A Review of the Role of Law and Policy in Human-Wildlife Conflict

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Abstract

Interactions between people and wildlife are often mediated by laws, policies, and other governance instruments with profound implications for species conservation. Despite its importance for conservation practice, governance of these human-wildlife relationships is an under-researched area. Our research aim was to understand the link between law/policy and human-wildlife conflict (HWC) and the implications for species conservation using a systematic quantitative review of the literature on the human dimensions of HWC. We identified 133 relevant HWC studies, conducted in 45 countries, involving 114 species. Over 80% of the articles mentioned law, mainly national-level legislation, with little reference to customary or tribal law. However, only 40%, stated whether the laws had influenced the HWC—most reported negative associations with HWC or a mix of positive and negative associations. The perceived ineffectiveness of law was primarily attributed to lack of implementation, support, and enforcement and perceived erroneous laws. The few positive associations included stakeholder involvement, management flexibility, and adequate compensation. Our findings reveal a knowledge deficit on the detailed effects of law on HWC and conservation conflicts in general. Overall, law as an institution seems to exacerbate or prolong most conflicts instead of providing a pathway to coexistence and enhancing species conservation.

Keywords: law, policy, human-wildlife conflict, human dimensions

Link to supplementary material: https://bit.ly/3vHnPzD

INTRODUCTION

Human-wildlife conflict (HWC) has been simply defined as 'occurring when the needs and behaviour of wildlife impact negatively on the goals of humans or when the goals of humans negatively impact the needs of wildlife' (IUCN 2005). This includes instances when wild animals damage or consume crops, livestock or fish catches; threaten human safety (e.g., by injuring/killing humans); and when wild animals damage, or are damaged by, physical property (e.g., collisions with vehicles) (Peterson et al. 2010). In practice, HWC has mainly been addressed by managing wildlife with traditional approaches including lethal methods, relocation, separation via barriers and fencing, and other methods of habitat manipulation (Conover 2002; Treves et al. 2009).

This definition of HWC, however, does not encompass the full scope of relationships, actions, and values that constitute HWC (Peterson et al. 2010; Bruskotter et al. 2015). The term itself has also been criticised for portraying wildlife as combative (Pooley et al. 2020), when in reality the conflicts are often conservation and social-based (Redpath et al. 2015). Some authors have argued that the focus on "conflict", which reinforces the human-nature dichotomy and focusses primarily on negative impacts, should be refocussed towards examining the concept of "coexistence", which has been defined as a state

where "humans and wildlife coadapt to sharing landscapes" (Pooley et al. 2020). Coexistence does not imply there is no conflict, but that it is managed to remain within tolerable levels (Pooley et al. 2020, Carter and Linnell 2016). To achieve this, institutional alignment needs to be improved such that communities can adapt broader policies to locally specific contexts (Carter and Linnell 2016).

To this end, increasing attention is given to the conception of conflicts as social, not merely environmental (Adams and Mulligan 2003; Ango et al. 2017; Dickman 2010; Hill 2015). Conflict often reflects disagreements between stakeholders over appropriate management of wildlife. This can be representative of differences in environmental values and attitudes, which are rapidly changing due to varied global influences such as technological advancement, global economic integration, and land-use changes (IPBES 2019, Chapter 2.1). They can be based on deeply rooted historical and cultural differences, and circumstances (see for example Talukdar and Gupta 2017; Bhatia et al. 2017). This makes conflict resolution an almost impossible task. Policymakers, politicians, and wildlife managers have to consider and resolve all societal influences in a given area to have an HWC policy that successfully works to reduce negative human-wildlife interactions.

The move to a sociological understanding of HWC has been exemplified in many studies, particularly literature focused on the 'human dimensions' of the conflict, hereafter 'human dimensions research'. This refers to research on the human side of the conflict, for example, the values and attitudes that people hold towards a certain species, or other stakeholders in a conflict, what drives those values and attitudes, and how they might be changed (e.g., Seifu and Beyene 2014; Ango et al. 2017; McKay et al. 2018; Noga et al. 2018). This human dimensions research is often intended to be used to shape management policies in a way that is aligned with those attitudes and values.

Whilst human dimensions research is a necessary step in the conflict response, it is not the only relevant concern. Consideration of other societal influences is needed to inform and reshape the policy response to HWC in a way that has a lasting effect. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) stressed the indirect effect that *institutions* have on biodiversity losses and conservation outcomes, as they are 'fundamental mediators of the perceptions and values about nature and nature's contribution to people, as well as the relationship between humans and all other aspects of life on Earth' (IPBES 2019, Chapter 1). Institutions in this context are defined as formal and informal rules and norms that structure individual and collective behaviour (Ostrom 1990, 2005). Analysis of the institutional effect on human-wildlife conflict outcomes is still in early stages but has been attempted or referred to by several researchers in the HWC space (including in the political ecology space; De Motts and Hoon 2012; Rai 2019). For example, there is a common suggestion that greater understanding of other influences on conservation is needed

e.g., differences in views based on varying geographical and sectoral management approaches (Lute et al. 2018); or decision-making heuristics (Heeren et al. 2017). Further, it has been suggested that the scholarship is missing a nuanced understanding of the factors that produce conflict, including an appreciation for the individual nature of each conflict (Yurco et al. 2017).

