

UNDERSTANDING COEXISTENCE WITH WILDLIFE

EDITED BY: Simon Pooley, John D. C. Linnell, Ursula Münster,
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UNDERSTANDING COEXISTENCE WITH WILDLIFE

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Editorial: Understanding Coexistence With Wildlife

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Understanding Coexistence With Wildlife

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INTRODUCTION

As humans and wildlife come into increasing contact under the pressures of climate change, human development, successful conservation and wildlife recovery, and zoonoses, it is urgent that we learn to facilitate coexistence with wildlife in shared multi-use landscapes, for the wellbeing of both wildlife and people. The terms “human-wildlife conflict” and “human-wildlife coexistence” are both used in work aiming to achieve this, but in both cases a variety of definitions exist. While the term “coexistence” is being increasingly mentioned, possibly linked to a preference for a positive framing of human-wildlife interactions in particular, it is not often defined (see however Pooley in this special issue), and remains understudied. This is partly because conservation scientists are less familiar and less comfortable with the kinds of questions and methodologies required to study human-wildlife coexistence. It is also easier to study things you can count (impacts, e.g., attacks, extent of damage or frequency of interactions) than coexistence, which often involves not doing things (e.g., refraining from retaliation or protesting). This collection of papers offers the most comprehensive and cross disciplinary examination of human-wildlife coexistence published so far.

Human-wildlife conflict research increasingly draws on approaches from a diversity of social science and humanities disciplines in order to better understand human-human conflicts over interactions with wildlife. The emphasis in human-wildlife conflict is on understanding and addressing conflicts between different groups of people over wildlife, and reducing negative impacts of wildlife on humans and vice versa. Here, research often focuses on risks and benefits of sharing a landscape with wild animals of conservation concern, and attempts to analyse and influence decision-making over how to do so. Solutions often proposed include separating humans and wildlife, or providing material benefits and compensations to those sharing landscapes with wildlife. This is vital work of direct relevance to policymakers and managers. Some additional dimensions that human-wildlife coexistence studies add to this research focus include a direct interest in positive human-wildlife interactions, and in this context, broader consideration of different ways of valuing and interacting with wildlife and the natural world.

In our call for papers for this special issue, we asked contributors to think about what the scope of human-wildlife coexistence should encompass, and how to study it. We wanted to learn more about coexistence from those places where it is being actively cultivated and researched. The focus of this special issue is on reasons for—and approaches to—coexistence which are not directly related to the material costs or benefits of living with particular species of wild animals. We were particularly interested in human-wildlife interactions in “everyday” shared/mixed-use landscapes, rather than only iconic conservation landscapes.

We did not offer contributors any definition of coexistence; rather, we suggested that authors should think through their own conceptions of coexistence. We suggest that conservationists should take care when generalizing such conceptions when attempting to facilitate coexistence in particular scenarios of human-wildlife interaction. We agree with contributors Glikman et al. when they advocate for working with those with relevant interests to define coexistence for particular scenarios. As noted by Pooley in his perspective piece, this requires self-reflexivity and recognition of difference.

DIversity in HUMAN-WILDLIFE COEXISTENCE

This special issue offers a rich diversity of perspectives on, and approaches to, human-wildlife coexistence—without claiming to represent that diversity comprehensively. We were delighted to receive submissions from authors with backgrounds from both the Global North and South. Contributors come from a diversity of academic and sectoral backgrounds, with training variously in applied sciences, natural and social sciences, including anthropology, biology, conservation science, critical social science, environmental science, forestry, geography and zoology. Several papers are interdisciplinary efforts. The geographic range of the studies is also reasonably wide, spanning North America, Europe, and South Asia.

Although we collectively selected those abstracts that fitted our aims for the special issue, and checked first submissions to confirm their fit, we did not edit every paper (not appropriate for any we authored or co-authored, for instance). We are pleased with the stimulating diversity of approaches and proposals included, but equally these do not necessarily represent our own views or approaches.

ORGANIZATION OF THE MATERIALS

We have presented the shorter opinion and perspective pieces first (Part 1), followed by the longer research papers (Part 2). The former raise key conceptual matters influencing how we think about human-wildlife coexistence. These include reflections on whether and how to define human-wildlife coexistence and some of the key ethical implications of trying to facilitate coexistence (Pooley), negative and positive dimensions of coexistence and how to encourage the latter (Bhatia), the importance of not excluding conflict from conceptions

of coexistence (Hill), and the usefulness of relational rather than dualistic frameworks for thinking about human-wildlife interactions (Schroer). Glikman et al.’s surveys reveal the diversity of perspectives among conservationists on concepts of coexistence, tolerance and acceptance. Kaltenborn and Linnell explore how coexistence ideas fit with the many different conservation subdisciplines, strategies and paradigms currently competing for primacy.

The richness of the discussions and investigations in the full-length research papers (Part 2) are too diverse to summarize here, so a few general points must suffice. Notably, the selected papers encompass studies of a wide range of those with important interests in human-wildlife coexistence scenarios, including: conservation managers (Vance Martin et al.), ranchers (Bogezi et al.), farmers (Thinley et al.), and locals including villagers sharing landscapes with wildlife (Toncheva and Fletcher; Thekaekara et al.). This demonstrates the need to consider a wide range of interests—not forgetting those of wild animals—when attempting to understand and foster coexistence.

The historical and cultural dimensions required to make sense of the dynamic nature of human-wildlife relations over time are the focus of papers by Broz et al., Oommen, and Thekaekara et al. Papers by Oommen, Nair et al., and Thekaekara et al. emphasize what we can learn from indigenous approaches to coexisting with wild animals that can have negative impacts on humans, their crops or livestock. Broz et al. provide insights into the emerging discourse of veterinization associated with zoonoses and wildlife disease management.

Finally, while we do not advocate for any one approach to fostering human-wildlife coexistence, several papers in this special issue offer fascinating recommendations for doing so, including conceptual frameworks suggested by Pettersson et al., and Toncheva and Fletcher.

CONCLUSION

Thinking about human-wildlife coexistence requires us to widen the aperture on what we consider important in the study of human-wildlife interactions, and therefore on how to study them. This special issue will introduce readers to ideas and approaches and readings not often encountered in mainstream conservation science contexts, and hopefully will stimulate further interdisciplinary thinking and studies in this exciting and growing area.

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More Than Just No Conflict: Examining the Two Sides of the Coexistence Coin

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Keywords: peace, violence, human-wildlife conflict, human-wildlife interactions, tolerance

INTRODUCTION

Human-wildlife coexistence is an understudied field within the Human Dimensions literature. Primarily due to the difficulty in defining, studying and implementing its various facets, researchers and practitioners often end up defining it by what it is not – for example, the absence of violence or retaliation (Nyhus, 2016). Based on Carter and Linnell's 2016 definition, (Pooley et al., 2020, p. 2) described coexistence as “a sustainable though dynamic state, where humans and wildlife coadapt to sharing landscapes and human interactions with wildlife are effectively governed to ensure wildlife populations persist in socially legitimate ways that ensure tolerable risk levels.”

I would like to further complement the idea of coexistence as a dynamic, co-adaptive state by proposing that it can comprise at least two dimensions – negative and positive. To explore this concept, I draw upon Galtung's 1964 definition of negative and positive peace.

Considered by many as the Father of Peace Studies, Galtung offered an alternative theory of peace at a time when the dominant definition of peace was circumscribed to the absence of war or assault (Chambers, 2004; Gleditsch et al., 2014). He suggested that violence often took place in an environment where basic human needs had not been met. These included “most basic needs” such as life and survival, to “basic needs” such as food, health, and education, to “near-basic needs” such as freedom, career, and political participation, to “people's relation to nature” (Al-Abedine, 2017, p. 85).

The unfulfillment of human needs, according to him, led to “freezing” (e.g., apathy, withdrawal) or “boiling” (e.g., revolt, mutiny) (Rubenstein, 1990). Instability in political or domestic settings resulted in direct violence (e.g., wars, assault, terrorism), which was often a symptom of deep-seated structural and/or cultural inequities (Galtung, 2000). He thus considered violence as a triangle with direct, cultural and structural dimensions as its three sides. These ideas were crucial in advancing the definition of peace.

According to Forcey (1989), peace does not imply the absence of conflicts but instead, the absence of violence. Galtung defines peace as the progression toward mutually accepted social goals, which may be complex and difficult, but not impossible to attain (Galtung, 1969). By extension, negative peace can be understood as the absence of direct or visible violence. It is the cessation of undesirable oppression or retaliation. Positive peace, on the other hand, refers to the integration of human society (Galtung, 1964, p. 2). He later defined positive peace as the absence of structural and cultural forms of violence, which are often invisible (Galtung and Fischer, 2013). Positive peace thus relies on the creation of structures, institutions and attitudes that facilitate social justice, well-being, and harmony for all. Negative and positive peace may be separate dimensions but cannot exist without each other.

Since the goal of peace theory is to understand and further coexistence between individuals and groups, I argue that Galtung's ideas can also be applied to better understand human-wildlife coexistence.

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DECONSTRUCTING COEXISTENCE

My central argument is that coexistence between people and wildlife can have “negative” and “positive” dimensions. To illustrate this, I refer to Bhatia et al.’s 2019 argument that tolerance – an essential component of coexistence – is a spectrum going from manifested intolerance (negative attitudes and behaviors toward wildlife) to stewardship (positive attitudes and behaviors toward wildlife) (Figure 1). Manifested intolerance comprises incidents that result in violence toward wildlife – a straightforward example of conservation conflict. Latent intolerance on the other hand, refers to the negative attitudes that do not result in violence toward wildlife which, along with neutral responses (ambivalent attitudes and behaviors), can be termed negative coexistence.

Negative coexistence can thus be defined as a state in which people do not engage in any form of retaliatory killing or harm to wildlife though their attitudes may not necessarily be pro-conservation/pro-wildlife. To clarify, wild animals are often killed for subsistence or sport in many parts of the world. However, this definition refers to contextual killing, that is, killing in response to wildlife-caused damage (to people and/or property). While several factors affect an individual’s decision to kill or harm wildlife, violence toward wildlife can be a result of deeply ingrained cultural biases, negative stereotyping, and/or structural or economic inequities (Chavez et al., 2005; Lucas, 2016).

Positive coexistence focuses on the cultural and structural dimensions. It needs an environment in which people feel emotionally and socially supported, and thus consider supporting wildlife conservation despite the costs. According to Bhatia et al.’s 2019 typology, positive coexistence would include aspects like appreciation (positive attitudes) and stewardship (positive attitudes and behaviors) (Figure 1).

The idea behind proposing this theoretical dichotomy is to illustrate that coexistence does not simply imply the absence of intolerance but can be a state of positive associations with and actions for wildlife. Often, the aim of conservation is to reduce behavioral intolerance which can be achieved through legal or moral means. It may be effective in reducing the anthropogenic impact on wildlife which, in Galtung’s vocabulary, refers to a reduction in direct violence. However, it may not always translate to positive attitudes or behaviors – a goal that many conservationists (would like to) strive for. Positive coexistence can truly blossom in an environment that harbors socio-cultural, financial and emotional support systems that help people cope with losses and enable them to protect wildlife despite the odds. In short, it calls for a structural and cultural paradigm shift in which impacts are mitigated, and affected stakeholders feel connected to wildlife at the same time.

IDEOLOGICAL COMPLEXITIES

A pertinent question to ask here is “coexistence for whom?” Like peace, coexistence is contextual and has multiple interpretations. For example, Galtung (1981) pointed out that peace theory tends to be skewed in favor of the powerful and is used to

maintain *status-quo* in society. Schmid (1968) similarly criticized peace research by pointing out that facilitating negative peace, that is prohibiting violence, often means giving more power to the powerful while ignoring the needs and motivations of disenfranchised individuals or groups. Galtung’s work has been criticized for not offering any criteria to assess and facilitate equity, and for using the terms like “equality” and “justice” interchangeably (Al-Abedine, 2017). These are valid criticisms of his ideas and are relevant for coexistence research too.

In the field of biodiversity conservation, for example, one tries to balance the needs of various human and non-human stakeholders some of whom may have diametrically opposite interests. How, then, can we come up with a unified idea of coexistence that is mutually acceptable to most, if not all groups? Moreover, is it even possible to transition to positive coexistence which, like Galtung’s ideas, sounds all too utopian and nearly impossible to achieve (Bönisch, 1981; Gur-Ze-ev, 2001)? To add to it, we are not always well-versed with the nuances or standard/appropriate definitions of the various terminologies that we employ, and sometimes use them indiscriminately (e.g., human-wildlife conflict, tolerance, local communities, to name a few).

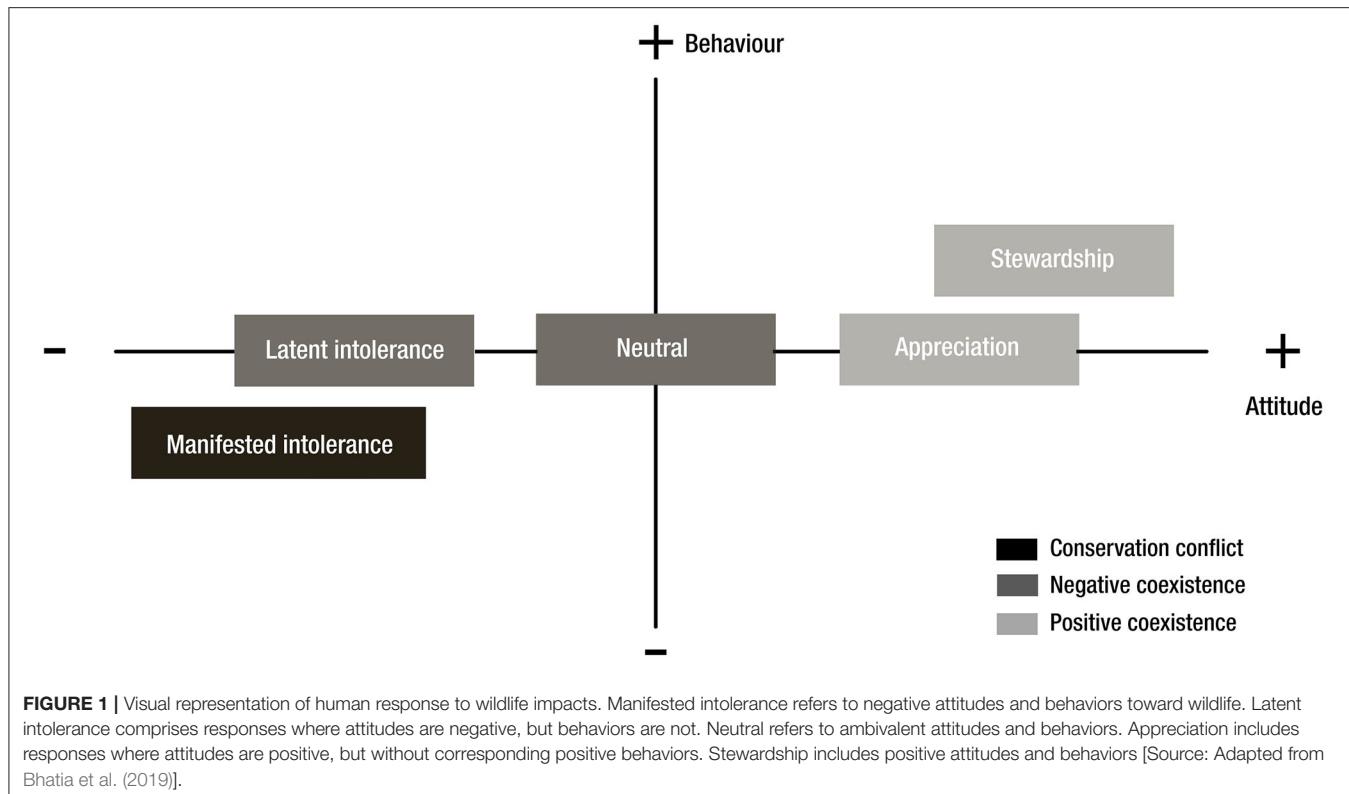
How does one navigate these challenges and complexities all the while attempting to facilitate and/or maintain coexistence? The theoretical, ideological, and practical challenges of applying the principles of peace research to our context can understandably be overwhelming. However, I would argue that this marriage can help reduce our efforts at reinventing the wheel (indeed, peace, conflict, coexistence is not unique to biodiversity conservation). Conservation practice requires us to think more carefully about how we engage with the problem and the efficacy of the various tools that we employ to deal with them.

Speaking of tools, Galtung defines peace using a mathematical formula [Peace = (Equity × Empathy)/(Trauma × Conflict)], which may seem strange at first. However, the formula can help us consolidate the learnings. According to the formula, mutual and equal benefit, and empathy for another’s pain can enhance positive peace, whereas reconciling trauma and minimizing violence can enhance negative peace. To negotiate an acceptable version of peace, Galtung proposes a three-step approach which can help understand the origin of destructive behaviors and result in strategies to rectify them (Galtung, 2011).

