholders involved and the relationships between them, including the identification of any gaps in the targeting of stakeholders and willingness to engage in a dialogue process.

To map stakeholders, we used specific questions of the questionnaire (highlighted in **Supplementary Appendix 2**).

The results from the interviews were not recorded or transcribed verbatim. Given the context of the interviews, held in areas with acute levels of conflicts, the authors felt that recording of interviews would not be appropriate and would lead to interviewees being less open about the issues raised in the interviews. Notes, however, were taken during the interview with the approval of interviewees, and a summary of the discussions for each interview was created so that key issues that emerged from the interviews could be used for analyses. We coded interviews in Excel using open coding to identify themes under the three main categories used in the interview guide (Gibbs, 2007).

This open coding process resulted in fourteen main nodes and 91 subnodes being identified.

RESULTS

We focus in our results on the general understandings in each case study, rather than distinguishing between stakeholders across case studies. We highlighted key stakeholders perspectives when they pointed out particularly relevant information relating to a specific context. We acknowledge that our approach is partly subjective, but at the same time we are confident that the selected stakeholders, who showed willingness for long term

²www.lcie.org

³www.iucn.org

TABLE 1 | Main stakeholder groups identified for interviews in the four areas and interviews held.

Group	Description	Study site	Nr of interviews held	Total
Farmers	Including individual farmers and professional associations representing them	Ávila (AVF1-AVF9)	9	18
		Grosseto (GRF1-GRF4)	4	
		Harghita (HGF1-HGF3)	3	
		Trento (TNF1-TNF2)	2	
Hunters	Including individual hunters and/or representatives of hunting associations	Ávila (AVH1)	1	5
		Grosseto (GRH1)	1	
		Harghita (HGH1-HG2)	2	
		Trento (TNH1)	1	
Institutions	Either local, provincial, regional or national, also including police corps if relevant	Ávila (AVI1-AVI3)	3	12
		Grosseto (GRI1-GRI4)	4	
		Harghita (HGI1-HGI4)	4	
		Trento (TNI1)	1	
Scientists	Including representatives of scientific institutions or independent consultants	Ávila (AVS1-AVS2)	2	4
		Grosseto (GRS1)	1	
		Harghita	0	
Environmentalists	Mainly representing local or national environmental organizations	Trento (TNS1)	1	11
		Ávila (AVE1-AVE3)	3	
		Grosseto (GRE1-GRE2)	2	
		Harghita (HGE1-HGE5)	5	
		Trento (TNE1-TNE2)	2	
Animal Welfare organizations	Only present in Italy, representing animal protection groups	Grosseto (GRW1-GRW2)	2	4
		Trento (TNW1-TNW2)	2	
Total				54

In brackets is the interviewee code used to identify these stakeholders.

TABLE 2 | Actions taken in this work for mapping the conflict using data collected through interviews and within the framework proposed by Redpath et al. (2013).

Step	Aim	Action taken
1	Identify Stakeholders	Contact with large carnivore experts at national and local levels. Map stakeholders against interest and power in large carnivore management/conservation
2	Map stakeholders values, attitudes, goals and positions	Classification of interview notes into main themes and subthemes
3	Gather all scientific evidence, together with gaps and uncertainties	Collection of all published literature and previous work and initiatives undertaken in the study sites
4	Identify economic, ecological and social impacts	Classification of interview notes into main themes and subthemes
5	Understand wider socio-political contexts (i.e., legislation)	Identification of main legal instruments at local, national, international level

collaboration are diverse and embedded enough to allow us to reach our main goal, i.e., to generate a broad understanding for each region.

The frequency of reported issues as identified in our analytical framework is reported in **Figure 2**. The issues that emerged in the interviews relating to each subnode are described below.