Notwithstanding the efforts of various social scientists (see for example Margulies 2018; Mathur 2014), the institutional influence on HWC remains underdeveloped in the literature, including the role of the institutions of law and policy in the resolution of HWC. IPBES states that legal institutions may be indirect drivers of change (and in this case conflict) because of their impact on market mechanisms and production processes, standard-setting, local community coordination, securing collective rights, property and resource-use rights, protected areas and other conservation policies such as payments for ecosystem services (IPBES 2019, Chapter 2.1).

This paper seeks to move the literature forward by examining whether the human dimensions research has captured the effect of law and policy as institutional influences in HWC. As a societal institution, one way of conceptualising the law is as a system of socially controlled and sanctioned norms and morality (e.g. Akers 1965). We postulate that the law is one potential institution that affects human values and attitudes to wildlife, and therefore can affect HWC. Law cuts across cultures, boundaries, and conflicts and is often a rigid and significant influence on human behaviour in circumstances of HWC. For example, law can mandate the designation of protected areas, which in turn can shape the relationship people have with land and animal species within it. However, the influence of law can extend beyond control of behaviour to influence the values and attitudes that people hold towards wildlife and other stakeholders in a conflict. For example, if a person can no longer use land due to legal changes rendering it a protected area, that person could develop anger and resentment towards the endangered species being protected within that area, the conservationists and other stakeholders who lobbied for the protected area, and the law-makers themselves, fuelling further social conflict. Several studies show that the law may affect HWC in multiple ways. Top-down governance approaches can increase animosity between stakeholders and result in prolonged or exacerbated conflict (D'Anna et al. 2016; Storie and Bell 2016). Conversely, a proliferation of collaborative and stakeholder-inclusive legal mechanisms can increase engagement with conflict resolution and improve outcomes (Treves et al. 2009). In light of this, and global calls for increasing ties between science, stakeholders, and the law (IPBES 2019); analysis of the link between law, policy, and HWC is urgent and necessary.

This article aims to test the hypothesis that law may have significant impacts on HWC, as demonstrated in current human dimensions research, and better understand any links between law, HWC, and human attitudes to conflict, whether it be by way of normative influence or conflict aggravator (i.e., whether the law has a positive or negative association

with HWC). Although this connection has been considered by various authors in the discipline of law (see for example Trouwborst 2010; Couzens 2013; Woolaston 2018), there appears to be a real gap in this connection in the conservation science literature. This is tested at first instance by analysing the way that law is considered and discussed by human participants in human dimensions research. We conducted a systematic quantitative literature review of empirical human dimensions research (where human subjects were interviewed or surveyed about their attitudes and values towards wildlife and specific conflicts) published between January 2000 and January 2019. The purpose was to discover whether the theorised links between law, policy, and conflict are considered by wildlife conservation scientists and managers in HWC research and articulated or acknowledged by participants, and, if so, which types of laws and policies are viewed as having a positive association with HWC (i.e., either do not exacerbate the conflict or help to alleviate the conflict) and which have a negative association with HWC (i.e., increase or prolong the conflict).

We note a limitation of the study, in that conservation scientists are unlikely to have a deep understanding of the legal structures surrounding a conflict, nor focus primarily on law as an object that can affect human values and attitudes. Also, papers that address the law/conflict nexus in some capacity, but are not empirical human dimensions research, fall outside of our search terms. However, we suggest that the benefit of this study is twofold. First, we suggest that law is a human dimensions issue and so should be considered in the human dimensions research space. This study analyses whether it is a current consideration in empirical research. Second, without preliminary information on how law may be associated with values and attitudes, as expressed by human participants, we cannot understand the effect of the law on HWC and cannot begin the process of addressing this part of the conflict. We suggest that this study be used to promote further empirical research that focuses directly on values and attitudes to law in situations of conflict, and their subsequent effect on conflict resolution in the context of wildlife conservation.

MATERIALS AND METHODS

We conducted a systematic quantitative literature review (SQLR) to identify relevant articles and extract the required data. This type of review allows literature to be collated and interpreted in a structured and comprehensive manner, using an evidence-based framework (Pullin and Stewart 2006). Understanding gaps in knowledge and visualising trends in a topic facilitates effective future research, a vital step towards establishing an evidence-base on a conservation issue (Sutherland et al. 2004; Pullin and Knight 2009). Although systematic reviews on human-wildlife conflict (HWC) exist (e.g. Inskip and Zimmermann 2009; Kansky and Knight 2014; Eklund et al. 2017; van Eeden et al. 2018), none have explored the link between HWC and law.

SQLR steps

Using the SQLR methodology, we collected the data using four clearly defined steps (Pullin and Stewart 2006; Pickering and Byrne 2014). In step one, we formulated the topic and searched online databases using keywords to identify relevant articles ("planning"). Step two involved an initial screening of the articles collected to exclude those that were obviously irrelevant and a more detailed screening to ensure only articles directly related to the topic of human dimensions of human-wildlife conflict remained ("searching"). Step three involved extracting data into a structured database ("data extraction"), and then data were analysed for trends in step four ("data synthesis"). This process is described further below and is illustrated in Supplementary Figure S1.