FROM IDEOLOGY TO PRACTICE

The first stage is mapping where an external/disinterested negotiator *individually* speaks to each stakeholder (group or representative) and maps out the contours of the problem from their perspective. At this stage, they could enquire about the fears, hopes and aspirations of the stakeholder vis-à-vis the issue. Empathetic, compassionate and open communication can enable the group/representative to confide in the negotiator (Galtung, 2004). This stage involves determining what the goal of each stakeholder looks like.

The next stage is to legitimize the goal with the help of the law, human rights perspective and generally accepted ethics and social



norms. For example, is the goal legal – does it involve actions that are legally prohibited? What are the human costs of pursuing the goal? What are the costs to wildlife and domestic animals in our case? These discussions can enable the negotiator to understand what is at stake and if there is wiggle-room.

The third and final stage is referred to as bridging where the negotiator assesses the compatibilities and incompatibilities between the goals of the different stakeholders. Through sustained dialogue and cooperation, they endeavor to find a middle ground that may be mutually acceptable.

Indeed, all of this is easier in theory than in practice. Further, as Pooley et al. (2020) pointed out, coexistence is a dynamic state implying that the same stakeholder group may feel differently toward wildlife in different situations/contexts. Additionally, the agency of the animals is completely missing from the discussion. The closest alternative to the voice of wild animals is the voice of conservationists who consider themselves capable of interpreting the needs of wildlife and wild places (Redpath et al., 2015). Similarly, local communities who tend livestock consider themselves legitimate representatives of their animals. Galtung's approach, some may argue, is more suited to human communities in conflict. However, numerous studies now suggest that human-wildlife conflict is essentially the conflict between the goals and aspirations of various human groups (Redpath et al., 2015, Peterson et al., 2010).

In recent times, toolkits like IUCN's CEPA and Snow Leopard Trust's PARTNERS Principles (Hesselink et al., 2007; Mishra, 2016) have provided practitioners with the skills to engage

with communities. Such conservation toolkits combined with learnings from an allied field can enhance our efforts in the right direction. To me, the special feature of Galtung's three-step approach is the presence of an external negotiator. While this may be a luxury in a field that is fraught with funding issues and socio-political complexities, it is important to note that conservationists trying to find a middle ground to resolve wildlife-related conflicts may only be serving their own interests and agendas. Such impressions can put stakeholders on the defense, especially if the discussions assume a coercive tone, not to mention that these discussions usually reflect vast power asymmetries.

The negotiator, however, could be someone that most parties respect and hold in high regard – a person without vested interest. For example, it could be someone with experience in engaging with communities and wildlife management. The proposed solution(s), as Galtung insists, must strive to be constructive, concrete and creative, whilst being mindful that coexistence is a fragile and dynamic state that requires constant work. The three steps can enable us to better understand conflicts, validate different perspectives and design solutions that minimize or resolve friction. The aim is to move from negative coexistence to a positive one, which the three-step approach can facilitate. At the very least, we could try to intersperse the two depending on the context. In theory, positive coexistence is likely to last longer and may be more resilient because it calls for a structural shift that focuses on managing negative wildlife impacts, and enabling positive associations between people and wildlife.

There have been various theories of peace propagated by different schools of thought (see Kant, 1795; Kelman, 1993; Okoth, 2008). A full review is beyond the scope of this paper. Galtung's theories, however, have withstood the test of time and are based on a deep understanding of the situation on-ground (Lawler, 1989; Cravo, 2017).

The proposal presented here is an effort to learn from a field faced with similar challenges. The most significant one being the challenge of reconciling the needs of various stakeholders as well as arriving at a shared vision of the landscape, its people and the environment. The solutions that are devised within a particular socio-economic and cultural setup, however, may not generalizable though they may have common elements. It is thus important to be mindful that conservation challenges (especially

conflict mitigation) are, in a sense, unique and require innovative approaches to ensure the well-being of all parties, humans and animals alike.

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Coexisting With Different Human-Wildlife Coexistence Perspectives

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Over the last decade, there has been a remarkable increase in scientific literature addressing human–wildlife interactions (HWI) and associated concepts, such as coexistence, tolerance, and acceptance. Despite increased attention, these terms are rarely defined or consistently applied across publications. Indeed, the meaning of these concepts, especially coexistence, is frequently assumed and left for the reader to interpret, making it hard to compare studies, test metrics, and build upon previous HWI research. To work toward a better understanding of these terms, we conducted two World Café sessions at international conferences in Namibia, Africa and Ontario, Canada. Here, we present the array of perspectives revealed in the workshops and build upon these results to describe the meaning of coexistence as currently applied by conservation scientists and practitioners. Although we focus on coexistence, it is imperative to understand the term in relation to tolerance and acceptance, as in many cases these latter terms are used to express, measure, or define coexistence. Drawing on these findings, we discuss whether a common definition of these terms is possible and how the conservation field might move toward clarifying and operationalizing the concept of human-wildlife coexistence.

Keywords: human-wildlife acceptance, human-wildlife conflict, human-wildlife interactions, human-wildlife tolerance, World Café, conservation lexicon

INTRODUCTION

Research on human-wildlife interactions has evolved from a focus on conflict to the inclusion of coexistence, acceptance, and tolerance (Woodroffe et al., 2005; Frank, 2016; Pooley et al., 2017, 2020; Frank et al., 2019). While various definitions and metrics of human-wildlife conflict have been proposed, tested, and applied over the last decade (Redpath et al., 2015; IUCN, 2020; Treves and Santiago-Ávila, 2020), the term coexistence is still defined and applied inconsistently throughout the relevant literature (Carter and Linnell, 2016; Chapron and López-Bao, 2016; Morehouse and Boyce, 2017). For example, Frank (2016) defines coexistence as a balance or a negotiated

compromise between humans and wildlife on how to exist together; Chapron and López-Bao (2016) use an ecological community perspective where coexistence happens when species have different ecological niches and moderately compete for resources. The latter definition sees humans as *super predators* and questions whether humans can become less competitive and differentiate their niche to avoid conflict with species with overlapping needs. Further, recent scientific literature reviews show that focusing on the term coexistence alone is likely insufficient (e.g., Brenner and Metcalf, 2020; Knox et al., 2021). Thus, researchers may ascribe different meanings to coexistence, tolerance, and acceptance based on their worldviews and socio-cultural, political, and economic contexts. It is imperative to understand the relationship between coexistence, tolerance, and acceptance as they are often used interchangeably, without clear definition, or to define one another (Bruskotter and Wilson, 2014; Kansky et al., 2016). This lack of shared understanding makes it difficult to compare case studies, test metrics, and build on previous research to create innovative and equitable solutions that enable humans and wildlife to share the same landscape.

To work toward a better understanding of what coexistence means, and its relationship with tolerance and acceptance, we ran two World Café sessions at international conferences; one in Namibia, Africa, at the “Pathways: Human Dimensions of Wildlife (Pathways)” conference in January 2018, and another in Ontario, Canada, at the “North American Congress for Conservation Biology (NACCB)” in July 2018. The World Café method is an engagement process that recreates an informal cafe-table setting where four or five participants discuss an issue in rounds of conversations. The facilitators (KR at Pathways and JG at NACCB) organized three progressive conversation rounds of approximately 20–30 min each and instructed participants about their tasks. Each table had markers and poster-sized paper, which allowed participants to doodle, draw, and visually record the collective knowledge created through their conversations (The World Café, 2015). Ethical review and approval was obtained through the Institutional Review Board (IRB# 03849e) of Miami University, Ohio, before the world cafés and informed consent was requested verbally from participants during the sessions.

During the first round of discussions, we asked participants (i) whether these three terms were synonyms, and if not, how they relate to one another (e.g., one containing the other, the three situated along a continuum), and (ii) how these concepts could be defined. In a second round, we asked participants what conservation success looks like in terms of coexistence, tolerance, and acceptance. In the final round, we asked participants to describe the most important factors that comprise coexistence, acceptance, and tolerance with a view toward operationalizing the terms.

In this article, we present the array of perspectives shared by participants and build upon these results toward a more grounded understanding of coexistence, as applied by conservation scientists and practitioners. Drawing on these findings, we discuss what factors could help clarify and operationalize the concept of human-wildlife coexistence.

RESULTS

A total of 56 participants attended the two World Café sessions (20 in Namibia, and 36 in Ontario). As it was out the scope of the Word Café, and therefore of this perspective, we did not record participants' nationalities or backgrounds; however, we can state that a majority of the participants were academics (i.e., professors and graduate students) and/or practitioners who work mainly in Africa (Pathways conference) or worldwide (NACCB conference). In line with the conferences' themes, focus, Pathways participants predominately had social science backgrounds, whereas NACCB participants had natural science and socio-ecological backgrounds.

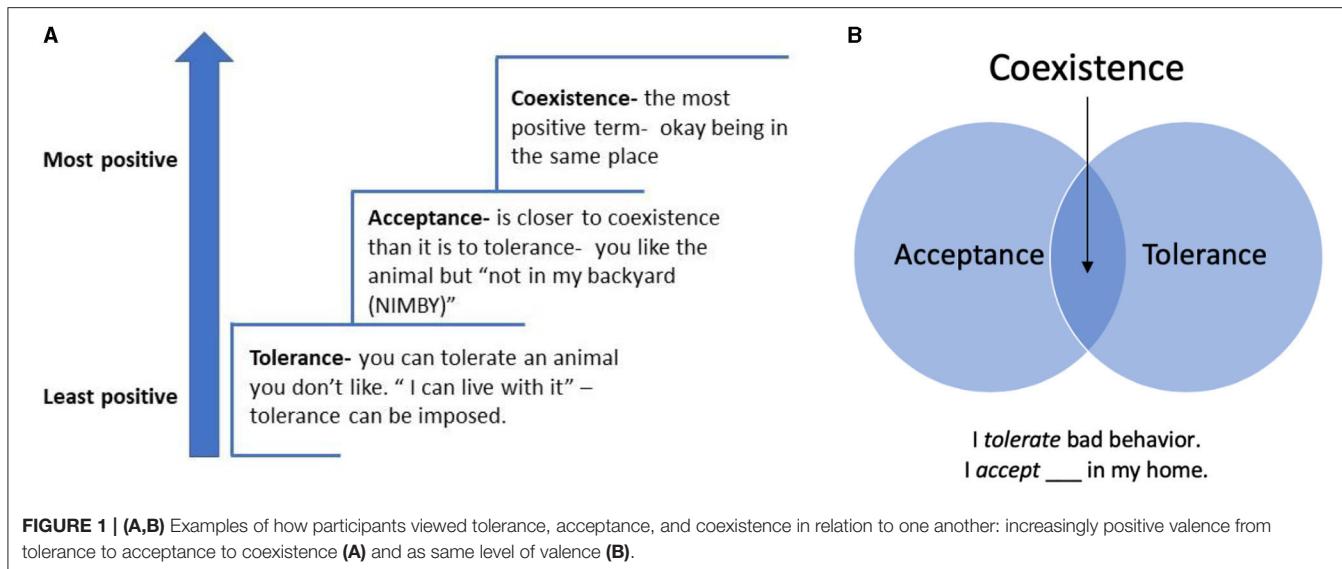
Are Coexistence, Tolerance, and Acceptance Synonyms? If Not, Then How Do They Relate to Each Other? How Should Each of Them Be Defined?

Participants perceived that although tolerance and acceptance were closer to each other than to coexistence, there was a high degree of similarity among all three terms. There was no consensus on how these concepts should be organized in relation to one another, though many participants positioned coexistence as connoting a more positive situation than tolerance and acceptance (Figure 1A). Compared to the other terms, tolerance was described as a more passive state with the implication of burden—a state of agreeing to disagree. Ability to influence decision-making processes was often seen as a factor affecting the level of tolerance; lack of power was described as leading to lower tolerance. Acceptance, in contrast, was described as a state in which the value of a species was recognized, yet there was no active promotion of human-wildlife coexistence—once again suggesting a more passive state than that of coexistence. The concepts of tolerance and acceptance were sometimes perceived as leading to coexistence (Figure 1A) and by some participants as at the same level of valence (Figure 1B).

Several prominent ideas emerged regarding definitions of the three concepts. Participants emphasized that although universal definitions could facilitate comparisons and evidence compilation, agreement on such definitions is likely impractical. Conservation programs operate within complex systems, so terminology must be adaptable to different contexts. For example, multiple participants described coexistence as a dynamic state composed of multiple dimensions, including spatial, temporal, social, and institutional facets. They also noted that coexistence often implies interactions between social and ecological elements of a system. In general, participants expressed that coexistence would not be bound with an endpoint, but rather, underpin harmony over time.

What Does Conservation Success for Human-Wildlife Interactions Look Like? What Do we Ultimately Want to Achieve in Conservation: Coexistence, Tolerance, or Acceptance?

Similar to the discussion around standard universal definitions, conservation success was seen by many as context-dependent.



When coexistence is the end-goal, participants identified significant aspects of successful conservation, including a balance between the costs and the benefits associated with wildlife, reduced levels of conflict and negative interactions between humans and wildlife, and human behavioral changes that decrease pressure on wildlife populations. In addition to these outcome-based metrics, processes that influence success were also listed, such as productive collaboration, inclusivity, respect, and balanced power relations in conservation programs. Participants expressed differing perspectives on whether success can be labelled as coexistence, although multiple participants described coexistence as a better outcome than thresholds associated with tolerance and acceptance.

Mirroring the first round, some participants emphasized the need for flexibility—in particular, the ability to adapt definitions of success relative to coexistence, so terms reflect social outcomes (e.g., human well-being), ecological outcomes (e.g., population persistence), and resilience at relevant scales.

What Factors Are Most Important to Measure Coexistence, Tolerance, and Acceptance?

Reflecting the complexity of the three terms, participants stressed that both quantitative and qualitative measurement are valuable. Participants that conceptualized tolerance as a threshold offered behavior-based measures like the number of retaliatory killings of wildlife. Other measurable factors were attitudes, agreement regarding wildlife management strategies, and perceptions of wildlife-related costs and benefits. Participants suggested that acceptance and tolerance might be best measured at the individual level, but also may form a threshold of social carrying capacity at the collective level. Coexistence, in contrast, spans populations, ecosystems, and landscapes. Having a multi-scale nature, coexistence necessitates a composite measure that captures the overlap in scales of social and ecological dimensions.

In addition, the participants identified the following relative factors of coexistence, or characteristics of the state of coexistence in some contexts: (i) benefits of existing together are equal to or outweigh the costs for both sides; (ii) negative interactions between two groups is non-existent, low, or tolerable; (iii) tolerance is high; (iv) acceptance is high; (v) neither humans or wildlife species are substantially negatively impacting the other; (vi) species are thriving; (vii) attitudes toward the species are positive or at least neutral; (viii) the state may be unstable. Coexistence is a state to strive for with clear metrics to guide goal attainment/success.

DISCUSSION

Participants found it challenging to define tolerance, acceptance, and coexistence. Instead, they supported more fluid definitions of the terms based on the contextual dimensions associated with each (i.e., spatial, temporal, social, and institutional) and the conservation issue at hand. However, despite hesitancy to strictly define these terms, many participants felt it was important to identify indicators and metrics for tolerance and acceptance, as they are not perceived as synonymous (e.g., Bruskotter and Wilson, 2014; Lute and Carter, 2020). Tolerance can be understood as having both negative and positive connotations. Specifically, it can be viewed as a virtue in that people wish to be considered tolerant. Yet being tolerant might not mean that a person prefers to assent to a specific situation; people might tolerate a situation just because they have no other option. This is similar to how Kansky et al. (2021) define tolerance: “the ability of an individual to absorb the potential or actual costs of living with wildlife” (Kansky et al., 2021, p. 604). Tolerance was seen as a lower bar than acceptance and coexistence. Acceptance was perceived as unassociated with whether people held a specific opinion or were impacted by conflict.

Coexistence was perceived as an overarching concept and participants advocated for context-specific definitions crafted

by the local stakeholders. Overall, participants' descriptions of coexistence had commonalities despite the variation in conservation context. For example, participants felt that for coexistence to occur, the species and humans must be living in/sharing the same landscape, at the same time, which is supported by some authors (Carter and Linnell, 2016; Crespin and Simonetti, 2019), but not others (Treves and Santiago-Avila, 2020). Participants added another characteristic to coexistence: that neither species is inhibiting the survival or sustained existence of the other species, which distinguishes coexistence from co-occurrence (Morehouse and Boyce, 2017; Lamb et al., 2020). What we found even more unique in the participants' perspectives was the scaled nature of the three terms: tolerance begets acceptance, begets coexistence (**Figure 1A**). This point has been debated in the literature, some indicating that for coexistence to occur, attempts should be made to increase acceptance (Lute and Carter, 2020) over tolerance (van Eeden et al., 2021). As Glikman et al. (2019) and König et al. (2020) suggest, we stress that coexistence is a dynamic process. Furthermore, a dynamic state of coexistence parallels the panarchy framework for understanding resilience in social-ecological systems across scales (Holling, 2001), a perspective that embraces system dynamism through cycles of growth, conservation, release, and reorganization.