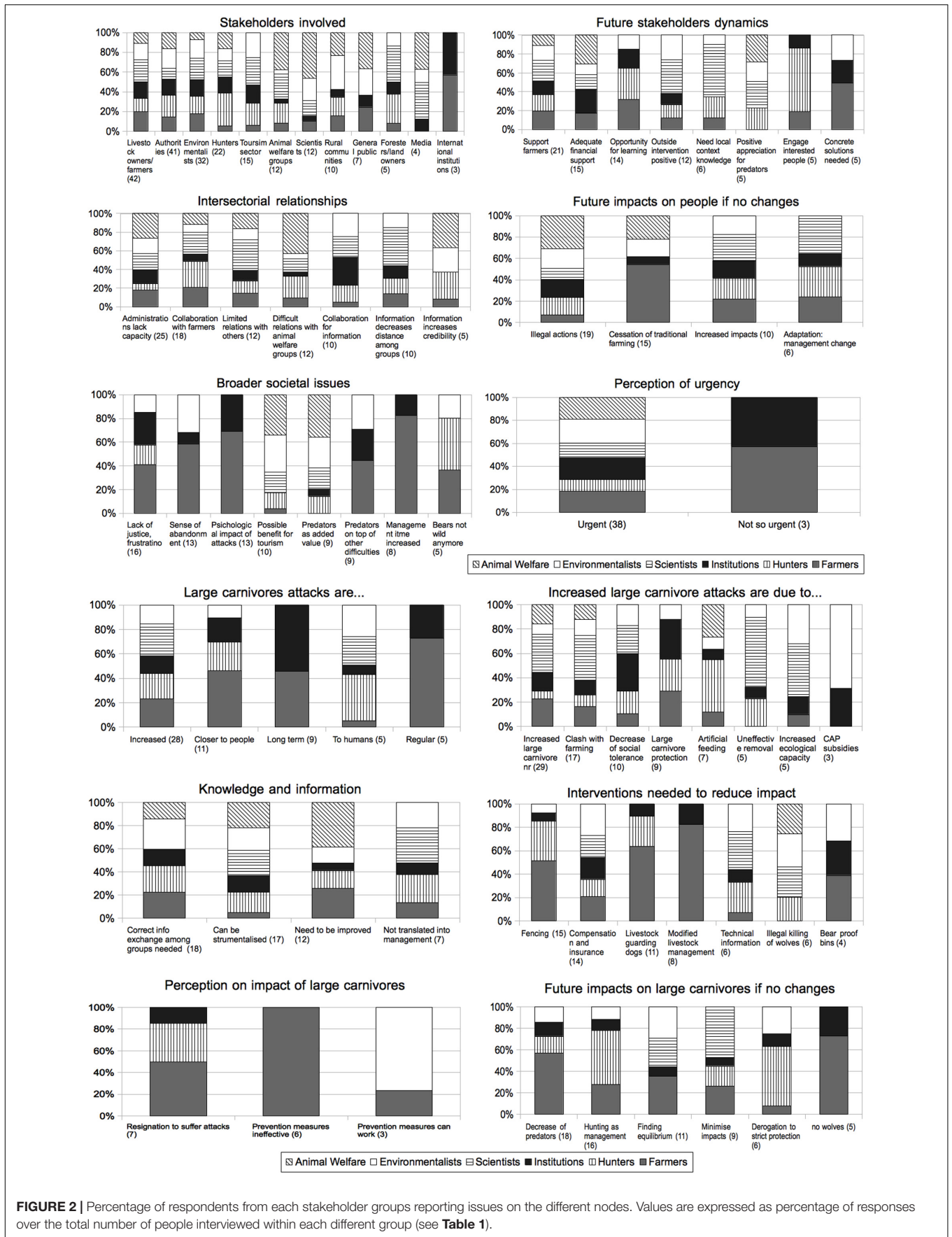


FIGURE 2 | Percentage of respondents from each stakeholder groups reporting issues on the different nodes. Values are expressed as percentage of responses over the total number of people interviewed within each different group (see **Table 1**).

Characteristics, Causes, Impacts and Potential Future of Large Carnivores Attacks

Most interviewees ($N = 28$: 12 farmers from all study sites, 5 environmentalists from Ávila, Harghita and Trento, 5 from institutions in Ávila, Grosseto and Trento, 3 scientists and 3 hunters from Ávila, Harghita and Trento) reported the attacks suffered had increased, and lamented the economic (direct and indirect) costs and property losses (e.g., AVF4, AVF6, AVE2) and the consequences of attacks, such as the disruption of the flock (TNF2) or psychological impacts (AVF6). Large carnivores were reported to be increasingly approaching people/farms, thus losing their “wildness” ($N = 11$ – from Grosseto: GRF2, GRF3, GRF4, Harghita: HGF1, HGF2, HGF3, HGE2, HGH2, HGI2, HGI3 and Trento: TNF1) with attacks being reported during the day (mainly from Grosseto – GRF2, GRF4, GRF3, but also from Harghita – HGF1). Attacks were described as ongoing (e.g., since 1990s – GRF3, since 2007 – AVF1, AVF3, AVF5), and in some cases regular (i.e., on a monthly basis, $N = 5$, only from Ávila: AVF1, AVF2, AVF3, AVF8, AVI2). Eight interviewees reported that bear attacks on humans had also been recorded and were increasing (from Trento, $N = 4$: TNE1, TNF1, TNI1, TNH1, and Harghita, $N = 4$: HGH2, HGE1, HGE4, HGI3). Other issues reported were the occurrence of attacks on calves in autumn (AVF1, AVF3) and the unusual attacks on calves in Grosseto, where the main livestock industry is focussed on sheep.

The majority of respondents linked the increase in the frequency of attacks to the increase of wolves and bears, both in terms of numbers ($N = 29$: 13 farmers and 6 from institutions in all study sites, 4 scientists from Ávila, Grosseto and Trento, 3 environmentalists from Ávila, Harghita and Trento, 2 from animal welfare groups and 1 hunter from Trento), and range ($N = 11$: 3 scientists and 3 from institutions in Ávila, Grosseto and Trento, 3 farmers from Harghita and Grosseto, 2 environmentalists from Harghita and Trento). In seven cases the increase of large carnivores was not considered as being a natural process (e.g., reintroductions, AVF7, GRF4, AVF4, TNS1, TNW1, TNH1, TNW2). In two cases the increased presence of wolf was seen as a “proliferation” (AVF1, AVF3). Interviewees from Ávila and Grosseto reported the presence of wolf being incompatible with extensive livestock breeding ($N = 17$ out of 32 in those areas: 6 farmers, 3 scientists, 3 from institutions, 3 environmentalists, 1 hunter and 1 from animal welfare groups). The perceived increase of attacks to the livestock was seen as being linked to a decrease in social tolerance by ten interviewees (HGF2, HGF3, AVI1, AVI2, GRI2, GRI3, AVS1, HGE1, TNE2, TNH1). The increase of large carnivore numbers was seen as a result of their protection ($N = 9$ – mainly from Harghita: HGF2, HGF3, HGH2, HGE2, HGI1, HGI2, but also from Ávila: AVI1, AVF5, and Grosseto: GRF3), artificial feeding practices (for bear, $N = 7$ from Harghita: HGH2, HGI1, HGF1, HGF3, HGE2, also reported to be related to tourism bear watching practices: HGH1, TNW2), and the increase of ecological carrying capacity ($N = 5$ from Harghita: HGE2, HGF3, Ávila: AVS1, AVE3, and Grosseto: GRI3). Increase in prey numbers and wild woody vegetation as a result of land

abandonment were reported as causing large carnivores increase. The ineffective intervention to remove large carnivores ($N = 5$ – from Ávila: AVS1, AVH1, AVI3, Harghita: HGE2 and Grosseto: GRS1), explained as the illegal killings that disrupt the social structure of wolf packs (GRS1) or larger bears being removed for trophy (HGE2) destabilizing the population structure or the absence of a clear and systematic control of wolves north of Duero river (AVI3).

Interviewees from Grosseto were particularly aware of wolf-dog hybrids presence in their territory, as a result of locally high admixture rates (Salvatori et al., 2019), and a targeted pilot project aimed at managing hybrids (LIFE Ibriwolf⁴). Interviewees reported hybrids to be a problem ($N = 3$: GRF3, GRF4, GRH1) as they are perceived to attack during daytime more often than wolves. Animal welfare representatives and environmentalists voiced that it was acceptable to kill them and the responsibility was on the dog owners (GRW1).