Step one (planning): Articles identified from searches of online databases

We searched four commonly used online databases (Scopus, Science Direct, HeinOnline, Index to Legal Periodicals and Books) to identify articles that described empirical human dimensions research relating to HWC and law. Our key search terms were (law OR legal OR legislation OR proclamations OR jurisdiction OR court OR tribunal OR illegal OR offence OR prosecution OR conviction OR sentence OR policy) AND (wildlife OR conservation OR biodiversity) AND (conflict OR 'biodiversity conflict' OR coexistence OR co-existence OR human-wildlife OR human). As the overall purpose of our SQLR was to gather evidence on the ground level assessment of law in situations of HWC, we did not focus on articles that generally described or reviewed laws, legislation, and/or policies. Instead, we focused on the literature that empirically detailed stakeholder attitudes and on-ground application of the law. Keyword restrictions mean we may have missed taxon-specific papers or more specific instances of conflict that did not include any law/policy references. All databases were searched for relevant articles published between January 2000 and January 2019. An initial search was conducted on 3 March 2018, and the search was updated on 20 January 2019. This date range was selected because human dimensions papers proliferated in that period and to avoid including outdated research. We limited our search to peer-reviewed journal articles and early access papers published in English. This search excluded grey literature, editorials, comments, reviews, white papers, books and book chapters, and conference proceedings, as such literature rarely included empirical data specific to the search. All articles found meeting our criteria were entered into an Endnote library (n = 3882).

Step two (searching): Initial screening of Endnote library and identification of articles specifically relating to HWC

We manually searched the Endnote library created in Step one to exclude unrelated or irrelevant articles. The initial screening exclusions were (i) articles where only the title, abstract, and keywords were in English, (ii) non-peer-reviewed articles, e.g. editorials, books, conference reviews, grey literature, (iii) articles where the topic used in the paper did not match the

review topic (e.g. focused on a description of the legislation), and (iv) articles where the topic was only used in the keywords and/or references and was not a major focus of the paper. This library contained 2856 articles.

We further refined this initial library to remove articles that were not directly relevant to our review topic. Specifically, these exclusions related to articles involving: (i) broader issues such as climate change, habitat loss, and deforestation that did not specifically mention HWC in any form in the abstract, (ii) social conflict regarding energy or the issues mentioned above, (iii) non-wildlife related fisheries conflicts (e.g. fishing rights), (iv) livestock management and pastoral practices unless they existed as a direct response to HWC (i.e. HWC was explicitly mentioned), (v) coexistence between different wildlife species, (vii) articles where HWC was only included in the discussion as an identified need for further research or something that might be applied to a review topic field, and (viii) those that presented only secondary data (e.g. reviews). The final library for step two contained 133 articles (see Supplementary List S1 for list of articles).

Step three and four (data extraction and synthesis): Analysis of trends

We extracted the data from 133 selected articles into categories (see Supplementary Table S1 for details of categories). We then examined several geographical and thematic trends using descriptive summary statistics in Excel. The R package *fmsb* (v.0.6.3; Nakazawa 2018) was used to compile the radar charts. The analysis included summarising (i) geographic trends in authors and study locations, (ii) taxonomic trends in species/ species groups involved in the conflict, (iii) methodological patterns in study type, data type, and discipline, (iv) types of conflict involved, (v) mitigation techniques used to ameliorate the conflict, (vi) types of law involved, (vii) the effect of the law on the conflict, and (viii) types of policy involved. Where the effect of the law was not clearly delineated by the authors of the subject papers, we judged the effect based on the papers conclusions and statements/quotes from participants. We also examined the interactions and relationships between these trends.

RESULTS

General publishing information and study methodology

Most of the 133 studies included in the final analysis were published in environmental science (n = 110), biological science (n = 74), and/or environmental social science-related journals (n = 43). Relatively few were published in economics (n = 7), law (n = 5), energy (n = 6) or business-focused (n = 3) journals.

Five main data collection methods were used in the studies: interviews (n = 99), written questionnaires (n = 47), literature surveys (n = 31), observations (n = 30) and focus groups (n = 24). Over 40% of the studies (n = 57) used only one type of method (primarily interviews, questionnaires) while the others used multiple data collection methods. Study participants

were broadly classified into six major groups: individuals affected by HWC (e.g., villagers), commercial organisations, rangers or scouts, conservation groups or NGOs, scientists or academics, and government or state. Most study participants were individuals from local communities (n = 118 studies), followed by government officials (n = 44), commercial organisations (n = 32) and NGOs (n = 28). Relatively few participants were from academic (n = 19) or ranger (n = 12) groups. Fifty-nine studies involved participants from more than one group (2-6 groups) while 74 studies only involved participants from one of the groups (72 studies just with individuals, 1 with government, 1 with rangers).

Geographic trends

The 133 studies were conducted in 45 different countries (Supplementary Figure S2). The most studied countries were India (n = 16), USA (n = 15) and Sweden (n = 10), with the remaining countries being the focus of between 1 and 7 articles (19 countries with 1 article, 23 countries with 2-7 articles). Of the 133 studies, 101 were focused on a specific region (e.g. state, province, county) within the country, four were specifically focused at the national level and the remainder did not specify the region. Over 60% (n = 62) of the 101 region-specific studies were only conducted in one location while the remainder were conducted in several sites/locations.