Consistent with some literature (Glikman et al., 2019; Knox et al., 2021), participants did not perceive a strong necessity to have strict definitions for the three terms. Yet, there was agreement and recommendations that these terms should be defined by the specific conservation groups working on a particular issue or conservation program (i.e., government organizations, conservation organizations). We agree that defining these terms is paramount when coexistence, tolerance, and/or acceptance are adopted as objectives of a project, with indicators and specific metrics used to guide measures of success. As previously discussed, the way we define coexistence matters (Glikman et al., 2019). The definitions we use help us understand and frame which measures, approaches, and innovations conservationists implement to promote coexistence. For example, if coexistence is defined as human and wildlife peacefully sharing landscapes, we may strive to minimize human-wildlife interactions, as avoidance of negative interaction may help maintain peace. This scenario is exemplified by cases that involve damage reduction like bear-proofing measures to reduce access to residential garbage (Johnson et al., 2018). If instead we strive for a concept of human-wildlife coexistence that entails species recovery and expansion, avoidance may not be enough and success may be reached when local communities become stewards of a species, as exemplified by Lion Guardians (Hazzah et al., 2019). We realize that the state of coexistence, like human-wildlife relationships, may be fragile and ever shifting (Yurco et al., 2017; Frank and Glikman, 2019). Whatever the details, agreeing on a definition of coexistence ahead of time can help focus efforts on the outcomes most valued by stakeholders and indicate when success is reached and/or when a definition needs to be re-assessed and adapted to a newly desired human-wildlife condition.

Seeds to Operationalize Terms

It is evident from both workshops that stakeholders should define tolerance, acceptance, and coexistence to fit their conservation contexts. This presents a challenge on how to define and measure these items across studies. The perspectives expressed in the workshops support building on a measure of tolerance for wildlife, such as that proposed by Brenner and Metcalf (2020). Specifically, further work should focus on better understanding human behavioral and attitudinal attributes toward wildlife or its behavior. Further, the workshops' results indicate that acceptance and tolerance are different and the terms should not be used as synonyms (e.g., Bruskotter et al., 2015; Slagle and Bruskotter, 2019), nor to define one another (e.g., Lischka et al., 2019). Acceptance was described as a step above tolerance, begetting coexistence, and involving recognition of the value of a species (**Figure 1A**). As such, potential future studies should focus on the plurality of values toward wildlife to identify attributes of acceptance. While tolerance and acceptance were generally conceptualized at the individual-level, coexistence was frequently viewed from a systems perspective, referring to a socioecological state comprised of interactions between social and ecological components. Coexistence can be human-to-animal but also human-to-human. As suggested by Pooley et al. (2020), coexistence requires a careful approach where researchers "listen carefully to and learn from others" (Pooley et al., 2020, page 06). Then, operationalizing these terms can be done *a priori* using closed ended questions or *a posteriori* using open ended questions. Closed ended or Likert-style scale questions require consideration and definition of different components of tolerance, acceptance, and coexistence. Open-ended questions allow stakeholders to define these terms for their specific context. For example, questions to define acceptance can be worded as follows: (i) who is impacted the most by the consequences of human-wildlife issues? and (ii) should you consider people as accepting a consequence if they have no interest or stake in the conflict about wildlife?

CONCLUSIONS

It is clear from the two workshops that participants have different perspectives on how to define tolerance, acceptance, and coexistence. The authors of this paper respect this output and believe that we can coexist with this diversity of ideas and continue to work toward deepening our understanding of the concepts.

Regardless of definition, there does appear to be a commonly recognized hierarchy from tolerance to acceptance to coexistence. Furthermore, there is some consensus about the level at which the concepts are defined and operationalized: tolerance and acceptance describe individual attitudes and behaviors, and coexistence is more broadly nested in the social-ecological landscape. Future research should continue to explore the relationships between these concepts and at which scale they are applied.

Given the complexity and variability of perspectives about coexistence, we recommend that researchers, managers and decisions-makers engage in inductive inquiry that avoids unspoken and untested assumptions about human-wildlife interactions. Definitions should not be pre-determined without community and stakeholder input, especially when researchers/managers and decision-makers are new to an area, community, or project, and may hold different perspectives than those involved in the human-wildlife interactions. We suggest considering the specific context and needs, and then identifying and clearly articulating relevant concepts—regardless of their names—that can then be measured. Similarly, we emphasize that there is a need to develop a glossary of terms when embarking on a research project. Such development will help with clarify definitions among research teams, lead to a more robust understanding of how to appropriately measure tolerance, acceptance, and coexistence, and enable shared interpretation of findings. We believe this will ultimately assist with further development in the scholarly literature around these terms and allow academics to continue to deliberate, debate, and progress toward a more unified set of definitions and measurements.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

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ETHICS STATEMENT

The studies involving human participants were reviewed and approved through the Institutional Review Board (IRB# 03849e) of Miami University, Ohio, USA. Written informed consent for participation was waived due to the conference context. This is in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

JG, BF, and KR contributed to design of the study methods. KR facilitated the World Café in Namibia whereas JG and AM facilitated the World Café in Toronto. JK organized the results. JG, KR, and JK wrote the first draft of the results section. BF and JG wrote the first draft of introduction. CS and EM wrote the first draft of the discussion. SM wrote sections across all manuscript. All authors contributed to several discussions on the conception of the manuscript, contributed to manuscript, revision, read, and approved the submitted version.

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Conflict Is Integral to Human-Wildlife Coexistence

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Keywords: human-wildlife conflict, human-wildlife interactions, human-wildlife coexistence, conflict narratives, conservation

INTRODUCTION

Interactions commonly labeled as “human-wildlife conflict,” i.e., instances where wildlife presence and/or actions impact negatively on human interests, dominate the conservation science literature on human-wildlife interactions (Hill, 2017; König et al., 2020). However, interactions between people and wildlife are much more varied and complex than this, as exemplified in various ethnographic works including the study of people-tiger relations in the Sundarbans, West Bengal (Jalais, 2010), people-wildlife relations in Japan (Knight, 2003) and people-badger relations in the UK (Cassidy, 2019). There is increasing concern within the conservation community that the continued focus on conflict narratives risks making this the primary, or even the only, way of conceptualizing interactions between people and wildlife within this field. While obscuring opportunities for better understanding the nuances of these complex relationships this could jeopardize conservation action and outcomes (Hill and Webber, 2010; Pooley et al., 2020). One response to this is a call for a reconfiguration of the ways in which researchers study these human-wildlife interactions, encouraging a shift of focus from “conflict” to “coexistence” (Frank and Glikman, 2019).

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The meaning of human-wildlife coexistence is often implicit rather than explicit in much of the literature using the term (Carter and Linnell, 2016). Some authors address that deficit, but meanings assigned to the term human-wildlife coexistence vary from human-wildlife coexistence as human-wildlife co-occurrence (Harihar et al., 2013) to ideas of co-adaptation of humans and wildlife (Carter and Linnell, 2016) and human-wildlife conflict and coexistence representing two endpoints of a continuum, where “coexistence” is understood as “peaceful coexistence” (Frank, 2016). The more general emphasis appears to be on moving away from “conflict” both as a way of framing our thinking about human-wildlife interactions, and in the way we describe certain types of interaction.

The language used to describe people-wildlife encounters influences the way we interpret and imagine these experiences and relationships (Peterson et al., 2010; Hill, 2015). Arguments for revising terminology mirror an earlier debate promoting a rethink of the label “human-wildlife conflict,” persuasively expounded in Peterson et al. (2010). Indeed, Pooley et al. refer to this earlier debate in their recent paper as the impetus to encourage further examination of current framing of human-wildlife interaction narratives (Pooley et al., 2020). However, the move to adopt a coexistence focus appears driven by more than just a switch away from a human-victim: animal-perpetrator framing. Instead, or additionally, the emphasis is on encouraging a shift of focus from negative aspects of human-wildlife relationships, as often represented within a conservation conflicts framing (Marchini et al., 2019) to one that acknowledges, and incorporates the idea, that human-wildlife relations are not inherently or solely negative in nature, with wildlife having significant value, and groups of people exhibiting tolerance for sharing space with wildlife.

However, we should not be too quick to drop conflict as part of the way we understand multi-species coexistence. I propose that we should consider conflict as one aspect or even a necessary condition of human-wildlife coexistence. Additionally, we should be wary of adopting a dualistic model of “conflict” to “coexistence” or a continuum perspective because neither framework adequately represents the complex nature of human-wildlife interactions, which are multifaceted, dynamic and often grounded in time and place.

CONFLICT AS A COMPONENT OF, OR NECESSARY REQUIREMENT OF, HUMAN-WILDLIFE “COEXISTENCE”

Conflicts about wildlife are complex and nuanced, involving multiple stakeholders, whose priorities, viewpoints and agendas can clash (Madden, 2004; Redpath et al., 2013; Madden and McQuinn, 2014). The Levels of Conflict framework (Canadian Institute for Conflict Resolution, 2000), adapted by Madden and McQuinn (2014) provides a useful analytical construct for understanding the intricacies of conflicts about wildlife. Madden and McQuinn demonstrate that while conflicts about wildlife can exist solely at the “dispute” level, i.e., the bodily, tangible sign of the conflict (e.g., livestock losses to carnivores), conflicts about wildlife rarely exist only at this level. Underlying conflicts exist because of historically unsolved clashes between different human groups leading to resentment, mistrust and even disruptive or uncooperative behaviors. Furthermore, deep-rooted, or identity conflict, occurs when people feel their sense of self or group is threatened, they feel unacknowledged, disempowered, and disrespected (Madden and McQuinn, 2014). Consequently, many conflicts around wildlife are entangled within the interactions and relationships between specific human groups, and to understand these conflicts fully we need to explore the underlying issues. In any of these types of scenarios it is different human values, agendas and the interplay of power relations that are key sources of conflict between the different human stakeholders, irrespective of the human-wildlife interactions under scrutiny.

According to Lederach, an academic and practitioner in conflict transformation and peacebuilding, conflict is normal in human relationships. He argues that conflict should be viewed positively, as a marker of the need for, and as a catalyst for, change (Lederach, 2003). Moreover, instead of regarding peace as the endpoint “conflict transformation views peace as a continuously evolving and developing quality of relationship” (Lederach, 2003; pg. 20). The important point is that peace is not static or the end goal of processes adopted to address conflict between protagonists but is a dynamic reflection of the state of relationships. Human interactions and relationships with other humans are “dynamic, adapting and changing,” as are human interactions with wildlife (Manfredo et al., 2020). Consequently, we should think carefully before removing the concept of “conflict” from narratives about human-wildlife interactions, or to restrict its use to situations where “peaceful” coexistence breaks down.

CONFFLICT AS A CATALYST FOR REFLECTION AND CHANGE IN INTERACTIONS AROUND WILDLIFE

Where conflicts about wildlife arise, or existing conflicts are exacerbated, this can be a result of changes in local human-wildlife relations, including changing wildlife population distribution and density (Leong, 2009), changes in human and/or animal behavior (Naughton-Treves et al., 2017), and even institutional and policy changes that create social and political discord with other stakeholder groups (McLennan and Hill, 2015). Consequently, conflict should be considered a catalyst for reflection and change. For example, carnivore conflict mitigation strategies in Norway focus on reducing economic impacts (compensation) and providing technical solutions to reduce livestock predation. However, the small Norwegian wolf population is concentrated in areas with little or no livestock production. Therefore, there are relatively low rates of livestock losses in these regions yet there is substantial resistance toward wolf populations in these areas among certain rural groups, including hunters. Analysis of these conflicts about wolves reveal that these are social conflicts involving multiple stakeholder groups (Skogen and Krane, 2003). Reducing wolf predation on livestock and increased monitoring of the wolves have done little to reduce conflict narratives. Instead, these actions appear to further alienate stakeholders, including pro-wolf groups, and reinforce rural people’s sense that their traditional land use and livelihoods are undervalued and are threatened by the interests of the pro-wolf lobby (Skogen, 2017). The persistence of these human-wolf conflict narratives, even in the face of considerable investment of resources into conflict mitigation signals the need for reflection and revision of approach, whereby policies and practices address more closely the concerns and priorities of non-farming stakeholders who currently feel ignored.

A MUTUALLY INCOMPATIBLE OR CONTINUUM PERSPECTIVE OF HUMAN-WILDLIFE COEXISTENCE IS PROBLEMATIC

Some authors characterize human-wildlife conflict and human-wildlife coexistence as antithetical or mutually exclusive conditions, where human-wildlife coexistence refers to a situation that is conflict-free (e.g., Crespin and Simonetti, 2020; Jordan et al., 2020). Others see conflict and coexistence as opposite ends of a spectrum. Frank proposed the “conflict-coexistence” continuum, with conflict at one end involving “extreme negative attitudes or behaviors toward a species,” progressing via less extreme adverse viewpoints or actions to a point of “no action taken toward wildlife, either positive or negative.” The points on this continuum are not fixed, are culturally, socially, and geographically variable, and can differ for individuals and groups over time and according to changing circumstances (Frank, 2016).

In both models the implication is that peaceful coexistence is the goal of conflict management or resolution processes.

But given the complex and fluid nature of human-wildlife relationships, and the recognition that human-human conflicts are often, if not always, part of conflicts about wildlife, representing the relationship between conflict and coexistence as a dichotomy or continuum is problematic.

Human-wildlife relationships are multi-faceted, nuanced, and intricate, and should not be conceptualized solely with reference to types and nature of physical encounters between people and wildlife. Animals have symbolic significance and this symbolic nature can be central to understanding human-animal interactions, whether conflictual, harmonious or both. This is true in the context of conflicts around wildlife, as demonstrated by Sousa et al. (2018) in their analysis of local responses to attacks by chimpanzees in Cantanez National Park, Guinea Bissau, and Skogen (2017) in his discussion of the wolf and what it symbolizes for rural and urban residents in Norway. In the former instance chimpanzee behavior is used as a vehicle for understanding unwelcome behaviors in human neighbors; in the latter instance, the animal model is a symbol of changing states. For rural Norwegians the wolf symbolizes the decline of rural populations and rural ways of living; for urbanites it symbolizes “an authentic, wild nature” (Skogen, 2017; pg. 54). Additionally, the symbolic nature of animals is not fixed. Animals can move between categories, as illustrated by Lopez-Fernandez and Frazão-Moreira’s analysis of the social construction of the Iberian lynx in Portugal, and its shift in status within rural populations from “pest” to “conservation icon” (Lopez-Fernandez and Frazão-Moreira, 2016). Animals can even straddle categorical boundaries, for example, badgers in the UK, which are legally protected “pests” (Cassidy, 2019). Furthermore, viewing animals or interactions with them, within discrete dichotomous categories is not necessarily appropriate. Goldman et al.’s analysis of lion hunting by Maasai in Kenya and Tanzania reveals that lion killing is in response to “overlapping motivations that are simultaneously social, emotional and political” (Goldman et al., 2013; p. 490), and that adopting an explanation where lion killing by Maasai is viewed as either a cultural activity or a practical response to the threat of livestock losses (Hazzah et al., 2009), is misleading.

As illustrated above the ways in which people interpret and regard wildlife and their actions do not necessarily fall into discrete categories. Animals can simultaneously inhabit different symbolic spaces, shift between, or even straddle, categories. Adopting a dichotomous perspective (good/bad; tolerance/intolerance; conflict/coexistence) is a persuasive approach that is appealing and conceptually easy to understand but is an overly simplified and often inaccurate representation

of human-wildlife interactions. Being able to understand, recognize and accommodate the complex and fluid nature of human-wildlife relationships needs to be part of the way we conceptualize human-wildlife coexistence.

DISCUSSION

Human-wildlife interactions, including conflicts about wildlife, are complex and nuanced. Carter and Linnell (2016, pg. 575) define human-carnivore coexistence as “a dynamic but sustainable state in which humans and large carnivores co-adapt to living in shared landscapes where human interactions with carnivores are governed by effective institutions that ensure long-term carnivore population persistence, social legitimacy, and tolerable levels of risk.” This framing of human-wildlife coexistence acknowledges the interplay between the biological, ecological, cultural and societal factors inherent in human-wildlife relationships in shared landscapes. Furthermore, the authors acknowledge that where large-bodied carnivores and humans share landscapes, conflicts of interest are likely to arise, either between people and wildlife, or different human-interest groups. Consequently, a permanent, “conflict-less” or “peaceful” state is likely to be unachievable. I suggest that this is not restricted to human-carnivore coexistence but is applicable to human-wildlife coexistence generally, therefore meaningful ways of conceiving human-wildlife coexistence must take this into account.

Transforming conflict into coexistence, where coexistence is the permanent or long-term removal of, or significant decline in discord between the various interest groups is unrealistic. What is important here surely is that “conflict” is not specifically inter-species conflict, i.e., between humans and their wildlife neighbors, but is conflict with others be they human or non-human. Furthermore, conflict can be an agent for change, so removing “conflict” from ideas of coexistence is perhaps risky. Conflict, as a state, has value, it should not automatically be viewed as negative and to be avoided but should be understood as part of the experience of multi-species coexistence, and as an indicator of, and force for, change, thereby facilitating long term co-occupancy and even perhaps “sometimes peaceful” coexistence between humans and wildlife.