A number of interviewees reported suffering negative psychological or economic impacts of large carnivores. Psychological impacts mentioned were: feeling depressed after suffering attacks to livestock ($N = 13$: 10 farmers from all sites and 3 representatives of institutions from Harghita and Ávila), feeling frustrated by the lack of effectiveness of implemented management measures ($N = 16$: 9 Farmers from all sites, 4 representatives of institutions from Grosseto and Harghita, 2 Environmentalists from Harghita and Ávila, and 1 representative of the tourism sector from Harghita), or resignation and abandonment by authorities ($N = 13$: 9 Farmers, 3 Environmentalist and 1 representative of institutions from across all project sites). The economic impact reported was in terms of increased time needed to watch the flocks ($N = 8$ from Ávila: AVF4, AVF5, AVF6, AVF7, AVF9, AVI1, Trento: TNF2, and Harghita: HGF2) and the fact that large carnivores were adding to the many difficulties the farming sector was already facing ($N = 9$: AVF4, AVF5, AVF7, GRF3, TNF1, HGE1, GRE1, AVI2, GRI1). Positive impacts mentioned were the fact that large carnivores could represent an opportunity for the tourist industry ($N = 10$: AVE1, GRE2, HGE2, HGE4, TNE2, GRH1, TNF1, AVS1, TNW1, TNW2) and they could be seen as an added value for the territory ($N = 9$: AVE1, AVE2, GRE2, HGE1, GRH1, GRI2, AVS1, GRW1, GRW2), also considering the ecological role they play in the ecosystem (e.g., ungulate regulation).

Decreasing large carnivores numbers was reported to be the possible result of future management interventions ($N = 17$: 12 farmers from all study sites, 2 environmentalists from Grosseto and Harghita, 2 from institutions in Ávila and Harghita, and 1 hunter in Harghita). In one case non-lethal methods were envisaged (i.e., bear relocation, TNF1), and in two other cases a generic “removal” of individuals was hoped for (TNF2, TNH1). No wolves at all were hoped for by some interviewees in Ávila. Hunting was considered a valid management intervention to keep numbers of large carnivores down in Harghita and Ávila ($N = 16$: 8 farmers (AVF1, AVF3, AVF5, AVF6, AVF7, AVF8, HGF1, TNF1), 4 hunters from Ávila, Harghita and Trento, 2 environmentalists from Harghita, 2

⁴www.ibriwolf.it

from Institutions from Harghita and Grosseto). Removal using derogation to full protection was also mentioned to be a possible future management in all cases but Ávila. The hope for an equilibrium was mentioned by some interviewees ($N = 10$: AVE1, AVF4, AVI3, AVS1, GRF3, GRE2, HGF1, HGF2, TNE1, TNF2), hoping for a better management (GRF3) and for a balance according to carrying capacity (HGF1).

Stakeholders Involved, Their Perceptions of Large Carnivores and Intersectorial Relationships

Livestock breeders (and/or the organizations they are represented by) and local/regional/national authorities were identified by the majority of interviewees ($N = 42$ and $N = 41$, respectively) as being the principal actors in the case studies ($N = 42$: 16 farmers, 8 environmentalists, 9 from Institutions, 3 hunters, 4 scientists and 2 from animal welfare groups, from all study sites; $N = 41$: 11 farmers, 10 environmentalists, 10 from institutions, 5 hunters, 3 from animal welfare groups from all study sites, and 2 scientists from Grosseto and Trento). Authorities were seen as having some responsibility for the current situation, but lack of trust with the authorities was mentioned. Environmental organizations were also reported to be strongly involved in the debate ($N = 32$: 11 farmers, 8 from institutions, 7 environmentalists, 3 hunters, 2 scientists, and 1 from animal welfare groups from all study sites), and in some cases identified as responsible for increasing the level of conflict. Hunters were mentioned ($N = 22$: 6 from institutions, 5 hunters, 4 environmentalists, 3 farmers, 2 scientists, and 2 from animal welfare groups from all case studies) for different reasons, mainly related to hunting wolf prey (AVH1, GRS1) or because they were expected to play a role in regulating the large carnivore populations (HGF1, HGH1, HGE2). The tourism sector was also mentioned ($N = 15$: 5 environmentalists from all study sites, 4 from institutions in Ávila, Grosseto and Harghita, 2 farmers from Trento and Grosseto, 2 scientists, and 2 hunters from Harghita), playing either a positive role by having the potential to contribute to the valorization of large carnivore presence (e.g., GRE2) or a negative one by not following regulations whilst undertaking large carnivore watching activities (e.g., HGE2). Other stakeholders involved included animal welfare organization ($N = 11$: 3 from animal welfare groups, 3 farmers, 2 hunters from Grosseto and Trento, 1 scientist from Grosseto, 1 from institutions and 1 environmentalist from Trento) and scientists ($N = 12$: 4 environmentalists and 3 farmers from Harghita and Grosseto, 3 from animal welfare groups in Grosseto and Trento, 1 from institutions in Harghita and 1 scientist in Grosseto). The latter were mentioned as having responsibility for not having shared useful information to feed management interventions (GRF3) or not to be present enough in the debate (TNW1). Others included the rural community ($N = 10$: AVF1, AVF3, TNF1, GRE1, HGE1, HGE2, HGE3, HGH1, AVI1, TNW1), the general public ($N = 7$: HGE2, TNE2, HGF1, HGF3, TNF1, HGI1, GRW2), foresters and landowners, the media, and the EC and other international organizations ($N = 5$: GRE1, HGH2, HGI3, GRS1, HGF1, $N = 4$: HGE2, GRW2, GRS1, GRI4, and $N = 3$: HGF2, GRF2, HGI3, respectively).

The main issue reported with regards to inter-sectorial relationships between stakeholders was the perceived lack of competence and preparedness of local / regional administration authorities ($N = 24$: 8 farmers, 5 farmers, 5 environmentalists from all study sites, 3 from animal welfare groups from Grosseto and Trento, 2 scientists from Ávila and Grosseto, 1 hunter from Trento). A marked lack of strategic planning (HGI1, HGE2, TNF1, TNW2) and political will to tackle the situation were reported (GRW2, HGF1, TNE2, AVS2).