Taxonomic trends

A total of 114 species were identified in the 133 studies. The vast majority were mammals (90 species) followed by birds (18 species). Only three reptile species were identified (python, crocodile, and tortoise). Several articles either did not specify the species involved or identified them very broadly; for example, monkeys, pigs, and carnivores. The most commonly discussed taxonomic groups were felines (e.g., lions, pumas, cougars, and tigers, n = 55), canines (including wolves, jackals, and coyotes, n = 47), primates (e.g., baboons, monkeys, and chimpanzees, n = 35), bears (e.g., Brown, Asiatic Black, and Sloth bears, n = 29), deer (including elk, gazelles, antelopes, n = 19), elephants (n = 16) and pigs (including boars and hogs, n = 14). The most common bird groups were predatory birds (e.g., falcons, kites, n = 6), game birds (e.g., partridge, pheasants, n = 4) and corvids (e.g., crows, jackdaws, magpies, n = 4). Wolves (n = 25) were the most highly represented individual species.

Conflict trends

We divided HWC reported in the included studies into 13 types (Supplementary Figure S3). The most common conflicts revolved around livestock predation (n = 60), crop destruction (n = 48), attacks on humans (n = 21), domestic animal predation (i.e. pets, n = 10) and property damage (n = 10). Livestock and domestic animal predation generally involved big cats (n = 37), wolves (n = 19), bears (n = 14) and other

carnivorous species (n = 27), while crop damage primarily involved primates (n = 15), elephants (n = 12), pigs (n = 12) and birds (n = 6). Attacks on humans were mostly associated with big cats (n = 10), elephants (n = 5), bears (n = 5), wolves (n = 4) and dingoes (n = 2). Property damage was generally caused by conflict with bears (n = 6) and elephants (n = 5). In 54 studies, more than one type of conflict was reported, either due to multiple issues with one species (e.g., human and livestock predation by tigers) or multiple issues with a range of species in one location (e.g., crop destruction and property damage by elephants, baboons, and pigs).

We identified 17 different HWC mitigation techniques from the data. The most common techniques reported were the illegal killing of wildlife by shooting or poisoning (n = 52); compensation for humans, both financial and non-financial (n = 41); legal killing including reduction programs or planned culls (n = 30); fencing (n = 16) and guarding by humans or guard dogs (n = 11). Less common techniques included education programs (n = 3), traditional tribal management (n = 2), village resettlement in the case of tiger predation on humans (n = 2), and revenue sharing from tourism (n = 1). Seventeen articles did not specify the type of mitigation used. Fifty-two articles (39%) reported the use of more than one mitigation technique.

Human-wildlife conflict and law

Over 80% of the studies (n = 108) specifically mentioned law in relation to the HWC, e.g., the relevant legislation that applied to or governed the conflict, the role of the legislation in the outcome of the conflict, whether observed mitigation techniques were prescribed or precluded by legislation. Of these, 57 (53%) specifically mentioned the relevant law by name (see Supplementary Table S2 for specific laws). The level of government the law related to (i.e., local, national, international) was mentioned by 70 of the 108 studies (65%). Most studies related to law at the national level (n = 57), followed by international (n = 18) and local law (n = 13). Most studies discussed law at one level (n = 53) with 16 discussing law at two levels (local + national or national + international) and only one discussing all three levels. Customary law was referred to in 15 articles: 11 mentioned tribal law, two mentioned religious law, while two did not clearly state what type of customary law was being referred to in the article. Only one article referring to customary law was from a Global North country (wolf management by Native Americans in the USA). The remaining customary law articles were from African (n = 8), Asian (n = 6) or South American (n = 1) countries.

Human-wildlife conflict and policy

Policies relating to HWC (e.g. species management plans, National Action Plans, National Development Plans, National Park Management Plans) were mentioned in 84 (63%) of the studies. However, only 54 (40%) studies stated the name of policy. Studies based in the high-income countries were more likely to mention policy and identify the specific policies relevant to HWC compared to those based in the low-income countries. Most of the policies discussed in the studies based in high-income countries were either species management/recovery plans (70%), or national biodiversity plans/strategies (17%). In low-income countries, policies related to national biodiversity plans (50%) or national development plans (25%) were most commonly identified. No articles from low-income countries mentioned international or regional policies.

The effect of law and policy on human-wildlife conflict

Over 40% of the studies (n = 55) did not state whether the law had influenced the HWC discussed. Studies which did state the law's effect mainly reported that the law had negative (n = 49), or a mix of positive and negative (n = 21), consequences on HWC. The law was reported to have a positive association with HWC in only seven studies. There were no obvious geographic or taxonomic trends in the impacts of law on HWC (Tables 1a and 1b).