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The author confirms being the sole contributor of this work and has approved it for publication.

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The Coexistence Potential of Different Wildlife Conservation Frameworks in a Historical Perspective

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Wildlife management in contemporary society means balancing multiple demands in shared landscapes. Perhaps the greatest question facing today's policy makers and wildlife professionals is how to develop frameworks for coexistence between wildlife and the plethora of other land use interests. As a profession, the roots of wildlife management and conservation can be traced back to the 1600's, but most of the relevant frameworks that have shaped the management of wildlife over time have emerged after the mid-1800's and particularly since the 1960's. Here we examine the historical development of the main traits and concepts of a number of management and conservation frameworks that have all contributed to the multifaceted field of contemporary wildlife management and conservation in Europe and North America. We outline a chronology of concepts and ideologies with their underlying key ideas, values, and operational indicators, and make an assessment of the potential of each paradigm as a coexistence framework for dealing with wildlife. We tie this to a discussion of ethics and argue that the lack of unity in approaches is deeply embedded in the differences between rule-based (deontological) vs. results-based (consequentialist) or context dependent (particularist) ethics. We suggest that some of the conflicts between ideologies, value sets and frameworks can be resolved as an issue of scale and possibly zonation in shared landscapes. We also argue that approaches built on anthropocentrism, value pluralism and environmental pragmatism are most likely to succeed in complex socio-political landscapes. However, we caution against moral relativism and the belief that all types of cultural values are equally valid as a basis for contemporary wildlife management.

Keywords: wildlife management, conservation, frameworks, concepts, values, ethics

WILDLIFE MANAGEMENT AS A CHALLENGE IN CONTEMPORARY LAND USE MANAGEMENT

Wildlife management has matured over the last 150 years into a professional discipline aiming at nurturing sustainable wildlife populations as well as meeting a range of complex and often conflicting societal goals. Throughout this history, the scientific debates and politics of wildlife management have struggled to find some level of consensus on purpose, optimal strategies and ways of dealing with diversifying value systems, conflict, and trade-offs. Over such an extended period

of time, society has experienced tremendous changes. Public and scientific perspectives on nature and wildlife have undergone a long and extensive journey from early interest in wildlife biology to managing complex socio-ecological systems. Despite massive amounts of scientific research on wildlife, a highly developed management profession and associated institutions, the issues and challenges facing contemporary wildlife management are formidable (Daskin and Pringle, 2018; Linnell et al., 2020; Van Beeck Calkoen et al., 2020). We are far from a consensus in the sense of broad public acceptance on what should be the key objectives of maintaining viable populations of various species, what are the optimal management models, which of the benefits that may accrue from wildlife are the most important ones, and what management practices are acceptable to the greater public? In fact the whole future relationship between humans and wildlife is under negotiation, including issues related to the appropriate space to conserve wildlife (i.e., land-sharing vs. land-sparing, *sensu* Phalam et al., 2011) and the appropriate forms of interaction that we should have with wildlife (i.e., hunting or protection). In this article we will argue that the field is marred by deep conceptual challenges relating to conflicting views on pluralism vs. monism in values and goals, methodological differences, and most importantly the lack of a unified ethical framework as a basis for developing important, but difficult priorities and strategies for wildlife management.

Contemporary wildlife management cannot be separated from wider discussions of land use management, environmental governance, sustainability, and biodiversity conservation. Indeed, it cannot be separated from other societal and political sectors such as health and welfare, defence, border security, food security, climate change adaptation, energy production, rural development, forestry or agriculture. In short, these are the larger discussions of how we manage the multiple and complex demands on already pressured landscapes. We no longer live in an era where the propagation and harvesting of a single game species is considered an independent task left to a small cadre of professionals, where in many cases emotional responses or economic interests often challenge reason and fact and lobby for influence (Nelson et al., 2016).

The most central challenge in contemporary wildlife management is finding acceptable modes of coexistence both between wildlife and people in general, and coexistence between different groups of people with competing interests. These dynamics reflect the ever on-going changes of values, perceptions, and interests in wider society, and burdens the field of wildlife management with the challenge of interacting with an increasing number of other societal interests.

The question of understanding conflict has dominated the study of human–wildlife interactions through recent years (Redpath et al., 2015), although there is a recent and increasing focus on coexistence (Nyhus, 2006). Although coexistence is as yet a poorly defined and emerging concept for the purposes of this paper, we conceptualise coexistence in a broad sense as efforts to achieve increased acceptance for wildlife and positive relations between people and wildlife, and between people about wildlife (Frank, 2016). To define coexistence, we find it useful to follow the general thinking of how biodiversity can be impacted

by human activities, and conversely how biodiversity can affect the well-being of people (e.g., Treves et al., 2009; Young et al., 2010; König et al., 2020). Impacts of, and interactions with biodiversity are almost inevitably perceived and experienced differently by different stakeholders (Linnell et al., 2020). Hence mitigating impacts typically lead to conservation conflicts since different stakeholders have different societal and conservation goals (Redpath et al., 2013, 2015). Ideally, coexistence between people and wildlife is the absence of such conflicts, where intolerance of wildlife is reduced as well as equitable distribution of costs and benefits of wildlife conservation is increased (Jordan et al., 2020). In reality, coexistence will never be a steady state of bliss, but at best a more sustainable dynamic state where human–wildlife interactions are managed in socially legitimate ways, and at reasonable levels of risk and cost (Carter and Linnell, 2016; Pooley et al., 2020).

Clearly, the challenges and tasks of wildlife management have moved beyond the trade-offs between consumptive and non-consumptive interests. In modern democracies where land-sharing, (where multiple interests need to get along), rather than land-sparing (areas set aside for more exclusive interests) of more, or less, natural environments will be the dominant mode of use and management, there must be space for value pluralism, but equally a need for large-scale policy coordination (Loconto et al., 2020). This implies an urgent need to sort between compatible and incompatible values, strategies, and management approaches for the long term aim of maximising coexistence with other land use interests. That notwithstanding, there is also similar need for discussion around how to manage land-sparing areas in protected zones.

In this paper we review the main tenets of what we consider a historical development of conservation and wildlife management frameworks from early regulatory harvesting approaches to contemporary debates over multifaceted conservation and management regimes. We live in an increasingly interconnected and complex world, where much of the current debate in wildlife management and conservation centres around ideas like rewilding, compassionate conservation, and new types of conservation science—all of which are manifestations of underlying competing value discourses, ethics, and intellectual traditions. Current wildlife management and conservation debates reflect fundamental underlying societal concerns beyond maintaining certain species and population levels such as; environmental sustainability (e.g., Mebratu, 1998), ecosystem health (e.g. McShane, 2004), public health (e.g. Morris et al., 2006), food security (e.g., Weste et al., 2014), livelihoods (e.g., DeFries et al., 2006), both social and environmental justice (e.g., Chapron et al., 2019), governance (e.g., Newell et al., 2012), economic revenue (e.g., Hediger, 2008), cultural identity and heritage (e.g., Cheape et al., 2009), and more. The extensive conflation of ethics, values, strategies, vested interests and scientific evidence give rise to controversy, conflict, and confusion in current wildlife management debates.

This motivates our overall goal to shed some light on which ideas might help further the development of coexistence frameworks, as well as pointing out salient questions that need further study in order to better understand what drives the

various positions in wildlife management. We attempt this through two objectives. The first is to outline a broad chronology of wildlife management concepts, including a description of the main ideas and framings that have driven the development of a series of more or less distinct frameworks. Secondly, we wish to identify the key values that characterise these frameworks and the relationships between them. Based on this we suggest a set of operational indicators of the frameworks and outline a chronology of the frameworks and our interpretation of when each one commenced. Essentially our work builds on the broad outline offered by Mace (2014), but goes into greater detail and depth.

Our review is mainly based on published material, chiefly scientific articles, scientific books, text books and technical reports. Some of these sources are review papers, while other publications are exponents for the various frameworks as we have defined and interpreted these. Furthermore, we have surveyed Wikipedia and other popular scientific outlets to calibrate our interpretation of scientific traditions, expressions, and frameworks with those in more popular use. Essentially, our perspective is a first world view and the material we build on is largely from Europe and North America. We in no way suggest that we have reached maturity or arrived at an end point in the deliberations over the most appropriate wildlife management concepts. Likewise, we do not have space to explore all the nuances of each. Our intention however, is to develop a narrative by broadly assessing the main lines in historical and contemporary management frameworks with respect to the potential for coexistence with other land use interests.

We assert that all conservation and management frameworks are social constructions, i.e., multiple ways we have chosen to select and represent knowledge, the way we distinguish between the human and the non-human world, the needs of wildlife and people, as well as the (if any) ethical and moral obligations we have toward the environment. It follows then that an analysis of these social constructions (framework) can follow different socio-cultural, philosophical, legal, or ethical paths. Our main interest here is to draw out the key ideas from different frameworks that are particularly important for designing future coexistence frameworks, broadly understood as management approaches that facilitate the maintenance of viable populations of wildlife in shared landscapes in a context of broad public acceptance. For the purposes of discussion here we have chosen a mixed approach in examining historical frameworks where we primarily focus on what we interpret to be the key ideas and societal values shaping the core of the frameworks, and the conceptual framing these ideas have evolved within, which includes both ethical orientations and scientific epistemologies.

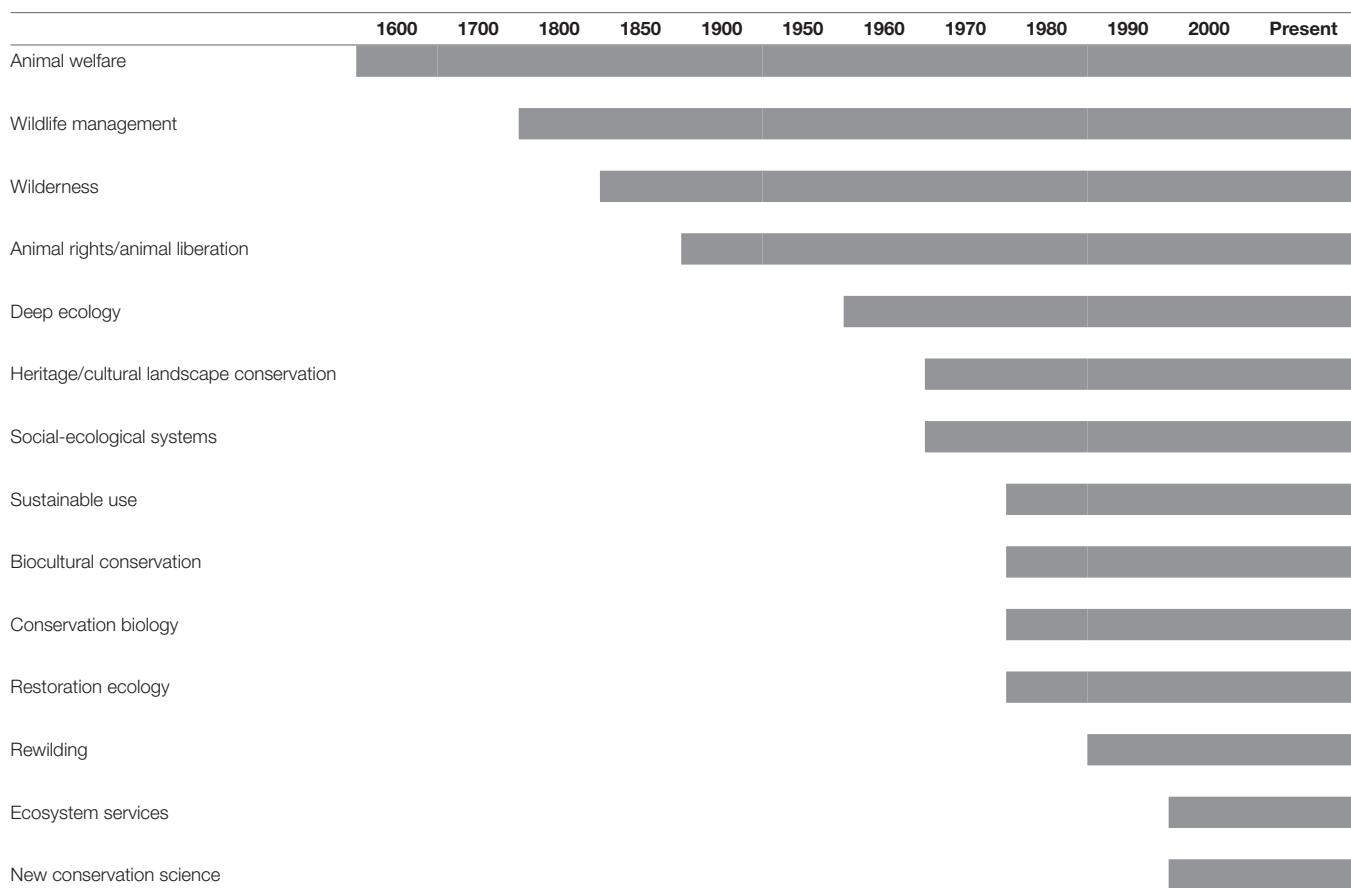
FRAMEWORK CHARACTERISTICS

We recognise 14 different conceptual frameworks commencing from the seventeenth century and up till today; animal rights/animal liberation, animal welfare, wilderness, restoration ecology, deep ecology, socio-ecological systems, conservation biology, wildlife management, sustainable use, ecosystem

services, heritage/cultural landscape conservation, rewilding, and biocultural conservation. We built this categorisation on a set of loosely defined criteria; that each conceptual orientation/framework is supported by a number of scientific references, that each framework to some extent seems to have influenced debates over management policy as evidenced by scientific and public publications, that the frameworks self-identify with their own terminology, journals, associations, and/or textbooks, and that each framework appears to have significant relevance for our interest about how to balance multiple interests in coexistence management. For each of these we have delimited a rough time line indicating an approximate inception point (**Table 1**), as well as a short listing of what we identify as the main concepts and framing, the key ideas and values, and the operational indicators of the frameworks. We have also assessed the compatibility of each conceptual framework with the other frameworks, and listed some significant and defining institutional events for each one (**Table 2**). In **Table 3** we identify the dominant value orientation characterising each framework and how some salient values are shared across several frameworks. All of these frameworks internally embrace a diversity of forms. An analysis of each in detail would require multiple books, not just a review article. Hence our discussion is by definition only able to compare the broadest elements of each framework. However, our goal in this article is to open a high-level discussion of relevant strategies for the practical operationalisation of human-wildlife coexistence rather than engage in (the equally important) academic discussions of within-framing scholarship.

Chronology and Complexity

Concern for the population status and well-being of wildlife and animals in general and for the appropriate relationship between humans and wildlife is not a recent idea and is visible in philosophy, religion, cultural norms, and legislation of human societies on a millennial timescale. However, in order to keep this review manageable we focus on more recent periods. The idea that non-human animals are sentient beings with consciousness and an ability to suffer independent of humans goes back (at least) as far as the seventeenth century, and this particular value orientation has spurred some of the earliest known wildlife-related legislation. Other frameworks like wilderness preservation, wildlife management, socio-ecological systems and animal rights also have old historical roots ranging from early 1800's to early 1900's and have persisted up to the present. The wilderness preservation movement has particular relevance to coexistence models in the Anthropocene with its emphasis on the intrinsic value of nature, the explicit integration of science with ethics, and the strong influence on land use zoning politics since the late 1800's. The movement was shaped by thoughtful and eloquent individuals like John Muir and many others in subsequent years (e.g., Oelschlager, 1991; DeLuca and Demo, 2001). Also, the early phase of the wildlife management era in the early to mid-twentieth century (notably the works of Aldo Leopold) had a profound impact on the later environmental movement and environmental ethics in its quest to integrate

TABLE 1 | Approximate historical timeline of conceptual frameworks.

science with ethics and deliberation of values and societal benefits (e.g., Lorbiecki, 1996).

Frameworks such as deep ecology, heritage conservation, socio-ecological systems, and sustainable use (e.g., Sessions, 1995; Glasby, 2002; Ostrom, 2009; Bridgewater and Rotherham, 2019) have been around for several decades, but all emerged as articulated ideas in the second half of the twentieth century. Some of the frameworks and value orientations that currently are at the centre of many controversies such as ecosystem services, restoration ecology, and rewilding (e.g., Brown et al., 2011; Petriello and Wallen, 2015; Svenning et al., 2016; Martin, 2017), are actually fairly recent constructions, emerging from the 1980's and onwards (Table 1).

Debates around approaches to wildlife conservation can sometimes give the impression that the field has gone through an evolution from one set of ideas and values to another. A linear type of development and replacement would suggest that differences and conflicts are resolved and greater consensus on measures and objectives are achieved as time goes on. On the contrary, the opposite seems to be the case. Each new development or new paradigm emerging from a schism has persisted alongside its parent paradigm. We argue that one of the main causes of the conflicts we are presently witnessing is caused by the fact

that just about every idea, concept or paradigm that has ever been developed is still around. The critical insight is that while new ideas and frameworks have emerged, the old ones have still persisted alongside their respective supporters, stakeholders, and opponents. Inter-framework complexity has increased significantly with time. Rather than replacing older frameworks and notions, new ideas have mostly widened the field without retiring the ideas in previous or parallel directions of thought (Table 2). Obviously, there is no simple explanation for this. Wildlife conservation is a multi-layered concept, and it is highly debateable whether a single approach or framework can encompass all the challenges and tasks it involves. Complementarity can be useful as well as an impediment to progress.