Most interviewees reported having good relationships and positive attitudes toward the other stakeholders, being involved in current or past collaboration initiatives of varied nature, mainly with livestock breeders ($N = 17$: 7 farmers and 3 hunters from Ávila, Grosseto and Harghita, 2 scientists from Grosseto and Ávila, 2 environmentalists from Ávila, 2 from institutions in Ávila and Harghita, 1 from animal welfare groups in Grosseto). In one case the total lack of direct relationship between local farmers and the relevant National authority was mentioned (HGF3). Limited relationship with other groups was reported by eleven interviewees (3 farmers and 2 scientists from Ávila and Grosseto, 2 environmentalists from Ávila and Trento, 2 from institutions in Grosseto and Harghita, 1 from animal welfare groups in Grosseto and 1 hunter from Trento), sometimes represented by provision of technical information only (AVS1) or channeled toward one group only (AVF4). A marked difficulty to establish a relationships between animal welfare group and other groups was reported in Grosseto and Trento ($N = 11$: 4 farmers, 3 from animal welfare groups, 2 hunters, 1 environmentalist, 1 from institutions). Information exchange / provision was considered as an important way of building relationships among stakeholders, up to the point that it could decrease the distance among different positions ($N = 10$: HGE3, GRE2, GRF1, GRF3, HGF2, GRH1, GRI3, GRI4, AVS2, GRS1): in ten cases collaboration was limited to provision of information, and in five cases information was believed to decrease credibility of certain people (considered responsible of misuse or instrumentalize information).

Knowledge Exchange Issues

The role of knowledge in conflictual situations was reported in all case studies. Lack of information flow across different interest groups ($N = 18$: 7 farmers and 5 environmentalists from Grosseto, Ávila and Trento, 2 hunters from Grosseto and Harghita, 3 from institutions and 1 from animal welfare groups from Grosseto) and the issue of instrumentalized information being spread were mentioned in the majority of cases ($N = 16$: 5 environmentalists from all study sites, 4 from institutions in Grosseto and Trento, 2 farmers, 2 from animal welfare groups, 2 hunters and 1 scientist from Grosseto). False information was often related to the lack of direct translation of scientific data. In one case false information was reported to be used to receive higher compensations. Aspects related to the lack of accessible information about large carnivore populations, attacks and behavior (HGE3), as well as the lack of training on how to behave in the presence of large carnivores (HGF1), were reported. The need to improve the quality of information on large carnivores was considered important for some interviewees ($N = 12$: 6 farmers from all study sites, 2

environmentalists from Grosseto and Trento, 2 from animal welfare groups in Trento and 1 hunter and 1 from institutions in Grosseto). Reliable information not being translated into management interventions was an issue for seven interviewees (GRF2, GRF3, GRE1, TNE2, GRS1, HGI3, HGH2). Other issues reported were the lack of information about the work done by farmers (AVF7) and their contribution to the conservation of cultural and biological diversity heritage (HGE1, HGE3).

Interventions, Prevention Measures, Livestock Management Measures to Decrease Impact of Large Carnivores

Thirty-three interviewees put forward suggestions of possible interventions or prevention measures to reduce the impact or level of large carnivore attacks. These included: fencing and corrals ($n = 15$: 11 farmers from all study sites, 2 hunters from Grosseto and Harghita, 1 environmentalist and 1 from institutions in Harghita); Compensation and insurance ($n = 14$: 5 farmers and 3 from institutions from Grosseto, Harghita and Ávila, 4 environmentalists from Ávila and Harghita, 1 hunter and 1 scientist from Grosseto) – although deemed as insufficient in some cases; Livestock guarding dogs ($n = 11$: 9 farmers from Grosseto, Trento and Ávila, 1 hunter from Grosseto and 1 from institutions in Ávila); modified management of livestock ($n = 8$: AVF1, AVF3, AVF5, AVF6, AVF7, AVF8, TNF1, GRI1); provision of information ($n = 6$: AVI1, AVS1, AVE1, HGE2, HGF3, GRH1); illegal killing of wolves ($n = 6$ – from Grosseto, Harghita and Trento); bear proof bins ($n = 4$: HGF1, HGF3, HGE2, HGI1) and others ($n = 6$).

In terms of other measures, interviewees advocated more local level management, comprised of local committees supporting large carnivore management (HGH2, HGE4), a task force with rangers at the regional level and bear emergency teams at the county levels (HGF3), bear fund that could be taken from tourism revenues (HGE4) and more experience-based management (HG15) – as well as decisions being made by a committee of scientific experts rather than the administration (TNW1).

In terms of the perceived impact of current interventions, three interviewees (AVF1, GRE1, AVE1) felt that interventions were effective in managing wolf attacks, versus six (AVF4, AVF8, GRF2, GRF3, GRF4, TNF2) who felt the measures were ineffective or caused other problems (e.g., conflicts between livestock guarding dogs and tourists). Many interviewees felt that farmers were simply resigned to the impact of large carnivores and highlighted a general lack of active management (AVE3, AVF7, TNI1).

Urgency of Action and Potential Activities/Impacts (on People, Livelihoods and Wolves) If No Action Was Taken

The vast majority of interviewees (37 out of the 40 who mentioned urgency) perceived that there was an urgent need to act in terms of wolf / bear management. A number of interviewees ($N = 39$) suggested what could happen should no action be taken. These ranged from: the use of illegal wolf/bear removal

($N = 19$: 5 from institutions in Ávila, Grosseto and Harghita, 5 environmentalists from Grosseto and Harghita, 4 farmers Ávila, Harghita and Trento, 3 from animal welfare groups in Grosseto and Trento, 1 scientist from Grosseto and 1 hunter in Harghita); cessation of traditional /extensive livestock breeding due to continued attacks ($N = 15$: 11 farmers from all study sites, 2 environmentalists from Ávila, 1 from institutions and 1 from animal welfare groups in Grosseto); increase of large carnivore attacks on livestock ($N = 10$: AVF1, AVF3, AVF5, HGF2, AVH1, AVI1, AVS2, HGE2, HGE3, HGI5) and adaptation to the current situation by changing ways of working (e.g., damage prevention measures) ($N = 6$: AVF1, AVF3, GRF2, GRH1, GRI1, AVS1).