Several reasons were provided for why the law was perceived as not effective in managing HWC. The most common reasons were lack of implementation of the law (n = 44 studies), lack of local support for the law (n = 31), lack of enforcement (n = 30) and laws that were considered erroneous or unnecessary by stakeholders (whether the laws were in technical error or not) (n = 19). The type of complaints varied within each of these categories. For example, problems with implementation varied between the complexity of bureaucratic procedures surrounding controlled shooting (e.g., Weladji and Tchamba, 2003), difficulty in obtaining compensation payments under programs, or payments that did not equate to the losses sustained (e.g., Dondina et al. 2015; Harihar et al. 2014; Heikkinen et al. 2011; Maikhuri et al. 2001). Implementation issues also arose where collaboration with local stakeholders in the implementation of laws was lacking (e.g., MacKenzie et al. 2017) or devolution of power to a regional or local level was complicated (e.g., McBeath 2004; Risvoll et al. 2016).

Complaints about lack of enforcement were largely concerned with the illegal killing of wildlife (e.g. Kaltenborn et al. 2005; Gandiwa 2011; Espinosa and Jacobson 2012). For example, lack of enforcement against illegal wolf killing in Italy (reflected by a non-existent history of prosecutions) was seen as evidence of an informal policy approach of neglect towards the practice (Vitali 2014). Meanwhile, many studies questioned the lack of legal lethal control by governing bodies (Vitali 2014). Lack of enforcement was also an issue for encroachment into protected areas (Harihar et al. 2015; Fentaw and Duba 2017).

Many laws lacked support because of a lack of transparency (e.g., Espinosa and Jacobson 2012). Associated with this were complaints about lack of consultation and the presence of top-down legal and management approaches (e.g., Maikhuri et al. 2000; Pohja-Mykrä and Kurki 2014; Eriksson et al. 2016). Also, a general lack of trust in the management authority and

Table 1a
Geographic distribution of human-wildlife studies affected by laws

Law had negative effect		Law had positive effect		Law had positive and negative effect	
Country	Number of studies	Country	Number of studies	Country	Number of studies
USA	8 (53.3%)	Norway	2 (14.3%)	Australia	2 (40%)
India	7 (43.8%)	Canada	1 (25%)	Canada	2 (50%)
Finland	4 (80%)	China	1 (50%)	Ethiopia	2 (28.6%)
Sweden	4 (40%)	Scotland	1 (50%)	Portugal	2 (50%)
Botswana	3 (60%)	USA	1 (6.6%)	Uganda	2 (66%)
Australia	2 (40%)			USA	2 (12.2%)
Cameroon	2 (50%)			Botswana	1 (16.7%)
Canada	2 (50%)			Germany	1 (100%)
Ethiopia	2 (28.6%)			Ghana	1 (50%)
Italy	1 (25%)			Indonesia	1 (25%)
Mauritius	1 (100%)			Kenya	1 (25%)
Rwanda	1 (100%)			Mexico	1 (100%)
Scotland	1 (50%)			Nepal	1 (25%)
Spain	1 (100%)			Norway	1 (14.3%)
				Romania	1 (100%)
				Zimbabwe	1 (100%)

Table 1b
Taxonomic distribution of human-wildlife studies affected by laws

Law had negative effect		Law had positive effect		Law had positive and negative effect	
Taxonomic group	Number of studies	Taxonomic group	Number of studies	Taxonomic group	Number of studies
Canines	24 (51%)	Cats	2 (3.6%)	Cats	6 (10.9%)
Cats	12 (21.8%)	Bears	1 (3.4%)	Bears	4 (13.8%)
Bears	11 (38%)	Canines	1 (2.1%)	Deer	4 (21%)
Primates	8 (22.9%)	Deer	1 (5.3%)	Elephant	3 (18.8%)
Elephant	7 (43.8%)			Primates	3 (8.6%)
Pigs/hogs	7 (50%)			Canines	2 (4.2%)
Birds	5 (26.3%)			Pigs/hogs	2 (14.3%)
Deer	5 (26.3%)			Birds	1 (5.3%)
				Reptiles	1 (33%)

Note: Numbers in parentheses represent the proportion of studies for each country or taxon. Percentages for each country/taxon across the three categories do not always sum to 100% as not all studies demonstrated an effect of law on the HWC reported

law-makers led to lack of support for the end result, regardless of whether the laws would have been acceptable (e.g. O'Rourke 2014; Young et al. 2015; Dorresteijn et al. 2016).

Common complaints within the category of erroneous laws included inappropriate banning of hunting (e.g., Dixon et al. 2009; Von Essen and Allen 2017), affecting locals' livelihoods (e.g., Maikhuri et al. 2000; Wiafe 2016), and increased numbers of "pest" animals (e.g., Dickman et al. 2014). Similarly, laws that banned herding in protected areas were considered erroneous for various reasons, for example, Hazzah et al. (2013) suggested the erroneous law had a negative effect on attitudes towards lions. Other reasons for laws having a negative impact included lack of monitoring (n = 14), plurality or conflict of laws (n = 9), lack of local knowledge of law (n = 10), and the law being unclear or vague (n = 8).

The law was thought to have a positive impact on human-wildlife conflict for five primary reasons. The most common reason included the participation/involvement of all stakeholders in the management of the issue (n = 10). For example, one successful policy was:

"governed from the bottom-up; the governance procedures used are developed regionally, in collaboration with the Farmers' Union and local municipalities. Farmers were actively involved in the initiation of the scheme and have had an opportunity to communicate their concerns about the scheme"
(Eythórsson et al. 2017, S238).