Concepts, Framing, and Key Ideas

Animal Welfare and Animal Rights: Ideology vs. Science

We see a great span in complexity and roots of the concepts that frame the different conceptual frameworks (Table 2). In some cases the frameworks build on tenets from specific philosophical traditions. In other cases frameworks rest on, or get their inspiration from, a mixture of scientific disciplines, or they

TABLE 2 | Main traits of frameworks and assessment of coexistence potential.

Frameworks	Timeline	Concepts/framing	Key ideas/values	Operational indicators	Compatibility	Significant institutional events
Animal welfare	Ca. 1600–present	Non-human animals are sentient beings, consciousness exist in non-human animals (dominant view of neuroscientists)	Focus on well-being and suffering of animals, especially in the care of humans (science, slaughtering, pets, zoos), and how human activities affect welfare and survival of wild species. “Welfarism” attitude; utilitarian notion that animals can be exploited if benefit to humans is greater than suffering of animal	Measures of stress, illness, injury, freedom to express normal behaviour	Anthropocentrically driven, can both support and oppose harvesting and population control depending on the techniques and performance. Opposed by animal rights movement arguing animals should not be regarded as property and any use of animals is unacceptable. Also opposed by the view that humans have no duties to humans. <i>Coexistence potential = medium</i>	Early legislation in UK 1600 and 1700's Animal Welfare Act 1966, 2006. EU directives for farm animals in 2009, 2012.
Wildlife management	Game laws in Europe, early 1800's–present	Natural—and social science, balancing human needs with needs of wildlife. Integrates knowledge from multiple disciplines	Multiple goals, consumptive, non-consumptive, conservation, population control, conflict reduction Carrying capacity, Enhance desired/profitable species	Culling, habitat improvement	Strategically driven to achieve acceptable/desirable multiple outcomes of wildlife resources, resonates with sustainable use, ecosystem service, conservation biology. <i>Coexistence potential = medium</i>	Scientific approaches to game management in USA 1920's–30's (Leopold).
Wilderness	Prehistoric roots (philosophy, art) Conservation movement late 1800's Management 1960's–present	Preservationist	Biologically intact Legally protected Unchanged by modern human activities High spiritual and experiential value	Absence of hunting Specific allowances for indigenous groups Possible re-introduction of extinct species	To some extent resonates with deep ecology, human ecology, Coexistence limited to conservation/preservation strategies, overall goal—secure “space” for natural processes <i>Coexistence potential = low</i>	US Wilderness Act (1964) IUCN Protected areas classification (incl. Wilderness areas) Finnish Wilderness act
Animal rights–Animal liberation	Ca. 1900–present	Moral philosophy Rights advocates Utilitarian liberationists	Moral rights of animals Speciesism Maximising animal welfare Legal constructs Individual animals should have same basic rights as humans Animals should be free from human induced pain and suffering Animals should not be exploited for human purposes Individual animals have equal status irrespective of commonality and origin	Abstain from killing and eating animals Protection of species and specimens	Incompatible with most other framework, narrow focus, strongly at odds with multi-purpose management and human-centric approaches Virtually no potential for coexistence strategies Does not recognise other framework as morally legitimate, strongly value driven. <i>Coexistence potential = low/zero</i>	Contemporary movement formed in 1970 by Oxford post-graduate philosophy students. Animal law courses taught in a range of universities commencing 1980's and 90's. Radical factions of movement linked to violence and terrorist acts from 70's on
Deep ecology	Early roots early 1960's, definable movement from 1972/73 to present	Ecological and environmental philosophy promoting inherent worth of non-human beings and radical re-organisation of modern society Gaia hypothesis Living systems theory. Ecosystems can absorb only limited change caused by humans	The living environment has legal rights to live and flourish independent of instrumental or utilitarian needs and beliefs. The natural world is a homeostasis dependent on complex interrelationships between life organisms	Wildlife has intrinsic and legal rights, source of spiritual and educational value.	Strongly value driven—at odds with instrumental approaches, provides no practical direction for management goals and actions <i>Coexistence potential = low</i>	Coupling of ecocriticism, philosophy through literary writings, environmentalism in early 1970's Early influences; Spinoza, Nietzsche, Muir, Leopold, Carson. Næss, Arne. (1989). <i>Ecology, Community and Lifestyle: Outline of an Ecosophy</i> .

(Continued)

TABLE 2 | Continued

Frameworks	Timeline	Concepts/framing	Key ideas/values	Operational indicators	Compatibility	Significant institutional events
Heritage -Cultural landscape conservation	1970's-present	Holistic landscape ecology Multiple disciplines, history, archaeology, anthropology, ecology, geography, psychology, planning	Nature-culture links Historical events and trends in humans use and formation of landscapes Dynamics of integrated landscape values	Historic and contemporary hunting regimes. Subsistence practises	Idea/value driven, focus on history and cultural processes, provides little strategic guidance for applied management. Some resemblance with human ecology <i>Coexistence potential = low/medium</i>	UNESCO World Heritage Convention 1972. European Landscape Convention 2004.
Social-ecological systems	Late 1800's to present	Relationships between humans and their natural, social, and built environments	Holistic perspective on human relationships and interactions with surroundings. Social, psychological, cultural factors in human-environment interactions. Favours complexity over reductionism. Transdisciplinary approach to problem solving. Humans seen as a keystone species in ecosystems Anthropogenic biomes.	Holistic and integrative perspective on wildlife management vs. single species objectives. Conflict oriented	Strategic shift away from traditional nature-society dichotomy toward interlinked complexity. Potential to guide the evolution of sustainable use, conservation biology, wildlife management, ecosystem services <i>Coexistence potential = high</i>	Historical roots in geography and sociology. George Perkins Marsh's book <i>Man and Nature; or, physical geography as modified by human action.</i> (1864) Human Ecology journal 1972.
Sustainable use	Prehistoric roots as a concept, 1970'-80's-present as conservation paradigm	Recent: Sustainability science Multiple social-and natural science disciplines, Multiple scales	Avoid compromising environmental capacity and preserve options for future use Resilience Carrying capacity Avoid decline in biodiversity	Monitoring and maintaining desired population levels of species. Balancing of consumptive and non-consumptive goals	Strategically driven to achieve dynamic and multiple goals with high public and political acceptance. <i>Coexistence potential = high</i>	Brundtland Commission 1987, Millennium goals, SDG.
Biocultural conservation	1970's-present	Landscape geography and ecology mechanistic approaches to socio-ecological systems. Interdependence between biological and cultural evolution, emphasises social justice	Indigenous and local community knowledge, innovations, practises, adapted to social-ecological context	Adaptive capacity, social learning, flexible governance	Combines insights from community based conservation, co-management, social-ecological systems, cultural heritage and biocultural diversity. The broad bases of knowledge systems can both be enabling through incorporating a complexity of ideas, and disabling through lack of focus and large requiring large resources by adding multiple commitments. <i>Coexistence potential = medium</i>	World Heritage Convention 1972.
Conservation biology	1978-present	Interdisciplinary science, evolutionary processes Reaches beyond biology into humanities, social sciences, art, and education.	Maintenance, loss, restoration, and management of biodiversity	Species and habitat protection, preservation, <i>in-situ</i> and <i>ex-situ</i> conservation.	Ecocentrically driven strategy, resonates with wilderness management, partly wildlife management and restoration ecology <i>Coexistence potential = medium</i>	Modern movement formed at conference in 1978 at University of California, concern over tropical deforestation, eroding genetics in species, loss of species. Historical roots in late eighteenth century British Enlightenment. 1970's and on: multiple conservation acts (globally) addressing species protection.

(Continued)

TABLE 2 | Continued

Frameworks	Timeline	Concepts/framing	Key ideas/values	Operational indicators	Compatibility	Significant institutional events
Restoration ecology	1980's–present	Restoring and renewing degraded ecosystems by active human intervention (practical application ecological restoration).	Biodiversity has intrinsic worth and is important to ecological functioning Natural ecosystems provide humans and society with essential needs Damaged nature can be brought back to "natural" and desirable states Nature can "repaired" justified by anthropocentric as well as biocentric perspectives.	Impaired species richness/diversity can be restored. Extinct species can be re-introduced. New species can be introduced. Ranges from targeted, active intervention to minimal human intervention (rewilding)	Resonates with sustainable use, ecosystem services and to some extent wildlife management. Strategically driven to achieve desirable environmental states <i>Coexistence potential = medium</i>	First international meetings at the University of Wisconsin in 1980's as a response to vast environmental disasters caused by industry. Hilderbrand et al. (2005). <i>The myths of restoration ecology</i> . Ecology and Society
Rewilding	1990's–present	All living organisms are part of ecosystems and food chains Ecological complexity Socio-ecological interconnectedness	"Short cuts" to bring back ecological balance and earlier/original composition of nature and ecosystems Active and passive interventions Designate and protect land areas so that natural processes can unfold. Key concept: cores, corridors, and carnivores	Re-introduction of extinct species Extreme rewilding: back breeding, cloning, genetic engineering	Drive by both ideological and strategic concerns, i.e., establish desired and imagined natural states. Some correspondence with restoration ecology and wilderness management. <i>Coexistence potential = low</i> .	Earth First grassroots network 1990. Re-intro wolves Yellowstone 1994, arctic fox Norway 2000, golden eagles Scotland and Ireland, bison/visent 2010–2011 Europe.
Ecosystem services	Early 2000's–present	Economic valuation Ecology	Multiple benefits and services humans gain from the environment Human well-being	Tangible and intangible benefits from consumptive and non-consumptive benefits from wildlife Hunting fees, wildlife tourism revenues, meat sales	Strategically driven to optimise human benefits <i>Coexistence potential = low/medium</i>	First naming of term "natural capital" in 1973 (Schumacher) Millennium Ecosystem Assessment 2003.
New conservation science	Early roots mid 1980's (Soule, 1985), active debate ca. 2010–present	Anthropocentrism. Protect, restore, enhance environmental services that benefit people	Refocusing conservation biology by de-emphasising protecting nature for nature's sake. Conservation challenge is too large to include or prioritise intrinsic values. Challenges the idea of nature's intrinsic values. Discourse pitted as "nature and people" against "nature for people"	(possibly) instrumental objectives, consumptive management goals, economic measures	Strategically driven toward prioritising (narrow) human needs and dispelling intrinsic values on the grounds of excessive and unmanageable complexity. Somewhat extreme extension of ecosystem services thinking. <i>Coexistence potential = low</i>	Debate commencing with papers by Kareiva and Marvier (2012) and Soule (2013).

Note that the timeline represents the more formalized emergence of explicit versions of the framework, the underlying ideas have almost always circulated in implicit form for long periods.

TABLE 3 | Relationship between key values and conceptual frameworks (the dominant framework with respect to key values in bold).

Key values characterising the framework	Dominant framework	Associated framework		
Moral rights of wildlife and nature	Animal rights	Animal welfare	Deep ecology	
Animal well-being	Animal welfare	Animal rights		
Restoration of naturalness	Restoration ecology	Conservation biology		
Interdependence of humans and wildlife	Wildlife management	Deep ecology	Social-ecological systems	
Human/social benefits	Ecosystem services	Animal welfare (if benefits exceed suffering)	Heritage conservation	New conservation science
Indigenous knowledge	Biocultural conservation	Social-ecological systems	Deep ecology	Heritage conservation
Spiritual	Wilderness	Deep ecology		
Pristineness	Wilderness	Deep ecology	Rewilding	
Complexity and integration	Social-ecological systems	Deep ecology	Heritage conservation	
Instrumental needs	Ecosystem services	New conservation science	Animal welfare (if benefits exceed suffering)	
Intrinsic worth of species and nature	Animal rights	Restoration ecology	Conservation biology	Rewilding
Carrying capacity and resilience	Sustainable use	Wildlife management	Social-ecological systems	
Consumption	Wildlife management	Animal welfare (if benefits exceed suffering)		
Population control	Wildlife management	Sustainable use	Social-ecological systems	
Environmental maintenance	Conservation biology	Restoration ecology		

build on a selection of ideological and/or practical notions. The long lasting animal welfare tradition (e.g., Everett, 2001) has for centuries advocated that also non-human animals are sentient beings and that many animals have consciousness. At least early advocates based this on morality, pragmatic ideology, and utilitarian ideas (i.e., Singer, 1975), but the animal welfare tradition has gained support from science in later years (e.g., Dawkins, 2006). The movement began with a focus on domestic production, companion, and experimental animals, with only a recent expansion to embrace wild animals. At least some animal welfare considerations can be integrated with other frameworks. In contrast, animal rights frameworks stand almost purely on moral grounds (Regan, 1984), often with little grounding in modern science (e.g., Hutchins and Wemmer, 1986). This framework has over time resulted in sharp conflicts, violence, and speciesism (e.g., Carson et al., 2012). The animal rights framework generally leaves little scope for any other approach to animal conservation and management on moral grounds.

Wilderness, Rewilding and Deep Ecology: Removal of Human Agency

The wilderness paradigm is one of the older formalised frameworks and a land preservation concept originally coined in a western cultural construction arguing that man is an intruder into nature (e.g., Oelschläger, 1991; DeLuca and Demo, 2001). This proposition and framing based on a human-nature dualism has provoked many indigenous and rural cultures that view people as belonging as interactive elements within nature. Wilderness shares some of its philosophical grounds with the deep ecology paradigm through the emphasis on naturalness and human moral obligations to avoid leaving undue impact (Reed and Rothenberg, 1993). In recent years (1990s onward) there is

a clear line from wilderness and deep ecology to the rewilding paradigm with the focus on restoring wilderness and ecological integrity, and removing human agency (e.g., Drouilly and O'Riain, 2021). The operational boundary between restoration ecology and rewilding is fuzzy, as both frameworks strive to implement both active and passive management interventions. However, there is an important value distinction between the two in that rewilding actively argues that “wild” (in all its diverse meanings of the word but where removal of human agency is central) is a superior value over any other ecological variable, which again justifies a “no interventions” and a “let nature take its course” approach (Lorimer et al., 2015; Perino et al., 2019).

Recent Conservation Approaches: Confusion Over “Naturalness”

Some frameworks struggle particularly with the complexity of defining natural benchmarks. The conservation biology, restoration ecology and new conservation science frameworks, often indirectly, assume that nature can be brought back to natural and desirable states, but these frameworks also lack unambiguous frameworks and methods for defining which of multiple potential states should be the goal (e.g., Hobbs et al., 2006; Griffiths and Dos Santos, 2012; Higgs et al., 2014; Morse et al., 2014). Conservation biology in particular has been hugely influential on contemporary wildlife conservation and management, probably because it has managed to develop a fairly coherent framework that integrates biology, social sciences, and even art and education (Bennet et al., 2016). The key point for this group of frameworks is that an assumed idea of “naturalness,” i.e., a representation of nature that interests of power (influential stakeholders) can agree upon, justifies

management interventions on a landscape level (e.g., Bowman et al., 2017).

The Struggle for an Instrumental and Economic Justification

Recent decades have also seen the emergence of the importance of economics in conservation. The ecosystem services (e.g., Gómez-Baggethun and Ruiz-Pérez, 2011) and the new conservation science (e.g., Petriello and Wallen, 2015) frameworks both place human interests and benefits in the centre. Ecosystem services attempts the gargantuan task that no conservation or management paradigm has achieved, namely to integrate all tangible and intangible nature related values and benefits within one accounting system. With its conceptual basis in economic models, the idea has been to develop a yardstick of values that could guide virtually any type of resource management and policy decisions (e.g., Chan et al., 2012). Central to this concept is the idea that human well-being is the ultimate goal of successful resource management (Diaz et al., 2015). Hence, although the paradigm in theory recognises nature as having intrinsic values, it is in reality wholly instrumental and anthropocentric in its orientation attempting to include all the contributions of nature, positive, and negative to people such as diversity of organisms, ecosystems, and associated ecological and evolutionary processes. The new conservation line is even more explicitly anthropocentric and openly defies the idea that nature has intrinsic value (Miller et al., 2011, 2014; Soule, 2013). According to this paradigm, the contemporary biodiversity/sustainability crisis is too large and complex to include anything more than the most urgent human needs and interests, lest biodiversity conservation fail altogether.

Culture as Motivation for Conservation

Heritage and culture thinking has also influenced conservation and management frameworks in recent decades, albeit in different ways. Biocultural conservation and cultural landscape conservation both apply a suite of ideas from different disciplines in the natural and social sciences to the extent that they emerge as fairly fuzzy epistemological directions (e.g., Gavin et al., 2015; Ekblom et al., 2019). Biocultural conservation takes a more mechanistic approach to socio-ecological systems, yet with a heavy slant toward indigenous knowledge and practises (e.g., Bridgewater and Rotherham, 2019). Cultural landscape conservation places more emphasis on the role of history and views conservation as a dynamic process with a continuous negotiation and evaluation of priorities and key values. A key element in all these frameworks is that human activity, especially that which is defined as “traditional” or “indigenous” is actively valued as a part of nature, effectively promoting relational values with nature (Chan et al., 2016). This influences both the definition of conservation baselines (e.g., by recognising that human modified landscapes may have strong conservation values) and the appropriate role of humans in nature by supporting more interactive relationships (e.g., hunting, gathering, farming).