Illegal removal of large carnivores was the most common response to this question. This was suggested as a possible outcome in the absence of national strategies (HGE2) or lack of agreement over compensation (TNF1), but one respondent highlighted the increased stress in carrying out such desperate measures (HGF3). In terms of the cessation of traditional breeding, one interviewee highlighted the domino effect on other sectors (AVF6), and the potential social conflict resulting from such a change in the rural landscape (AVE2). Stakeholders highlighted the potential risk of increases of attacks on livestock (and humans in the case of Harghita – HG15) by large carnivores, highlighting the increased confidence of wolves and bears (e.g., AVF1 and HGF2). Regarding adaptation, interviewees highlighted some limitations, including the impact of fencing on the quality and price of milk produced (GRF2) (in Grosseto, the milk is used to make cheese that has a special appellation and quality based on the free-ranging animals).

Possible Future Stakeholder Outcomes/Dynamics

In terms of who should be responsible for implementing future scenarios, two interviewees suggested environmentalists should take the responsibility, whereas five suggested it should be the authorities.

When asked about the potential future solutions and dynamics among stakeholders, the majority of interviewees mentioned that an increased support to livestock breeders was desired ($N = 20$: 7 farmers from Grosseto, Harghita and Trento, 4 environmentalists and 4 from institutions in Ávila, Grosseto and Harghita, 2 hunters and 2 scientists from Ávila and Grosseto, 1 from animal welfare groups), together with adequate financial measures to support them ($N = 15$: 5 farmers from Ávila, Grosseto and Trento, 5 from institutions in Ávila, Grosseto and Harghita, 2 from animal welfare groups in Grosseto and Trento, 2 environmentalists from Ávila and Harghita, 1 scientist from Ávila). Positive attitudes were expressed toward the possibility of an outside intervention to decrease tensions and support dialogue ($N = 11$: 4 environmentalists from all study sites, 2 farmers from Ávila and Grosseto, 2 from institutions in Ávila and Harghita, 2 scientists and 1 hunter from Ávila) and it was considered an opportunity for learning and listening ($N = 14$: 7 farmers from all study sites, 3 from institutions in Grosseto and Harghita, 2 hunters and 2 environmentalists from Grosseto and Trento). Such action was based on the condition that the outcomes would

be concrete ($N = 5$: AVE2, AVF4, HGF1, HGF2, HGI5), the staff providing support had a good knowledge of the local situations ($N = 6$: AVF1, AVF3, HGE1, AVS1, HGH2, GRS1) and involved people were selected based on their genuine interests in solving the situations ($N = 5$: GRI3, GRH1, TNH1, GRF3, TNF2). Other desired solutions envisaged were related to shared responsibility (GRI4) and expenses (HGI5) for the long-term survival of large carnivores, and the hope for clear and adequate legislation ($N = 3$: HGI1, HGE2, HGF3).

DISCUSSION

Challenges and Opportunities Across Case Studies

Understanding the various dimensions of the conflict as the starting point of implementing a participatory process is critical. Across all case studies, we could draw a common picture of the main issues to be addressed in a participatory process. As hypothesized, despite the range of social and cultural conditions across the case studies, the main issues related to presence of large carnivores were coherent across different areas. However, not all issues related to relationships between and among different groups. Indeed, whilst a number of challenges related to relationships were common to all the four areas considered, including low levels of trust and communication between stakeholders, there were also other challenges including the need for greater knowledge exchange and the lack of capacity of authorities. There were, however, also a number of positive aspects that could support the move toward greater dialogue and management of conflicts. We discuss these in turn in this section, after a brief summary across case studies on the status of large carnivores and their impacts.

Most representatives of all stakeholder groups interviewed as part of this study highlighted an increase in large carnivore population densities in their area, and the reasons for this varied from policies affording large carnivores greater protection (e.g., Habitats Directive), to agricultural practices (Common Agricultural Policy subsidies) and artificial feeding practices (of bears in Harghita). This, for many stakeholders, also meant ongoing and regular increases in attacks from large carnivores, including subsequent economic, behavioral and psychological impacts of such attacks. In case studies such as Ávila and Grosseto, where extensive farming is common, the continued attacks were seen as a potential end to livelihoods dependent on such livestock breeding.

A key challenge identified in all case studies was the current perception of lack of information flow (on large carnivore ecology as well as on control methods) across different interest groups, and particular types of information being spread for an interest groups' own ends. Low information accessibility was reported even from areas where publications and reports were found, and a responsibility was found to be on scientists who did not make efforts to translate scientific findings into management proposals. Low knowledge accessibility is not unique to large carnivore conflicts. Indeed, this phenomenon has been highlighted in other conservation conflicts, including the

conflict between bird of prey conservation and grouse shooting (Hodgson et al., 2019). The structure of information flow, i.e., the existence of knowledge related to large carnivores and the transparency around knowledge generation and management decisions regarding large carnivores was suggested as a key leverage point for fostering human-large carnivore coexistence in human-shaped landscapes (Hartel et al., 2019). Furthermore, the lack of capacity in institutional response to effectively mitigate large carnivore impacts on human activities coupled with the perception among farmers that the protection of large carnivores is more important than human safety and property created a mistrust between the people suffering carnivore attacks and institutions. Such mistrust as expressed by respondents suggests that simple measures (such as purely the increase of knowledge flow without the simultaneous consideration of building trust between people and key institutions for large carnivore management and conflict mitigation) may not bring positive outcomes for large carnivore conservation in human landscapes (Hartel et al., 2019). Stakeholders' suggested priorities to address this issue therefore included increased quality of information on large carnivores, integration of local knowledge into the knowledge base, and translation of reliable information into management interventions and the increase of effectiveness in institutional responses for mitigating large carnivore impacts.

The second common challenge across case studies was that the conflict was not so much among stakeholders (for example between livestock breeders and environmental organizations) but between all stakeholders and the relevant authorities. Part of this was linked to the perceived lack of competence and preparedness of local, regional and/or national administration authorities. This ranged from compensation levels being too low, to lack of support for those incurring losses linked to large carnivores. A major part of the conflict, however, stemmed from the issue that interviewees (whether breeders, environmentalists, hunters or others) placed a high responsibility on authorities, and yet reported a lack of strategic planning and political will to tackle the situation with large carnivores. As such, in all case studies there was a perceived disconnect between local stakeholders and relevant authorities (especially at the regional or national level), in terms of information flow, technical support or policies. This situation left a number of stakeholders feeling abandoned and frustrated by the current approaches to dealing with large carnivores and perhaps less likely to want to engage with authorities.