Co-management of buffer zones and protected areas also resulted in more positive attitudes and local development (e.g., Gurung et al. 2009).

Flexibility in management via adaptive practices was the second most common reason that law had a positive impact on HWC (n = 7), with various studies combining the effects of adaptive co-management. For example, Tuvendal et al. (2015, 15948), analysed the community-based Goose Management Group (GMG) and found that:

"it is not the ability of the group to be adaptive that is the defining characteristic of the GMG. Above all, its success lies in establishing a collaborative arena for sharing experiences and addressing problems, justifying that the GMG is better described as an example of adaptive co-management".

Other reasons included appropriate levels of enforcement and punishment (n = 5), adequate compensation (n = 5), and the creation of wildlife viewing opportunities (n = 2).

The reasons reported for the law not working, when compared with the various mitigation techniques used (Figure 1), revealed that compensation failed and illegal killing was deemed necessary due to implementation problems relating to the law. Illegal killing was also deemed necessary by stakeholders to mitigate conflict due to a lack of support for the current law (n = 13). Legal killing of animals failed at a social level due to lack of support for the law (n = 11). Fencing as a mitigation strategy most often failed due to problems with implementation (n = 12) and enforcement of laws (n = 7).

Laws with a negative effect on conflict were most commonly national laws (n = 17 studies), followed by a combination of national and international laws (n = 8). Laws that had a mixed effect (i.e., both positive and negative effects) were most commonly local laws (n = 8). Laws that had a positive effect were spread equally between national, local, and international law (n = 1 each).

Compensation was less prevalent in North America (n = 2), South America, and Oceania (both n = 0) compared to Africa (n = 9), Europe (n = 14), and Asia (n = 17). Illegal killing as a mitigation strategy also followed this pattern. Legal killing was predominantly found in Europe (n = 11) and North America (n = 7). Fencing and guarding were predominantly used in Asia (n = 8 and n = 7, respectively) and Africa (n = 5 and n = 6, respectively). However, when comparing the reasons reported for the law to work using the various mitigation techniques mentioned, we found that compensation largely

succeeded due to adequate levels of reimbursement (n = 5) and co-management (n = 4). Scaring animals away from resources (e.g., crops and/or livestock) was successful due to participation by local communities (n = 3) and inclusion of adaptive management practices (n = 3). Community participation (n = 3) and enforcement of laws (n = 2) regarding punishment for illegal killings also somewhat succeeded as a mitigation technique.

DISCUSSION

The results indicate two primary issues that require further exploration: 1. Law and policy are not widely discussed in human dimensions of HWC literature, and 2. Where they are discussed, they are mostly negatively associated with values and attitudes surrounding HWC. This has profound implications for conservation, as law and governance instruments have been shown to influence the way that people interact with and think about wildlife. Without adequate consideration of these links, conservation attempts via law and/or policy may not be publicly accepted, risking positive conservation outcomes.

Law and policy as the missing link in HWC studies

The association of law with human-wildlife conflict appears underestimated and under-evaluated in the human dimensions of HWC literature. Although the 133 studies are generally diverse in geographical and taxonomic focus, and most superficially mention law in some form, many failed to assess
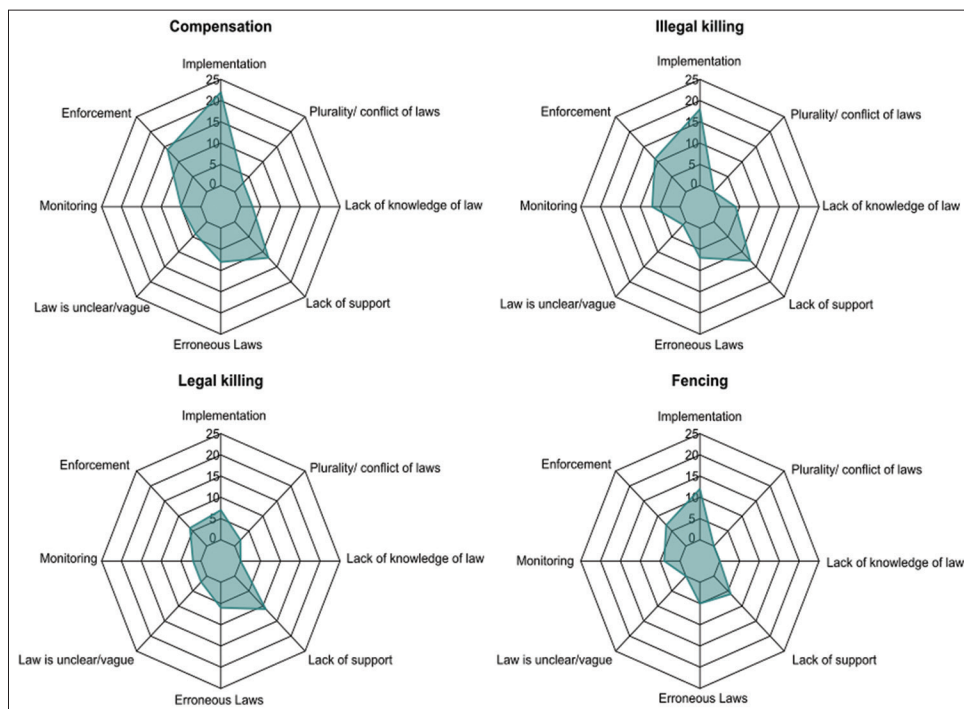