Sustainability; Interdisciplinary Science Shaped Through Policy

Sustainable use is perhaps the most heralded, most complicated and hardest to define conservation and management paradigm of recent decades (e.g., Mebratu, 1998; Constanza et al., 2007; Gore, 2015). It is certainly the paradigm that has attracted the most political attention since the 1970's. Although sustainable use is commonly referred to as a novel, integrating concept of recent decades, its key ideas stems from forestry, wildlife management, and other forms of natural resource management that have their roots in the nineteenth century, or even earlier. Its conceptual foundation can be loosely described as sustainability science which is a pragmatic conglomerate of natural and social science approaches at multiple scales (Kates et al., 2001). It is far easier to define the key ideas, indicators, and goals of this paradigm than its value- or conceptual foundations. However, the core of this paradigm is to avoid compromising environmental capacity in a long term perspective beyond what current public judgment deems acceptable. It is strongly informed and updated by available science, but ultimately finds its form through public and political policy processes. Recent papers have begun to merge aspects of sustainability science with ecosystem services and elements of biocultural conservation (e.g., Pascual et al., 2021).

Operational Indicators

For wildlife management purposes we are concerned with identifying the critical factors in coexistence frameworks. The question of what characterises conservation and management paradigms in a more operational sense is quite salient. This is also a question of how we actually recognise the grounds and motivations underlying political, ideological, and management expressions in policy or other forms of advocacy. The hunting—non-hunting dichotomy is perhaps the most obvious distinction relevant for wildlife. In the hunting category we find the wildlife management, sustainable use, ecosystem services, cultural landscape conservation, biocultural conservation, and new conservation science frameworks. In contrast, the animal rights, compassionate conservation, animal welfare, deep ecology, wilderness (but in some cases specific allowances are made for indigenous groups) and rewilding frameworks have little or no room for hunting practises as a legitimate activity. A less clear stance on the acceptability of hunting is found within the conservation biology and restoration ecology conservation frameworks. Here the main focus is on restoring species populations and ecological processes, but population control through hunting is in some cases seen as a necessary management strategy to achieve desirable states of “naturalness” and species diversity. However, both the legitimacy of hunting and its ecological impacts are contested within the pages of conservation biology journals.

Beyond the hunting—no hunting divide, a few other operational indicators can be identified (Table 2). These include positions on; re-introduction of species (wilderness, rewilding, restoration ecology, conservation biology), back-breeding, cloning, genetic engineering (rewilding), measures of stress, illness, and injury (animal welfare), expression and definition of animal rights and experiential values (deep ecology

and animal rights), changes in social learning and adaptive capacity (biocultural conservation), subsistence practises (cultural landscape conservation), hunting fees, wildlife tourism revenues, meat sales (wildlife management), monitoring of desired population levels of species (sustainable use, wildlife management), and economic cost-benefit evaluations (ecosystem services, new conservation science).

A final indicator lies in the location specificity of actions. Frameworks like wilderness, restoration ecology, rewilding, and heritage conservation are largely restricted to specific and limited areas of exceptional value with limited, or very specific forms of, human land use. In contrast, animal rights, animal welfare, compassionate conservation, deep ecology, sustainable use, biocultural conservation, ecosystem services, new conservation science and wildlife management are intended to be applied across a diversity of land use settings and the wider landscape. Conservation biology can find expression in both settings, as it focuses both on the limited extent of protected areas and on the wider landscape.

Value Differences

All wildlife management is embedded in social contexts (e.g., Manfredo, 2008). Management and conservation science proximately reflect beliefs about appropriate ways to value and rank the costs and benefits of keeping wildlife around, but ultimately reflect deeper sets of public values and ethical aspects of how we as humans interact with nature, and with each other. Recent debates and developments in different narratives of wildlife management and conservation reveal a complexity of underlying motives, attitudes, values, and beliefs in science as well as the rights of the non-human world. A major fault line runs between the animal rights/welfare community with a tendency to focus on individual animals' well-being or suffering, and several other groupings with a focus on ecosystems, populations and processes (e.g., Singer, 1975; Callicott, 1988, 1990; Hettinger, 1994; Light, 2002; Palmer, 2013; Dickman et al., 2015). Most of these debates demonstrate different social constructions of the (subjectively) preferred role of wildlife in society grounded in different ethical approaches. For instance, it seems we are currently witnessing an emerging doctrine of wildlife protectionism justified as compassion for wildlife (e.g., Treves et al., 2017; Wallach et al., 2018) which competes with the more traditional idea of stewardship through active management that underpins most western ideas of wildlife management. There is a long running debate about power and influence. Various individuals argue for a greater role of technical experts, the public, stakeholders, or appointed advocates to represent the interests of wildlife (Redpath et al., 2017; Treves et al., 2017). Likewise the fast growing debate over rewilding is also diversifying into more complex socio-ecological framings (e.g., Perino et al., 2019), and it appears that some groups use this essentially ecologically oriented narrative to argue that also humans should "rewild" their attitudes in the sense of being more reenchanted and reunited with nature (e.g., Bekoff, 2014). In other words, different attitudes toward the hunting/no hunting dichotomy as management tools, as well as disparate views of the different parts of the public as legitimate stakeholders run as

salient conflict lines through many of these debates (e.g., Treves et al., 2019a,b).

Ethical debates related to wildlife management often circle around disagreements between animal ethics on the one hand and environmental/ecological ethics on the other (Hutchins and Wemmer, 1986; Light, 2002). While animal ethics often focus on the sentience (ability to experience pleasure and suffering) and/or suffering of individual animals, it can also be about rights and justice. Environmental ethics places greater emphasis on populations, ecosystems and ecological processes. A major point of contention is the criteria for moral considerability and how to value nature, where some see the two ethical orientations as fundamentally incompatible (e.g., Singer, 1975; Faria and Paez, 2019), while others try to find some common ground (e.g., Callicott, 1988). For example, both schools of thought are often perceived as convergent fields collectively aiming to counter moral anthropocentrism, i.e., the notion that human interests should always be favoured over non-human interests. For our discussion of how ethical positions have shaped these conceptual frameworks, compatibility and coexistence potential in landscapes with wildlife and multiple other interests, the salient distinction is between the focus on the rights and welfare of individual animals and the prioritization of population viability and ecological functioning ("well-being") of the species and ecosystems which provide the prerequisite context for individual specimens (e.g., Palmer, 2013; Faria and Paez, 2019).

This schism springs out of different theoretical positions in environmental ethics (Palmer, 2013). Consequentialist approaches to wildlife management aim at producing the best possible outcomes and are often identified as utilitarianism, for instance bringing about optimal harvests, high levels of non-consumptive goal attainment (pleasurable experience of wildlife) or low levels of disease and suffering. Such approaches are also often more open to accepting a diversity of approaches adapted to local settings, in effect opening for ethical particularism. In contrast, deontologist approaches oppose the searching for best outcomes, since achieving flourishing or pleasure of populations of systems can come at the expense of individual suffering, and is therefore unjust and places unreasonable demands on individual specimens (Hettinger, 1994; Ramp and Bekoff, 2015). Deontological ethics argue that wildlife management should be guided by moral rules, principles and rights, or some combination of these, and not desired outcomes (e.g., Regan, 1984). Furthermore, there is often a tendency for these approaches to seek universalism, i.e. to apply the same rules across very diverse settings.

Compatibility and Coexistence Potential

History shows that conservation and management frameworks have not replaced one another as time went on. Most of the ideas of how we should manage wildlife that have emerged over time still seem to be out there with distinct schools of thought and supporters in different camps. With the lack of consensus and the resultant competition within and between frameworks, the question of compatibility of different frameworks becomes urgent. It is interesting to note that the domain of conservation and management frameworks have in no significant way matured

into any form of consensus and unity that can adequately deal with the complex human-wildlife interactions we are struggling with today. This begs the question of which framework(s) is/are best suited for a future human-wildlife coexistence perspective? However, it should be noted that while we have divided this complex field of ideas and values into 14 different frameworks, this is not a discrete classification. **Table 3** shows how we identify 15 key values that characterise the different frameworks, and how some of these values in some cases are found across more than one approach. Still, while some salient values are shared among some conceptual frameworks, this does not necessarily imply compatibility among the overall approaches (**Table 3**).

In fact, most of the conservation and management frameworks that we have conceptualised here demonstrate for various reasons limited, or even minimal, compatibility with each other. In our view, the sustainable use and socio-ecological systems approaches hold the greatest promise for future-proof coexistence frameworks, whereas animal rights holds the least promise (when applied to wildlife rather than the domestic/laboratory/companion animal contexts in which they developed). For the sustainable use paradigm the critical coexistence factor is the dynamic approach toward multiple goals (i.e., the Sustainable Development Goals) with high public and political acceptance as well as international institutionalisation. It is less preoccupied than several of the other frameworks with a narrow ideology, any particular set of values or moral rules, or notions of what constitutes the “correct” science. It can be organised to integrate indigenous, lay, and scientific knowledge, operates on different scales, and can provide specific directions to guide management actions under a diversity of situations, without attempting a one-size-fits-all approach. Recent papers within the field have been underlining the need to embrace value pluralism (Pascual et al., 2021).

The socio-ecological systems framework explicitly ties natural and social systems together and attempts to work against the traditional deconstruction of complex wildlife and conservation issues into separate disciplines or topics. This is perhaps the most holistic perspective of all the current frameworks, favouring complexity over simplicity and taking a transdisciplinary approach to problem solving. In wildlife contexts it is often human-wildlife conflict oriented and moves away from single species strategies. With a holistic framework that seeks to integrate social, psychological, cultural, and biological factors, we see potential for guiding the maturation of sustainable use, conservation biology, wildlife management and ecosystem services into more efficient, realistic, and legitimate management models.

We have chosen to characterise six conceptual frameworks as having a medium level potential for applicability to coexistence management models. Overall animal welfare proponents take a flexible approach to harvest control, and are more concerned with the humanness of techniques than principles. Restoration ecology resonates with other frameworks with explicit management objectives (ecosystem services, sustainable use, wildlife management), but has a specific strategy of achieving certain desirable environmental states—which can alienate or cause conflict with some stakeholders. Conservation biology

is an ecocentrically driven strategy with some shared baggage with restoration ecology and wildlife management, but has a relatively narrow focus on species and habitat restoration, which excludes multiple other interests. Wildlife management has a somewhat broader reach with multiple objectives on consumptive and non-consumptive wildlife values, but often limited or poor integration with other resource management objectives or broader societal nature values (especially the non-use values). Its traditional orientation toward one specific stakeholder group, hunters, is part of its baggage which it is trying to shake-off. Ecosystem services frames everything in anthropocentric and economic schemes, and struggles with value diversity (especially values not suited for monetarization). However, it can be fairly compatible with sustainable use and wildlife management, if it accepts hunting and harvesting as a set of provisioning and cultural services, and expands its frames to fully embrace the multiple ways of valuing the services, and disservices, associated with wildlife conservation in shared spaces (Brendin et al., 2015; Linnell et al., 2020).

We find the remaining seven frameworks to have less potential as frameworks for coexistence. They all have a rather narrow topical and/or ideological focus and too limited recognition of the legitimacy, value or usefulness of other frameworks. At the most extreme end we find the animal rights groups which often do not recognise other frameworks on moral grounds. We find this framing to be of virtually no use in operationalising human-wildlife coexistence. For example, it is not uncommon for thinkers in this field to argue that nature itself is not ethical because of the suffering inherent within natural processes (Bramble, 2021), thus rejecting both the non-human and human aspects of coexistence. The wilderness paradigm is likewise limited to conservation/preservation with the overall goal of securing space for natural processes, and has no room for multiple use or land-sharing. Deep ecology opposes any instrumental approaches and provides no direction for practical management goals in shared landscapes. Heritage/cultural landscape conservation is driven by a cultural value bias, and provides little strategic guidance for solving land use management or complex conflicts. Yet, it carries some relevance for wildlife management since it views hunting as a cultural practise and a way of maintaining traditional forms of interaction with wildlife. Furthermore, traditionally used landscapes may retain high value for biodiversity in some cases.

The rewilding and new conservation science frameworks both represent rather extreme expressions of wildlife value priorities, but in totally different directions. Rewilding shares some of its ideological baggage with the wilderness and restoration ecology traditions. Its origins are linked to achieving former, and sometimes idealised, ecological states without human influence (e.g., Donlan et al., 2006), and hence runs the risk of neglecting the human dimensions and diversity of views among stakeholders that always need to be reconciled. Proponents do not often acknowledge multiple land uses or land-sharing as alternatives. Some emerging forms of rewilding are more pragmatic, but then differ little from other frameworks such as restoration or conservation biology (Hayward et al., 2019). The new conservation science line of thinking can

be seen as an extreme extension of the ecosystem services paradigm in the way it simply shortcuts the multiple use/value plurality discussion by excluding any non-human needs or values on the basis of unmanageable complexity and dearth of time to achieve sustainability. In the face of conflicts, new conservation science could in theory reject the goal of conserving wildlife at all. We would argue that neither rewilding nor new conservation science carry any noteworthy potential as frameworks in future coexistence frameworks in dealing with wildlife in complex landscapes.

However, considering that landscapes consist of a diversity of land-use zones which often include various categories of protected areas it is clearly possible for some of these other frameworks to achieve greater relevance within limited areas, such as formally protected areas, or on private lands whose owners wish to adopt specific management approaches. For example, heritage/cultural landscape approaches can guide land-use and wildlife management decisions in landscape protection areas, and it is possible for rewilding or wilderness approaches to guide management of core areas of nature reserves and national parks. It is only the animal rights approaches that find no place in any point of the landscape because even national parks often implement various forms of wildlife population control or reintroduction, which is equally opposed by many animal rights groups.

HOW DO WE ADVANCE THE DISCUSSION ABOUT COEXISTENCE OF HUMANS AND WILDLIFE?

Most of the ideas about how to manage wildlife that have emerged through history are still circulating in public and professional debates. The complexity of structured ideas, interests, and opinions has increased since the early 1900s, although some of these ideologies and ideas go much further back. Diversity in frameworks and conflicts between them have increased significantly since the 1970–80's. One might expect that the field would gradually reach some agreement on the major goals of wildlife management and on how to reach them, especially in light of the enormous explosion in knowledge within the natural sciences, social sciences and humanities that has appeared in recent decades. Alas, this has not been the case. Rather than reaching unity where older frameworks evolve into newer versions with higher goal attainment and improved efficiency and legitimacy, while older frameworks are quietly allocated to the shelves of history, current wildlife management appears to be ablaze with more strife, schism, conflict, and disagreement over the appropriate strategies than ever before. Then again, perhaps a core issue is that several of the frameworks do not actually have much interest in wildlife management and/or are only marginally involved in wildlife issues.

Much of the reason for the lack of unity comes from major disagreements over underlying values and ethics, and whether policies should be norm or rule based (deontological) or guided by pragmatic approaches to reach desirable outcomes

(consequentialism). There is also conflict over the degree of scope for context dependence and variation (universalism vs. particularism or monism vs. pluralism). The major distinction runs between proponents of animal ethics, which tend to be framed within principled or rule-based approaches and proponents of environmental ethics or ecological ethics which tend to be associated with concerns about outcomes. Although some scholars have tried to argue that there are points of common interests and hence a certain compatibility, their differences largely appear irreconcilable due to the fundamentally different notions of morality and rights of non-human animals and the importance of ecological systems vs. individual animals. Interestingly, while both environmental ethicists and animal ethicists argue incompatibility between the two ethical orientations, they sometimes land at the same conclusion for exactly the opposite reasons, namely different definitions of which subjects or entities that are worthy of moral considerations. Rewilding is a good example as both “camps” advocate a return to a more pristine and natural environment with as little human involvement as possible. Environmental and ecological ethicists arguing for rewilding are motivated by protecting or re-establishing the larger system, while animal ethicists are concerned with the individual animals and value the removal of human agency.

It is hard to see how animal ethics can be a viable platform for contemporary wildlife management frameworks in coexistence landscapes for two major reasons. First, the monistic focus on “individual animals” rights and suffering is incompatible with the broader focus and functioning of larger ecological systems in environmental ethics. This is a major schism in how nature and wildlife is valued. Animal rights advocates strive to reduce the suffering of individual animals, and cannot accept that the importance of system functioning may incur costs and suffering to individuals. This is a biologically illiterate approach that mistakenly equates the well-being of animals with the absence of suffering. Some have argued that animal rights positions even lead to a rejection of nature (Hettinger, 1994) since many natural processes like predation, disease, density-dependent food limitation and climate driven fluctuations in available food sources lead to suffering. An extreme version of this is a recent suggestion to genetically modify carnivores so that they turn into herbivores, or alternatively killing them painlessly since it may be the obligation of humankind to prevent suffering among animals (Bramble, 2021).