In many ways, the low level of trust and communication between stakeholders were linked to the above challenges. Many of the stakeholders interviewed had been affected by large carnivores for a long period of time, and had seen little in the way of action or support. Levels of trust, especially toward authorities (as highlighted earlier) were low, as were communication flow between stakeholders and authorities. Lack of trust in conflict situations has been highlighted as key in terms of potentially stalling or halting management processes (Young et al., 2016a).

Despite the above challenges, it was surprising to uncover a number of opportunities highlighted by stakeholders who expressed overall positive attitude in engaging in a cooperation effort with others, not without suggesting clear conditions. In some cases very specific suggestions were made (e.g., improved

information to be provided, regulation of tourist activities, establishment of local committees). Indeed, despite a high level of resignation and disconnection (abandonment, separated from the rest of the society, not receiving adequate support) perceived by local stakeholders bearing the impacts of large carnivore attacks, many proposals were put forward by those same stakeholders in constructive ways. Thus there may be potential for them to be engaged and for effective future management interventions to make a difference.

When asked about the potential future solutions and dynamics among stakeholders, the majority of interviewees stressed the urgent need to address the issue of large carnivores, through increased management of large carnivores and their impacts in order to reach a balance in which large carnivore conservation and other human activities could co-exist. Interviewees highlighted the need for increased financial and practical support to livestock breeders, and the potential for an outside intervention to decrease tension and support dialogue as an opportunity for learning and listening.

To conclude, all case studies, despite contextual differences, were broadly open to discussing the large carnivore issue, and its management, with other stakeholders – hence moving toward the management part of the framework presented in the introduction.

Future Implementation of Participatory Management Processes

Although it was clear from interviews that many stakeholders were skeptical and tired of engagement after what they perceived as many years of failure, there were elements of curiosity that made stakeholders likely to potentially engage in future participatory processes around large carnivore management.

Such engagement, however, would be only possible where certain conditions are met. Stakeholders suggested that the outcomes of such actions should be concrete, the staff providing support must have a good knowledge of the local situations and involved people must be selected based on their genuine interest in solving the situations. Thus their potential interest was not driven by just naive curiosity but the need to find solutions that would effectively change the current situations (as can be seen in other conflict situations, e.g., Mishra et al., 2017).

The selection of stakeholders taking part in such participatory processes also needs to be careful thought-through (see e.g., Marshall et al., 2007). During past processes taking place in the case studies above, some of the most extremist stakeholders were missing (for example, in Grosseto the *Pastori d'Italia* group left; in Ávila, the farmer unions promoted a parallel anti-wolf platform and the animal right national group ASCEL declined our invitation to attend the meetings). This has been found in other participatory processes, where certain groups are excluded in order to reach a solution acceptable by most (but not all) stakeholders (Butler et al., 2008; Young et al., 2016b). Whilst this can make such processes easier, it is important to consider that in many instances, such groups may reappear after or during the completion of the participatory process. Furthermore, their absence in the group would make them lose consensus in the

long run, if other, more efficient solutions would prove practical and functional (Madden and McQuinn, 2014). As such, the selection of the most restrained stakeholders can give a temporary (and false) perception of success and the outcomes might be questioned later on by those who deliberately do not engage in the process. It must be acknowledged that although the stakeholder group we considered to be impacted by the presence of large carnivores was represented in all areas, we also made an effort in including other views, possibly representing not only the other extreme positions, but those moderate ones that could eventually represent, at least partially, the position of the general public. This is more difficult to engage in such processes, but still needs to be taken into account (López-Bao et al., 2017).

In addition, and considering the importance allocated by interviewees to competent authorities, the main condition needed may be the engagement of relevant authorities to commit and express political will to improve the situation and take forward outcomes from the participatory processes. Expectations are raised when stakeholders commit time and energy to such process and the question of sustainable impact at political and institutional level should be secured. Accountability of authorities needs to be carefully embedded in the participatory process to ensure a sustainable commitment toward the implementation of the process outputs/recommendations (Young et al., 2016a).

To conclude, we argue that participatory processes in all four areas could be implemented based on the common goals of the stakeholders involved and building on their will to see concrete changes. In addition, based on the key challenge of disconnect between stakeholders and authorities at the local, regional and national level, there may be many advantages of such a cross case study approach. Indeed, such an approach may have the potential to build a network that allows stakeholders to have better access to the relevant decision making scale by working in a coordinated manner instead of being isolated and by ensuring accountability of the authorities regarding the implementation of the process outcomes.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

AUTHOR CONTRIBUTIONS

JY and VS designed the study. VS, EB, YK led data acquisition. JY, VS, and EB analyzed the data and interpreted the results. LD, TH, SR, KM, JB, and JY participated in data acquisition. JY, VS, YK, TH, JB, and PC wrote the manuscript. All authors contributed to the article and approved the submitted version.

FUNDING

The study was developed within contract 07.027739/2017/771819/SER/ENV.D.3 “Service contract for the establishment of

regional/local platforms on coexistence between people and large carnivores” issued to Istituto di Ecologia Applicata.

acquisition: Provincia Autonoma di Trento, Regione Toscana, Junta de Castilla y Leon, Harghita County Council.

ACKNOWLEDGMENTS

We thank all our interviewees for their availability and willingness to share knowledge and perceptions. We are grateful to the administrations that facilitated our work during data

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fevo.2020.00182/full#supplementary-material>