Figure 1
Radar charts of the four most commonly studied human-wildlife conflict mitigation techniques, indicating the frequency for each reason the law was reported to not work. The outer circle represents a count of 25 instances (studies)

what role law may have in mitigating or exacerbating HWC. It is also worth noting that the 133 selected articles which mention law in some way represent a small proportion of the overall literature relating to HWC (e.g., Ravenelle and Nyhus (2017) found 288 articles relating to HWC compensation alone), which emphasises how little consideration law is given in this field.

Due to our keyword search, most studies mentioned law directly (90%) and therefore the inference may be made that the connection between the human dimensions research and the law is a prevalent topic. This would not be surprising, given that the nature of the conflict itself demands a legal and/or policy response. However, further analysis of how law and/or policy is discussed in these studies shows only superficial recognition of the depth of the connection, such that the number of papers that directly discuss law and/or policy and its connection to attitudes and values towards wildlife is significantly less. Only 52% of papers mentioned a specific law or policy and, in many of those instances, the connection between HWC and the law or policy was not stated or was tenuous. For example, the law was discussed where the wildlife concerned was threatened or protected, even when that status had little bearing on the research conducted or the conflict itself (e.g. Randriamamonjy et al. 2015), or to provide contextual relevance to the conflict or study (e.g. Silva-Andrade et al. 2016).

These results could imply that researchers within the human dimensions of HWC do not view law and policy as factors influencing values and attitudes surrounding the conflict, but instead view law and policy as an outcome. This is problematic for conservation outcomes because law may alter values and attitudes towards conservation of problem species (as discussed below). Therefore, there should be greater attempts to include law when considering social science with the conservation field, and not as a final outcome of other related studies. Another potential reason for the lack of discussion of law and policy is that researchers in this space may not be trained in law and policy analysis and therefore, do not view law as a social science issue that requires assessment. This requires further education and broader collaboration on the part of conservation social scientists.

Law and policy as a negative factor

It is clear from our review that law and policy can be a key factor in shaping attitudes around HWC. For example, Rohini et al. (2017) found the implementation of stringent wildlife laws created fear. Treves et al. (2013) found that laws around public hunting and lethal control of wolves were associated with diminished individual tolerance for wolves. Mouro and Castro (2017) demonstrate that a discrepancy between what the law prescribes and what the community approves of can make a person act against the law or delay action in compliance with the law. The regulatory context in which HWC is situated is complex. The 'law' is sometimes expressive (reflecting and institutionalising shared social values), and sometimes facilitative (defining the boundaries

within which those values might be deliberated upon) (Morgan and Yeung 2007). As our review shows, the law also traverses local, national, and international legal instruments, each of which may be more or less legitimate in the eyes of a regulated community, and can be regressive if it conflicts with shared social values and encourages or perpetuates conflict.

The emphasis on the negative interaction between law and HWC in some of the studies may indicate that the substance of the law – the values which it institutionalises – genuinely can have, and overwhelmingly have had, a negative effect on the resolution of HWC. This is different from the procedural aspects of law, such as the way that compensation schemes operate, which also appear to have negative consequences for human-wildlife conflict but are more readily addressed. However, an alternative explanation could be that this type of research is overwhelmingly focused on the negative impacts, while positive representations of the law and positive conflict outcomes are not highlighted. For example, the majority of HWC articles identified in a review by Bhatia et al. (2020) focussed on negative conflict interactions, while just 8% focussed on neutral interactions and 2% on coexistence. The reason for this emphasis may stem from the main goal of much HWC work, which has historically been to protect threatened wildlife from anthropogenic threats (Pooley et al. 2017). This framing limits opportunities and biases understanding of the relationship between people and nature (Bhatia et al. 2020, Pooley et al. 2020). Further, researcher expertise may lie elsewhere and they may lack the experience to grapple with the complexities of the local law and policy. The result is that the actual impact of law and policy is not considered during data collection and interpretation of the results.

Where the connection between law, policy, and conflict was clearer, law and/or policy overwhelmingly had a negative effect on situations of HWC, such that it caused, prolonged, or exacerbated the conflict. There appears to be several key reasons why this is the case. First, implementing laws and policies around human-wildlife conflict was rarely viewed as an easy or efficient process. This was particularly so with policies around compensation, where bureaucratic processes, minimal payments, and difficulty in obtaining payments were noted. This is consistent with previous research outlining the effectiveness of compensation schemes in instances of conflict (e.g. Ravenelle and Nyhus, 2017).