Second, this essentially boils down to monism vs. pluralism in values and contexts (Pascual et al., 2021). Animal ethics is primarily concerned with sentience and the possible suffering of individual animals, and thereby rejects other potential values attributed to wildlife depending on contexts. Various forms of environmental ethics open up for valuing wildlife at multiple scales from species to ecosystems, as well as pluralism in contexts and a diversity of value attribution. Value pluralism and coexistence models fitted to local cultures and contexts are essential in modern democracies where policy and management strategies will only be successful in the long run if they are products of negotiations among multiple stakeholders (Jensen et al., 2011; Bauer et al., 2020; Redpath et al., 2017; Drouilly and

O'Riain, 2021). Unfortunately, actually attaining value pluralism is a wholly different matter than identifying the need, as long as we witness a continuing social and political battle between ideology, deeply entrenched beliefs and science. How to reach a wider space for value pluralism in wildlife management is no doubt one of the key questions for future research, but also clearly needs to be seen together with similar struggles across a range of social issues including immigration, taxation, and LGBTQ policies.

Most of the conservation and management frameworks we have sketched out here have limited compatibility with other frameworks as long as we are talking in broad terms about larger landscapes, i.e., environments on a regional scale. Some frameworks such as animal rights, wilderness, deep ecology, rewilding, and new conservation science, all of which are grounded more on narrow ideologies than science, often reject other approaches to conservation and management as either morally unjustified and/or lacking of understanding of the most salient issues. By building walls against other schools of thoughts and sometimes even taking aggressive stances against reflection and deliberation around how to solve conflicts, they render themselves of limited use to current wildlife management challenges in a coexistence perspective. That is not to say however, that they don't have potential in carefully zoned and differentiated landscapes. We consider this an issue of scale; in a large reserve or multiple use area careful planning should theoretically be able to make room for a range of ideologies, value sets and management goals. That said, we are the first to acknowledge that protected areas globally are rife with conflicts and tensions between wilderness and preservationist orientations and biocultural and cultural heritage proponents, as well as conflicts between land-owners, local residents and national authorities (e.g., Grodzinska-Jurczak and Cent, 2011).

On the positive side, several frameworks show some promise and potential for promoting coexistence since they in various ways contain ideas and mechanisms that can guide cooperation. However, we only really find that one or two frameworks contain the breadth, flexibility, integrative, and cooperative nature and sufficient emphasis on research based knowledge. At the moment we opt to put our money on the sustainability paradigm and social ecological systems as the best options for future coexistence in shared landscapes.

Management and Policy Implications

There is an urgent need to figure out what distinguishes frameworks from one another in a practical way. We have identified a number of crude indicators in this review, but several are difficult to operationalise. The main divide seems to be about killing—or not killing animals. The problem here however, is that we know little about what the public in general (i.e., a long list of stakeholders) as opposed to academic framers of ideas think about killing wildlife. We need to know much more about the extent to which lay people adopt consequentialist or deontological ethics in their thinking about wildlife, and how they embrace pluralism. In other words—is the public concerned about the moral worth of the outcomes of management or simply judging the principles behind strategies and actions? There is

also much scope for exploring the dynamics of divergence between frameworks through the same frameworks that are used to explore religious schisms (Finke and Scheitle, 2009) or organisational schisms (Gorup and Podjed, 2017).

We find it premature and unrealistic to suggest a single, specific framework for future wildlife management, and it is unlikely that the field will agree on a unified approach in the near future. The way wildlife management is performed is a reflection of the embedding cultures, negotiations between value orientations and world views, competing political interests and the larger power struggles that exist in society at any given time. Considering the diversity in values, ethical platforms, and vested interests that surely will continue to characterise environmental issues in the foreseeable future, we recognise wildlife management as an evolving “wicked problem.” There will be few, lasting clear-cut solutions. Rather, we will see a demand for multisectoral decision making, innovative approaches and diversity in tools and geographic adaptations (DeFries and Nagendra, 2017; Mason et al., 2018). Furthermore, we must expect that the wildlife management field will face new challenges demanding growing attention such as zoonotic diseases and biosecurity (Chaber and Saegerman, 2017; Garcia-Diaz et al., 2017). These are not new questions to the wildlife field, but they are re-enforced by the covid pandemic (Roe et al., 2020) and will be increasingly important for other sectors such as the livestock-, food-, and health industries as a facet of the agriculture/wildlife interface. In fact, the emerging One Health approach with its origins in veterinary science (and its associated traditions, values, and sets of ethics), is rapidly emerging as a framework of increasing relevance for wildlife management.

We concur with those who argue that we need to develop or form a anthropocentrism with positive connotations for strategic purposes, since anthropocentric arguments for environmental protection are much more likely to be successful than non-anthropocentric ones. Furthermore, if anthropocentrism is sufficiently reflective, it can embody enough concerns and interests to in practise forge some convergence between anthropocentric and non-anthropocentric policy (Palmer, 2013). In dynamic and complex wildlife settings, environmental pragmatism characterised by methodological pluralism, i.e., policies allowing room for different theories and values, are much more likely to succeed than rule-based monistic approaches. In shared landscapes, there will always be diversity and disagreement among stakeholders who collectively form a coalition of value positions. If we embrace methodological pluralism and reject universalist and deontological approaches, the objective for policy becomes a task of developing common recommendations and areas of convergence in shared landscapes, although different interests have varying reasons for doing so. We believe that this should be possible to some extent for several of the frameworks we have examined here in a zoned landscape. Many wildlife habitats comprise both protected areas and multiple use landscapes. So there is room to accommodate different values and ethical positions—but in different places in a zoned landscape. It will however, require the acceptance of methodological pluralism and environmental pragmatism.

Finally, although we argue for pluralism we also caution against “moral relativism,” i.e., the notion that culturally distinct values cannot be judged against one another, and are therefore all equally valid (Dickman et al., 2015). Unbounded cultural relativism opens up for an “anything goes” strategy that will undermine efforts to merge concepts and approaches into management frameworks with higher public acceptance. The one thing we can be certain about however, is that the diversity of views among the public is growing. Wildlife management is increasingly stretching out beyond the realm and control of professionals, and our understanding of needs, perceptions, and wildlife values must increasingly embrace those of the greater public. Wildlife conflicts always have roots in deeper social structures that shape attitudes and behaviour. We strongly believe that future coexistence frameworks have a great need for better understanding the diverse ethical platforms supporting the diversity of stakeholders involved in wildlife issues.

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DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

BK conducted most of the research and wrote the first draft of the manuscript. JL discussed framing of article, main ideas, and co-wrote subsequent drafts of the manuscript. All authors contributed to the article and approved the submitted version.

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Coexistence for Whom?

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This perspective essay considers ethical and conceptual questions around who coexistence is for, who it affects, and who is to make it happen. The introduction considers some approaches to thinking about human-wildlife coexistence, debates on the utility of the concept and reasons for its current emergence into the mainstream. It next outlines the preliminary conception of coexistence informing this essay. The discussion considers challenges for a narrow conservation-oriented framing of human-wildlife coexistence, and offers insights from the literatures on stewardship and relational values for tackling these.

Keywords: coexistence, wildlife, conservation, diversity, human-wildlife interactions

INTRODUCTION

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This perspective essay considers approaches to, and debates about human-wildlife coexistence. It examines reasons for the emergence of coexistence into mainstream conservation research, and outlines the conception of it underlying this essay. The discussion considers challenges for a narrow conservation-oriented framing of human-wildlife coexistence, asking questions about culture, difference, and wildness. It draws on ideas from the literatures on stewardship and relational values as a means for widening the focus of human-wildlife coexistence studies to better address these challenges.

The Concept of Coexistence

The concept “coexistence” is neither novel nor recent, but it has emerged into the mainstream of conservation research over the past decade (Madden, 2004; Carter and Linnell, 2016; Nyhus, 2016; Frank and Glikman, 2019) as a significant orientation in thinking on human-wildlife interactions, itself a reframing which emerged a decade ago to recognize the limitations of a conflict framing (Peterson et al., 2013). The term is very much in play conceptually, with no fixed theory, definitions or principles—or even agreement that these would be useful—though some formulations exist (e.g., Carter and Linnell, 2016; Loring, 2016). Indeed, the strength and popularity of the concept may well lie with its plasticity at this point.

Key aspects of the growing popularity of the concept appear to be linked to a movement away from a focus on negative interactions with wildlife (Frank and Glikman, 2019), an increasing openness to Indigenous and local peoples’ ways of valuing and interacting with wildlife (IPBES, 2019), and a recognition of the limits of economic and instrumental measures to explain and prevent conflicts (Pooley et al., 2017). There is also growing recognition of the agency and sentience of animals and hence the necessity of proper consideration of their rights (Wallach et al., 2020).

The concept offers the potential to stimulate a step-change in thinking on human-wildlife interactions. In this context, coexistence may be a more productive concept if it is not prematurely constrained by a strict definition. It may be more usefully mobilized, for the time being, as a conceptual framework for investigating which ideas, approaches and stakeholders are relevant to holistically studying and facilitating human-wildlife coexistence.

This could follow Ostrom and Cox's (2010) conception of frameworks being used to provide theories with the general classes of variables necessary to explain phenomena. The aim would be to scope the terrain then work toward mid-level theories, avoiding either excessive generalization or limitations arising from studies of individual case studies regarded as unique. A unified survey of case studies could yield a coexistence framework, with primary entities (e.g., actors, governance systems) and associated attributes, these used to analyze different human-wildlife interaction challenges and scenarios in order to discover the most effective social-institutional responses to them. It seems likely that, as Ostrom (e.g., Ostrom and Cox, 2010) found, there are no specific rules that persist across all systems (see Zimmermann et al., 2021 on this for human-wildlife conflict). Instead, a set of design principles may be more productive, providing they work across multiple levels: of governance, policy, management, and research.

A few challenges appear noteworthy. Ostrom's social-ecological systems framework (SESF) perspective on natural systems is anthropocentric and focused on natural resources. Factoring in wild animals requires consideration of their agency and dynamism. Further, attempts to delimit a stable list of key SESF variables have not succeeded. There is neither a cohesive approach for adapting the framework for diverse contexts, nor general guidelines for applying it (Partelow, 2018). These problems are likely to confront any attempt to devise a framework for coexistence.

Alternatively, coexistence could be conceived of as a boundary object (Star, 2010) for facilitating synergy between different disciplines, sectors and worldviews on how best to facilitate sharing of landscapes between humans and wildlife. This will be explored a little further below. But before doing so it seems worthwhile to ask: is coexistence even a new idea, and why is it attaining prominence now?

Old Wine in New Bottles?

Some might argue that "coexistence" refers to ideas that have been around for decades in conservation circles, most notably "tolerance," "acceptance," and "cohabitation." Certainly, there are commonalities between some reasons for the emergence of "human-wildlife conflict" studies in the late 1990s (Mesmer, 2000), and now "human-wildlife coexistence" studies. Both are responses to concerns over increasing encounters between humans and wildlife, and conflicts over these, and both factor in human behavior. What is perhaps forgotten is that increasing encounters were recognized to emerge from successful conservation measures (notably from the 1970s) achieving increasing abundance of protected wildlife. This brought a recognition of the importance of human dimensions and of the responsibilities of conservationists for responding to negative impacts of potentially dangerous and destructive wildlife (Mesmer, 2000; Woodroffe et al., 2005; Manfredo, 2008).

An analogy for denying "coexistence" is novel is saying that: "global environmental change" has been a major topic for environmentalists since the 1980s, therefore the Anthropocene is not a novel concept. But the Anthropocene refers to a qualitative shift (acceleration) in global environmental change, and by

the early 2010s it had become a kind of cultural meme—in a metaphorical, not a biological sense (Voosen, 2012).

Likewise, "coexistence" is emerging in conservation and public discourses (at least, in the USA, Canada, some European countries and global south countries like Brazil and India) to capture a sense of heightened jeopardy in an epoch of accelerating extinctions resulting from intensifying human interventions in the natural environment. The concept is linked to a commitment to transforming how we deal with human-wildlife interactions in an epoch in which we will be increasingly forced to share space and resources, and acknowledges our shared biological inheritance and vulnerabilities to species-hopping diseases (Frank and Glikman, 2019; König et al., 2020).

In parallel with recent developments in human-wildlife conflict studies (Pooley et al., 2017), there is an increasing reaction against anthropocentrism, albeit from different directions, e.g., strong ecocentrism based on ideas about universal principles and the rights of animals (Vucetich et al., 2018), and recognition of different cultural frameworks for valuing and interacting with the natural world (Chua et al., 2020; Nijhawan and Mihu, 2020; Nair et al., 2021; Oommen, 2021). There is some tension at the heart of human-wildlife interactions studies, then, over how to reconcile an increasing commitment to recognizing and protecting the rights of the natural world, with a commitment to equity and recognition of local and Indigenous human ways of being in the natural world. The idea of coexistence with wildlife offers an opportunity to tackle this apparent contradiction.

Elements of Coexistence

Coexistence at the most basic level requires the persistence of humans and wildlife in shared spaces, with tolerable costs to both (Carter and Linnell, 2016)—recognizing that tolerance is subjective, difficult to assess in its indirect impacts, and perceptions of it vary (Slagle and Bruskotter, 2019). Coexistence, then, is about land sharing, not land sparing. It is, in the context of this discussion, what an emerging group of conservation-oriented people want. That is, conservationists should be self-reflexive about framings of coexistence; it is a normative concept.

Conservationists generally conceive of coexistence as more than tolerance; it is regarded as something more like stewardship, implying notions of care. As such, we need to remain alert to who decides on what or whom requires care, in what ways, and by whom will care be exercised—and what this implies for the objects of care, and for others impacted by such measures (Chua et al., 2020; Rubis and Theriault, 2020). Conservation as a sector has a long history (and continuing legacy) of colonial interference with local livelihoods and relations with wildlife, and displacement of locals in the name of caring for wildlife (Brockington et al., 2008; Dowie, 2009; Domínguez and Luoma, 2020). And while the emerging focus on compassionate conservation (Wallach et al., 2020) has much to recommend it, we should not allow it to foreclose on other kinds of relations and interactions that local peoples have with potentially dangerous and destructive wildlife (Smith, 2020). These may be as legitimate, in context, as the conservationists' desired relations of care and compassion.

Coexistence does not imply an absence of conflict, but rather a sustainable though dynamic state of coexistence where inevitable negative interactions are effectively governed in socially legitimate ways (Carter and Linnell, 2016). That is, agreed upon laws will play a part in regulating interactions. However, ideally coexistence ought to be (wherever possible) mutually agreed upon and facilitated, rather than enforced (Pooley and Redpath, 2018). Humans as well as wild animals should have agency and reasonable freedom to choose how to behave in shared landscapes (Marris, 2021).

Coexistence work goes beyond transforming conflicts related to species of wildlife regarded as priority species by conservationists. It considers more holistically challenges (and opportunities) of living with wildlife of all kinds, in all kinds of places. The work is conceptual and descriptive but also action-oriented: how do we collaboratively and adaptively intervene to enable positive interactions at a landscape scale, not just focus on preventing negative reactions in specific locales and scenarios (Marchini et al., 2019).

Costs and benefits of sharing landscapes with wildlife matter (Barua et al., 2013; Linnell et al., 2020). However, the focus in coexistence studies has thus far been on conceptually reframing human-wildlife interactions to include positive or neutral interactions. There are few case studies of positive human-wildlife interactions. Ideally, future studies will include a focus (not exclusively) on particular positive interactions and relations. This will extend beyond direct impacts of wildlife on humans and vice versa, and negative interactions, and look harder at non-rational factors influencing decision-making, including cultures and histories of human-wildlife interactions (see Pooley, 2016; Nijhawan and Mihu, 2020; Pooley et al., 2020; Agnihotri et al., 2021; Nair et al., 2021; Oommen, 2021).

Coexistence can be facilitated through action, or by restraint from action (what Bhatia, 2021 terms negative coexistence), the latter being more usual in coexistence scenarios, making it harder to observe, and study. Doing so requires interdisciplinary methodologies, alertness to colonial legacies in conservation thinking, and a transdisciplinary approach open to other knowledge systems and ways of valuing wildlife and the natural world (Datta, 2016; Bennett et al., 2017; Pooley et al., 2020).

Finally, coexistence is out there in the world already, in all its diversity, to be learned from. It exists independently of recognition and attention in the academic literature. It is perhaps best not constrained by strict definitions, or standards, or regulations dependent on these. Frameworks, principles and guidelines may have to suffice for the concept to evolve.

DISCUSSION

Beyond a Conservation Framing of Coexistence

The English word “coexistence” is of course an arbitrary sign attached to a variety of conceptions of human-wildlife interactions, and actual scenarios of interaction. Other languages may have a different word, or a phrase, for an analogous concept, and these vary in connotation. Zulu colleagues

translate “coexistence” variously as “*ukuphilisana nezilwane*” (Sifundo Sibiya, pers. comm. 2021) and “*ukuhlalisana kwabantu nezilwane*” (Abednigo Nzuza, pers. comm. 2021) both meaning something more like cohabitation than coexistence as outlined above (though “phila” means “live” but also “health”; so possibly “healthy living with”). Some languages may have no word for “coexistence”: cultures that don’t separate human and more-than-human worlds (Dwyer, 1994) may be baffled by the idea—believing that cohabiting landscapes and sharing moral universes with wildlife is intrinsic to life on Earth.