REFERENCES

- Altwood, T. C., and Breck, S. W. (2012). *Carnivores, Conflict and Conservation: Defining the Landscape of Conflict*. Fort Collins, CO: USDA National Wildlife Research Center.
- Bautista, C., Revilla, E., Naves, J., Albrecht, J., Fernández, N., Olszańska, A., et al. (2019). Large carnivore damage in Europe: analysis of compensation and prevention programs. *Biol. Conserv.* 235, 308–316. doi: 10.1016/j.biocon.2019.04.019 doi: 10.1016/j.biocon.2019.04.019
- Bixler, P., Dell’Angelo, J., Mfune, O., and Hassan, R. (2015). The political ecology of participatory conservation: institutions and discourse. *J. Polit. Ecol.* 22, 164–182. doi: 10.2458/v22i1.21083
- Blanco, J. C., and Cortés, Y. (2002). *Ecología, censos, percepción y evolución del lobo en España. Análisis de un conflicto*. Málaga: SECEM, 176.
- Boitani, L. (2018). *Canis lupus* (errata version published in 2019). *The IUCN Red List of Threatened Species* e.T3746A144226239.
- Boitani, L., and Ciucci, P. (1993). “Wolves in Italy: critical issues for their conservation,” in *Wolves in Europe. Status and Perspectives*, eds C. Promberger and W. Schröder (Monaco: Munich Wildlife Society), 75–90.
- Boitani, L., Ciucci, P., and Raganella-Pelliccioni, E. (2010). Ex-post compensation payments for wolf predation on livestock in Italy: a tool for conservation? *Wildl. Res.* 37, 722–730. doi: 10.1071/WR10029
- Bombieri, G., Naves, J., Penteriani, V., and Selva, N. (2019). Brown bear attacks on humans: a worldwide perspective. *Sci. Rep.* 9:8573.
- Bryman, A. (2014). *Social Research Methods*. Oxford: Oxford university press.
- Butler, J. R., Middlemas, S. J., McKelvey, S. A., McMyn, I., Leyshon, B., Walker, I., et al. (2008). The Moray Firth Seal Management Plan: an adaptive framework for balancing the conservation of seals, salmon, fisheries and wildlife tourism in the UK. *Aquat. Conserv. Mar. Freshw. Ecosyst.* 18, 1025–1038. doi: 10.1002/aqc.923
- Chapron, G., Kaczensky, P., Linnell, J. D., Von Arx, M., Huber, D., Andrein, H., et al. (2014). Recovery of large carnivores in Europe’s modern human-dominated landscapes. *Science* 346, 1517–1519. doi: 10.1126/science.1257553
- Creighton, J. L. (2005). *The Public Participation Handbook: Making Better Decisions through Citizen Involvement*. San Francisco, CA: Jossey-Bass.
- Enescu, C. M., and Hălălișan, A. F. (2017). The economic contribution of hunting products to the turnover of the forestry units in Romania. *Agric. Forest.* 63, 147–153.
- Frank, B., and Glikman, J. A. (2019). “Human–Wildlife Conflicts and the Need to Include Coexistence,” in *Human–Wildlife Interactions: Turning Conflict into Coexistence*, eds B. Frank, J. A. Glikman, and S. Marchini (Cambridge: Cambridge University Press), 1–19. doi: 10.1017/9781108235730.004
- Gehring, T. M., Vercauteren, K. C., and Landry, J. M. (2010). Livestock protection dogs in the 21st century: is an ancient tool relevant to modern conservation challenges? *Bioscience* 60:299. doi: 10.1525/bio.2010.60.4.8
- Gibbs, G. R. (2007). Thematic coding and categorizing. *Anal. Qual. Data* 703, 38–56.
- Groff, C., Angeli, F., Asson, D., Bragalanti, N., Pedrotti, L., and Zanghellini, P. (eds) (2019). *Rapporto Grandi Carnivori 2018 del Servizio Foreste e Fauna*. Trentino: Provincia Autonoma di Trento.
- Hartel, T., Scheele, B., Vanack, A. T., Rozyłowicz, L., Linnell, J. D. C., and Ritchie, E. M. (2019). Mainstreaming human large carnivore coexistence through institutional collaboration. *Conserv. Biol.* 33, 1256–1265. doi: 10.1111/cobi.13334
- Hodgson, I. D., Redpath, S., Fischer, A., and Young, J. (2019). Who knows best? Understanding the use of research-based knowledge in conservation conflicts. *J. Environ. Manag.* 231, 1065–1075. doi: 10.1016/j.jenvman.2018.09.023
- ISTAT (2013). *Bilancio Demografico Della Popolazione Residente Per Provincia E Anno-dal 2011*. Available online at: http://www.istat.it/it/toscana/dati?q=gettabletr&dataset=DCIS_POPORESBIL1&dim=63,2,3,0&lang=2&tr=0&te=1 (accessed July, 2019).
- Johansson, M., Ferreira, I. A., Støen, O. G., Frank, J., and Flyktet, A. (2016). Targeting human fear of large carnivores- Many ideas but few known effects. *Biol. Conserv.* 201, 261–269. doi: 10.1016/j.biocon.2016.07.010
- Junta de Castilla y León (2017). *Plan de Conservación y Gestión del lobo en Castilla y León*. Valladolid: Junta de Castilla y León.
- Lance, N. J., Breck, S. W., Sime, C., Callahan, P., and Shivik, J. A. (2010). Biological, technical, and social aspects of applying electrified fladry for livestock protection from wolves (*Canis lupus*). *Wildl. Res.* 37, 708–714.
- Linnell, J. D. C., and Cretois, B. (2018). *Research for AGRI Committee – The Revival of Wolves and other Large Predators and Its Impact on Farmers and their Livelihood in Rural Regions of Europe*. Brussels: European Parliament.
- López-Bao, J. V., Blanco, J. C., Rodríguez, A., and Godinho, R. (2015). Toothless wildlife protection laws. *Biodivers. Conserv.* 24, 2105–2108. doi: 10.1007/s10531-015-0914-8
- López-Bao, J. V., Chapron, G., and Treves, A. (2017). The Achilles heel of participatory conservation. *Biol. Conserv.* 212, 139–143. doi: 10.1016/j.biocon.2017.06.007
- Lute, M. L., Carter, N. H., Lopez-Bao, J. V., and Linnell, J. D. (2018). Conservation professionals agree on challenges to coexisting with large carnivores but not on solutions. *Biol. Conserv.* 218, 223–232. doi: 10.1016/j.biocon.2017.12.035
- Madden, F., and McQuinn, B. (2014). Conservation’s blind spot: the case for conflict transformation in wildlife conservation. *Biol. Conserv.* 178, 97–106. doi: 10.1016/j.biocon.2014.07.015
- Madden, F. M. (2008). The growing conflict between humans and wildlife: law and policy as contributing and mitigating factors. *J. Int. Wildl. Law Policy* 11, 189–206. doi: 10.1080/13880290802470281
- Marino, A., Braschi, C., Ricci, S., Salvatori, V., and Ciucci, P. (2016). Ex post and insurance-based compensation fail to increase tolerance for wolves in semi-agricultural landscapes of central Italy. *Eur. J. Wildl. Res.* 62, 227–240. doi: 10.1007/s10344-016-1001-5
- Marshall, K., White, R., and Fischer, A. (2007). Conflicts between humans over wildlife management: on the diversity of stakeholder attitudes and implications for conflict management. *Biodivers. Conserv.* 16, 3129–3146. doi: 10.1007/s10531-007-9167-5
- Mishra, C., Young, J. C., Fiechter, M., Rutherford, B., and Redpath, S. M. (2017). Building partnerships with communities for biodiversity conservation: lessons from Asian mountains. *J. Appl. Ecol.* 54, 1583–1591. doi: 10.1111/1365-2664.12918
- Morehouse, A. T., Hughes, C., Manners, N., Bectell, J., and Bruder, T. (2020). Carnivores and Communities: a case study of human-carnivore conflict mitigation in Southwestern Alberta. *Front. Ecol. Evol.* 8:2. doi: 10.3389/fevo.2020.00002
- Popescu, V., Pop, M., Chiriac, S., and Rozyłowicz, L. (2019). Romanian carnivores at a crossroads. *Science* 364:1041. doi: 10.1126/science.aax6742
- Preatoni, D., Mustoni, A., Martinoli, A., Carlini, E., Chiarenzi, B., Chiozzini, S., et al. (2005). Conservation of brown bear in the Alps: space use and settlement behavior of reintroduced bears. *Acta Oecol.* 28, 189–197. doi: 10.1016/j.actao.2005.04.002