Second, laws and policies struggle to adapt to differing values and attitudes held in different types of conflicts. For example, lack of enforcement of laws was an issue because laws prohibiting unauthorised killing were not enforced, whilst conversely, illegal killing was considered necessary in other conflicts because other laws to prevent conflict were inappropriately implemented. The negative associations are very diverse and one negative impact in a particular conflict may be seen as a positive in another. This is supportive of the literature that emphasises the unique nature of each conflict (e.g. Goodale et al. 2015), and IPBES' finding that local conceptualisation of conservation may differ from external paradigms (IPBES 2019). This lack of adaptability, and the

need for it, was also demonstrated by the papers that indicated a positive association between law and HWC, particularly those that lauded flexibility in management via adaptive practices. For example, in Norway, goose-farmer conflict was successfully managed via policy that offered stakeholders ongoing dialogue with managers, with the result that practices were moderated and adapted to local conditions (Eythórsson 2017; Tuvendal et al. 2015). Adaptive co-management also led to successful outcomes in seal-fisheries conflict in Scotland (Butler 2015).

One possible explanation for the association between law and negative outcomes is that law and policymakers are not considering human dimensions research, and attitudes and values of stakeholders, in their decision-making and legal drafting, or are not utilising the human dimensions research effectively. This is evident from two of the primary 'complaints'; lack of support for the law and general opinions that the law was erroneous or not fitted to the unique circumstances of the conflict. This has two consequences. First, in terms of substance, it means the normative content of law and policy may not reflect the perspectives and insights of those most directly affected by them. Second, in terms of procedure, implementation of law and policy may be compromised by a lack of 'buy-in' from relevant stakeholders or bylaws and policies which are poorly designed and so doomed to be ineffective. While these issues are not new and are often discussed by environmental lawyers and conservationists alike (e.g. Nagle 2009; Martin and Kennedy 2015), the way that law and policymakers utilise human dimensions research requires further exploration and empirical study.

Finally, an understanding of the law relevant to HWC in any community can only provide a partial understanding of lived experience. A classical understanding of the "law as command" risks overstating the pervasiveness of legal rules and oversimplifying the broader regulatory context within which HWC is addressed. For example, a range of regulatory actors and motivations may undermine the straightforward application of the law. Application of legal rules often involves the use of discretion by a decision-maker (e.g. a decision on whether to warn or to prosecute) and a range of non-legal factors will influence this decision. Compliance monitoring and investigation may be under-resourced, with a lack of enforcement officials and appropriate training. Transparency around enforcement action, with no explanation of why action was or was not taken, may also be lacking. While suggestive of further areas for research, these matters form a substantial body of scholarship that crosses a range of legal and policy sub-disciplines and go beyond the scope of this review (see for example M'Gonigle 2013; Colvin 2016; Kotchen 2020). However, the lack of significant empirical research in law journals, with the majority in conservation biology and environmental science, such as *Oryx*, *Plos One* and *Human Dimensions of Wildlife*, is notable. This focus in the sciences and environmental social sciences is indicative of those discipline's concerns with the application of the laws, rather than the substance of the laws themselves, and is

broadly consistent with a focus on the procedural dimensions of the law rather than their substantive or normative content. It is possible that law was too narrowly understood, both by participants in the studies and the researchers.

Broader HWC research trends

The sources of law discussed in the studies is decidedly Western. For example, only 15 studies referred to customary law, with greater emphasis placed on national and international laws and policies (the latter likely influenced by the number of international laws and policies in the EU concerning wildlife). As a result, the effect that traditional customary and tribal law may have on conflict remains comparatively untested, although research suggests a greater link between those types of law and positive conflict outcomes (e.g. Ango et al. 2017). Further, a link between colonial laws and the removal of collaborative customary laws and exacerbations of conflict is likely (Goldstein 2005), while IPBES suggests that changes in conservation values include the abandonment and erosion of indigenous local knowledge and traditions (IPBES 2019). While beyond the scope of this article, these factors are an important area for future research. The comparative lack of engagement with customary law (although we note that this may be because it is not recognised as 'law' and may not be discussed using legal terms); emphasis on science over societal considerations (such as values and the role of institutions); and complaints about the effectiveness of law/policy collectively suggest broader governance failures.

CONCLUSION

The implications of our review suggest that law and policy and HWC research operate as separate spheres, with only peripheral consideration of the other. The task of understanding the 'human side' of conflict is predominately undertaken by the environmental and biological sciences, and consideration of the effect of law as an institution is minimal. Although the human dimensions research is intended to shape management policies, it is not translating to the legal literature. While the precise reason for this gap is a question for future research, the gap itself has potentially serious implications for wildlife conservation. This is because the institutional influence of law and policy can shift local practice and willingness to act with a conservation ethic in situations of conflict, potentially resulting in higher biodiversity losses.

SUPPORTING INFORMATION

The PRISMA reporting diagram (Figure S1), the map of the geographic distribution of study locations (Figure S2), the summary figure of the main HWC types (Figure S3), the list of 133 reviewed articles (List S1), the details of the geographic and thematic trends analysed (Table S1) and the specific laws mentioned in the review articles (Table S2) are available online. The authors are solely responsible for the content and

functionality of these materials. Queries should be directed to the corresponding author.

AUTHOR CONTRIBUTION STATEMENT

All authors contributed equally to the concept, methodology, data analysis, and final manuscript.

CONFLICT OF INTEREST DECLARATION

None of the authors have any affiliation with, or financial interest in, the subject of this paper.

RESEARCH ETHICS AND DATA

Ethics approval was not required for this paper. The raw data are available by request from the corresponding author.

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