- Redpath, S., Linnell, J., Festa-Bianchet, M., Boitani, L., Bunnefeld, N., and Dickman, A. (2017). Don't forget to look down - collaborative approaches to predator conservation. *Biol. Rev.* 92, 2157–2163. doi: 10.1111/brv.12326
- Redpath, S. M., Bhatia, S., and Young, J. C. (2015). Tilting at wildlife – reconsidering human-wildlife conflict. *Oryx* 49, 222–225. doi: 10.1017/s0030605314000799
- Redpath, S. M., Young, J., Evely, A., Adams, W. M., Sutherland, W. J., Whitehouse, A., et al. (2013). Understanding and managing conservation conflicts. *Trends Ecol. Evol.* 28, 100–109. doi: 10.1016/j.tree.2012.08.021
- Ricci, S., Salvatori, V., and Ciucci, P. (2018a). *Assessment of the efficacy of damage prevention structures and livestock guarding dogs in Province of Grosseto. LIFE MEDWOLF technical report for action D2*. Rome: Istituto di Ecologia Applicata.
- Ricci, S., Salvatori, V., and Ciucci, P. (2018b). *Indagine sulla presenza del lupo in provincia di Grosseto. Progetto LIFE MEDWOLF*. Roma: Istituto di Ecologia Applicata.
- Sáenz de Buruaga, M. (2018). *Lobos. Población en Castilla y León. Situación en España*. Rimpego: León.
- Salvatori, V., Godinho, R., Braschi, C., Boitani, L., and Ciucci, P. (2019). High levels of recent wolf x dog introgressive hybridization in agricultural landscapes of central Italy. *Eur. J. Wildl. Res.* 65, 73–87. doi: 10.1007/s10344-019-1313-3
- Scarlat, N., Blujdea, V., and Dallemand, J. F. (2011). Assessment of the availability of agricultural and forest residues for bioenergy production in Romania. *Biomass Bioenergy* 35, 1995–2005. doi: 10.1016/j.biombioe.2011.01.057
- Selvi, F. (2010). A critical checklist of the vascular flora of Tuscan Maremma (Grosseto province, Italy). *Flora Mediterranea* 20, 47–139.
- Sjölander-Lindqvist, A., Johansson, M., and Sandström, C. (2015). Individual and collective responses to large carnivore management: the roles of trust, representation, knowledge spheres, communication and leadership. *Wildl. Biol.* 21, 175–185. doi: 10.2981/wlb.00065
- Teel, T. L., and Manfredo, M. J. (2010). Understanding the diversity of public interests in wildlife conservation. *Conserv. Biol.* 24, 128–139. doi: 10.1111/j.1523-1739.2009.01374.x
- Vaske, J. J. (2008). *Survey Research and Analysis: Applications in Parks, Recreation and Human Dimensions*. State College: Venture Publishing.
- von Korff, Y., d'Aquino, P., Daniell, K. A., and Bijlsma, R. (2010). Designing participation processes for water management and beyond. *Ecol. Soc.* 15:1.
- Widman, M., Steen, M., and Olofsson, K. (2019). Indirect costs of sheep depredation by large carnivores in Sweden. *Wildl. Soc. Bull.* 43, 53–61. doi: 10.1002/wsb.951
- Wikenros, C., Sand, H., Bergström, R., Liberg, O., and Chapron, G. (2015). Response of Moose Hunters to Predation following Wolf Return in Sweden. *PLoS One* 10:e0119957. doi: 10.1371/journal.pone.0119957
- Young, J., Marzano, M., White, R. M., McCracken, D. I., Redpath, S. M., Carss, D. N., et al. (2010). The emergence of biodiversity conflicts from biodiversity impacts: characteristics and management strategies. *Biodivers. Conserv.* 19, 3973–3990. doi: 10.1007/s10531-010-9941-7
- Young, J. C., Rose, D. C., Mumby, H. S., Benitez-Capistros, F., Derrick, C. J., and Finch, T. (2018). A methodological guide to using and reporting on interviews in conservation science research. *Methods Ecol. Evol.* 9, 10–19. doi: 10.1111/2041-210x.12828
- Young, J. C., Searle, K., Butler, A., Simmons, P., Watt, A. D., and Jordan, A. (2016a). The role of trust in the resolution of conservation conflicts. *Biol. Conserv.* 195, 196–202. doi: 10.1016/j.biocon.2015.12.030
- Young, J. C., Thompson, D., Moore, P., MacGugan, A., Watt, A. D., and Redpath, S. M. (2016b). A conflict management tool for conservation agencies. *J. Appl. Ecol.* 53, 705–711. doi: 10.1111/1365-2664.12612

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Copyright © 2020 Salvatori, Balian, Blanco, Ciucci, Demeter, Hartel, Marsden, Redpath, von Korff and Young. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.