That being noted, the focus here is on some relatively neglected but important dimensions to the idea of coexistence. These mainly concern equity and the limits of a conservation framing. Many traditional societies have developed ways of living in their environments and interacting with wild animals in ways which have impacts which align with conservationists’ aims (e.g., Jones et al., 2008). They might be said to “coexist” successfully with wildlife. Does this mean that western conservationists are talking about the same thing as such societies when they talk about “human-wildlife coexistence” in the service of conservation? Do they share ethical conceptions of living with wildlife? Ethnographic research suggests; very often not (Dwyer, 1994; Nadasdy, 2005; Lopes and Atallah, 2020; Nijhawan and Mihu, 2020).

Some societies do not distinguish between cultural and natural worlds, and so lack a conservation ethic—but not environmentally-friendly approaches and attitudes to land use and interactions with wildlife. It is not that nature is socially constructed for them; rather, the entire landscape is one of human agency and interaction, and within the realm of ethical consideration and reciprocity (Dwyer, 1994; Appiah-Opoku, 2007; Ingold, 2012; Datta, 2016; Oommen, 2021). Does this matter? One reason it does is because the “human” in the “human-wildlife” equation conceals a host of differences in power, influence, economic, and cultural status.

How is coexistence to be fostered where it does not exist? Even where land sharing is the favored option, the usual approach in conservation has been for biologists to study the requirements of priority species to survive, make recommendations on how human behavior should be modified to accommodate these needs (with co-benefits where possible), and social scientists, policymakers, and local managers are then tasked with making this happen. Yet, as Chua et al. (2020) show, aside from the methodological disadvantages of this disarticulated approach, at its heart are particular conservation priorities (e.g., elephant or orangutan) which may not be priorities (or be actually problematic) for locals (Rai et al., 2019; Nijhawan and Mihu, 2020; Rubis and Theriault, 2020). Considering the well-being and priorities of locals, and collaborating with them in environmental planning and management in ways that benefit them and wildlife, are not simply the right thing to do; rather, doing so seems in many cases to be essential for ensuring conservation is supported and endures on the ground (Chua et al., 2020; Reed et al., 2020).

Learning from, and being open to, *difference* when it comes to human world views, values, knowledge systems and thus in human-wildlife relations, is very challenging (Datta, 2016; Pooley et al., 2020). Profound differences exist within

the ranks of conservation (Sandbrook et al., 2019), let alone between metropolitan supporters of wildlife NGOs, authorities of various kinds and levels, and locals who live with wildlife, for example. The same applies within Indigenous and local communities living with wildlife (Agrawal and Gibson, 1999). While some Indigenous or other local communities have profound cultural relationships with particular species (Uyeda et al., 2016; Gebresenbet et al., 2018), their neighbors may not, and while some cultural attitudes to particular species are positive, others are destructive (Chua, 2009; Mangunjaya and McKay, 2012; Pooley et al., 2020).

Further, cultures are dynamic, and do not provide static timeless ways of relating to and interpreting the natural world (Dickman et al., 2014; Bobo et al., 2015; Agnihotri et al., 2021; Oommen, 2021). What of people who abandon their traditional beliefs and practices (willingly or through force of circumstance), or hybridize them with other practices, in ways inimical to conservation (Nadasdy, 2005; Dickman et al., 2014)? Or what of animals that become habituated to humans (Birke, 2014)? Will these humans and animals be excluded from conservation considerations as in some sense “inauthentic” or unethical?

Working in different cultures may involve interacting with communities with quite different ideas about authority, age cohorts and gender, decision making and how to organize society. Significant power differentials must be recognized between well-funded, highly trained foreign conservationists, in-country urban elites, international and local NGOs, and impoverished rural communities, for instance (Chua et al., 2020; Rubis and Theriault, 2020). In studying coexistence, taking the time to reflect on these complications—on the values, beliefs and ideas framing human-wildlife interaction research on one level, and also on the resources, actions, and interactions bound up in the *process* of doing conservation—seems vital, and yet challenging to make time for in the face of the current biodiversity crisis (Datta, 2016; Chua et al., 2020; Pooley et al., 2020).

Finally, there are questions about wildness. This is too entangled a debate to enter into fully here (see Marris, 2021), but necessary to mention in one respect: to what degree do the requirements of coexistence impinge on wildness, regarded as autonomy from external controls on behavior (*sensu* Kaye, 2015)? Are there degrees of wildness, or should we rather think of co-adaptation of free agents in shared landscapes (Carter and Linnell, 2016)? If the latter, ethologists need to widen their foci to include human-wildlife interactions in shared environments, something they have traditionally avoided doing (Birke, 2014). Will assessing human-wildlife coexistence then be something to assess quantitatively as degrees of interaction? This seems intuitively to be something for qualitative assessment, which will vary from more-than-human-community to more-than-human-community, but as academics like to say, further, research is necessary.

Stewardship and Coexistence

One way of addressing these several challenges may be to focus on consideration of who coexistence is for, who is implicated in it, and who is responsible for it? Emerging literatures

on stewardship, and relational values, may provide useful perspectives on the agency of conservationists in such scenarios.

Ideas about stewardship have emerged in sustainability science for thinking about how to shape social-ecological change in ways that recognize complexity, plurality, and the need to support social and ecological resilience and well-being (West et al., 2018). Such ideas have recently entered mainstream conservation thinking (Pascual et al., 2021). West et al. (2018) propose that stewardship can be mobilized as a boundary object to enable diverse research disciplines, and non-researchers, to collaborate on mutual challenges without requiring total agreement on definitions. Coexistence might also be usefully mobilized in this way.

We live in a time of growing recognition of the importance of the stewardship shown by Indigenous and local peoples in preserving biodiversity, and recognition of notable overlaps in biocultural diversity (Appiah-Opoku, 2007; Garnett et al., 2018; ICCA Consortium, 2021), though efforts by conservation organizations to incorporate traditional peoples and approaches have some way to go (Reed et al., 2020). This recognition enables a move beyond established definitions of stewardship which emphasize either human recognition of the intrinsic value of nature, or human valuation of nature as useful (instrumental value). These are abstractions, and research suggests that in fact stewardship *actions* emerge in the context of particular reciprocal relationships between human and non-human life in specific places (Barthel et al., 2013; West et al., 2018; Nijhawan and Mihu, 2020). It is these sorts of actions—or their absence—in particular places, that are of interest to human-wildlife coexistence studies.

Chan et al. (2016) describe relational values as a normative human sense of kinship with other living beings, bound up with notions of belonging, care, identity, and responsibility. These are both shared by various human stakeholders in particular conservation scenarios, and differ in their natures, origins, and commitments. Enqvist et al. (2018) propose a framework for thinking about three dimensions of stewardship which may prove useful for thinking through these shared and differing dimensions of coexistence (wildlife with humans, and humans with humans and wildlife). These dimensions are: care, knowledge and agency.

Care concerns the motivation to look after something, informed by emotions, meanings, preferences, and a sense of responsibility. Knowledge concerns the ways of knowing, skills and information informing stewardship actions. Agency concerns the abilities, capacities of individuals, communities, and organizations to affect change, as well as the possibilities and limitations provided by the biophysical context and material technologies available (West et al., 2018). To the latter should be added the presence and agency of non-humans.

Care in particular seems pertinent as it sits at the root of motivations for (or justifications of) stewardship. The way it is expressed tends to determine the kinds of knowledge applied, and what kinds of agency are considered legitimate. It is normative: deciding what is best for the target of care (and what the target should be, and encompass). It therefore requires reflection on the biopolitics of intervening to conserve, preserve and sustain

life: human and non-human (Chua et al., 2020; Reed et al., 2020; Rubis and Theriault, 2020).

Finally, assuming care is determined only by humans is limiting: relational thinking acknowledges the role of the environment, and other beings, in *eliciting* care (West et al., 2018). One conception of coexistence emerging from the environmental humanities and ethnographic research focuses on humans and wildlife as co-constitutive communities (Lestel et al., 2006; Van Dooren, 2019). For example, considering how human individuals and groups' commitments to particular animals, species, and landscapes are co-produced through interactions with those non-human actors, in particular places (Nijhawan and Mihu, 2020; Oommen, 2021). This includes an acceptance that wild animals learn, have cultures, and adapt to particular scenarios of interaction with humans, which is belatedly being recognized in mainstream ethology (Brakes et al., 2019).

CONCLUSION

This is a call to widen the aperture on what to consider when thinking about coexistence with wildlife. Doing so is challenging in that it requires embracing difference and acknowledging power differentials and dynamics. This means being open to new epistemologies, methodologies, ways of valuing, and interacting with nature and wildlife. While it should not distract attention from the hard-won acceptance of more holistic approaches to human-wildlife conflicts in mainstream

conservation efforts (Pooley et al., 2017), it involves broadening our considerations beyond a conservation science framework focused on preserving priority species and populations (Marchini et al., 2019). Considering coexistence involves acknowledging the limitations of a conservation framing on deciding which species matter, introducing reflexivity about who enacts and who is left out of conservation policies and actions, and considers the effects of all wildlife (including abundant, introduced and "pest" species) on humans and vice versa. It requires facing up to the tension at the heart of conservation between a devotion to purity and to diversity, and between an ethical commitment to scientific approaches to saving a fast disappearing natural world, and recognizing other ways of being in that world and the rights of local and indigenous peoples.

AUTHOR CONTRIBUTIONS

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The Arts of Coexistence: A View From Anthropology

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In this perspectives essay, I propose some ways in which current thinking in anthropology might inform the emergent cross-disciplinary field of coexistence studies¹. I do so following recent calls from within the conservation science community (including this special issue), acknowledging that understanding human-wildlife coexistence in the fractured landscapes of the Anthropocene² requires being open to alternative approaches beyond conventional frameworks of conservation science and management (see for instance; Carter and Linnell, 2016; Pooley, 2016; Chapron and López-Bao, 2019; Pooley et al., 2020). The essay suggests that relational (non-dualist) ways of thinking³ in anthropology, often building on Indigenous philosophy and expertise, may help ground coexistence studies beyond Euro-Western modernist conceptual frameworks—frameworks that perpetuate exploitative and colonial logics that many scholars from across academia view as being at the heart of our current ecological crisis (e.g., Lestel, 2013; van Dooren, 2014; Tsing, 2015; Todd, 2016; Bluwstein et al., 2021; Schroer et al., 2021). By proposing “relations” rather than objectified “Nature” or “wildlife” as the more adequate subject of understanding and facilitating coexistence in shared landscapes, I understand coexistence and its study first and foremost as an *ethical* and *political* endeavor. Rather than offering any conclusive ideas, the essay’s intention is to contribute some questions and thoughts to the developing conversations of coexistence studies scholars and practitioners. It does so by inviting conservation scientists to collaborate with anthropologists and take on board some of the current thinking in the discipline. Amongst other things, I suggest that this will help overcome a somewhat dated notion of cultural relativism—understood as many particular, cultural views on one true objective Nature (only known by Science), a perspective that explicitly and implicitly seems to inform some conservation science approaches to issues of culture or the “human dimensions” of conservation issues. Ultimately, the paper seeks to make a conceptual contribution by imagining coexistence as a dynamic bundle of relations in which the biological, ecological, historical, cultural, and social dimensions cannot be thought apart and have to be studied together.

Keywords: anthropology, conservation, coexistence, relationally, more-than-human ethnography

¹The title ‘Arts of Coexistence’ derives from a collaboratively organized workshop of the Oslo School of Environmental Humanities and the EASA network Humans and Other Living Beings, organized together with Ursula Münster and Hugo Reinert at the University of Oslo in May 2019.

²Given the cross-disciplinary readership of this journal, I use the term Anthropocene throughout this essay as it has already brought forth conversation across disciplines and beyond academia. I do so in awareness that the term has acquired many meanings and its usefulness is contested. For an overview of debates relating to the term, see <https://feralatlas.supdigital.org/?cd=true&bdtext=what-is-the-anthropocene>.

³Thinking through relations, rather than dualist distinctions, does not mean to imply a harmonious, symmetrical or ‘positive’ state of affairs. A focus on relations includes issues of detachment, rupture, violence and exclusion as much as of engagement, connectivity or kinship.

MORE-THAN-HUMAN ANTHROPOLOGY

In order to bring greater clarity into the potential role of social scientific approaches relevant to conservation science and management, Bennett et al. (2017) present an overview of different types of social science disciplines. In the article, the authors describe environmental anthropology as primarily concerned with the study of “culture” and how it “mediates” peoples’ understanding of the “natural,” “biotic” world. While this description is not necessarily wrong, today its basic relativist principles would probably not hold without being challenged on conceptual and political grounds. For the sake of future cross-disciplinary conversations, it deserves some qualification.

Anthropologists, as the name implies, have traditionally been concerned with understanding the social and cultural practices of “humankind” and have therefore centered on human activity in the way they approach research topics and analyse ethnographic materials (see for instance Noske, 1989). Thus, while other living beings have always been part of these studies, they have been included based upon their function for human culture, such as their symbolic or subsistence value. In recent decades, however, the discipline has seen increased calls to open the discipline up “beyond the human” and to regard other species not only as “objects” within human society but rather to investigate their active role as participants in social worlds that they share with diverse human communities (e.g., Lestel et al., 2006; Ingold, 2013; Tsing, 2013; for overviews see Kirksey and Helmreich, 2010; Ogden et al., 2013; Locke and Münster, 2015).

A central role in what has been termed the “more-than-human” or “multispecies turn” in anthropology is played by the knowledge, expertise and philosophy of diverse groups of Indigenous people (Sundberg, 2014). Especially Indigenous notions of more-than-human personhood, sentience and sociality have fundamentally shaped the work of anthropologists interested in rethinking the central categories we use to understand and act within the world. Taking Indigenous and other local peoples’ worlds seriously in and of themselves, without reducing them to one of many possible perspectives on a unified, external Nature, has been central for approaches that seek to question what constitutes reality in anthropological discourses and scientific knowledge practices more broadly (e.g., Todd, 2014, 2016; de la Cadena and Blaser, 2018)⁴. It has also led to the question of how the conceptual, methodological and ethical principles of anthropology may ultimately be transformed, if we open analysis to questions of more-than-human sociality (Ingold, 2013; Tsing, 2013) and meaning-making (Kohn, 2013; Schroer, 2019).

Foundational work that seeks to rethink human-animal and human-environment relationships, and that builds on narratives

⁴By using the terms Indigenous, local and Euro-Western to describe different knowledge practices involved in conservation, I am aware of the risk of implying a sharp division between them. This is not my aim. I follow Sundberg (2014) in highlighting that epistemes interact ‘across time and space’, yet I keep the terms in order also to point to their situated and particular characteristics. Especially the term local knowledge is unsatisfying as it may imply the existence of the opposite ‘universal knowledge’ in the form of Science. I maintain the term while keeping in mind that all knowledge including scientific discourse is always situated (Haraway, 1988).

and practices of Indigenous people, especially in the circumpolar North, stems from anthropologist Tim Ingold. Ingold suggests an understanding of human-nature relationships that acknowledges the inherent co-constitution of person and organism, of the cultural and the natural (Ingold, 2000). From his approach it follows that environments and landscapes are not mere (passive) material backdrops for human and animal interactions, but rather play a constitutive role for the diverse ways in which humans (and other-than-human animals) perceive, relate and respond to the world. Together with anthropologist Gisli Pálsson, he uses the term “biosocial becomings” to describe human life as always being caught up in a relational matrix in which the social and the biological cannot be separately understood. They argue for a more integrative approach in academia that overcomes the split in the division of labor between the natural and the social sciences (Ingold and Pálsson, 2013).

In a similar vein, anthropological work inspired by feminist science studies scholars, such as Donna Haraway (2008), has variously critiqued the idea of human exceptionalism which places humans endowed with language and culture outside and above the realm of animal lives and nature. In this context, anthropologist Anna Tsing (2012) has argued that human life is essentially an inter-species affair, meaning that anthropology’s central question of what it means to be human cannot be answered without acknowledging the importance of other living beings in the lives of humans.

This rethinking of dominant narratives of how we imagine peoples’ relationship to the more-than-human world has also led to renewed interest in the concept of domestication (and related terms such as wilderness) in recent anthropological debates with relevance to coexistence studies. In an edited collection, for instance, Lien et al. (2018) show that the origin story of domestication has been imagined through binary couplings such as savage and civilized, domestic and wild, nature, and culture. The history of domestication, the authors argue, is closely intertwined with racial and gendered hierarchies, and has led to an hegemonic approach to the other-than-human world that orders relations based on the logics of “...sedentary agriculture, private property, coercive husbandry, and extractive industries” (Lien et al., 2018, p. 2). Yet, as the contributors to the volume show, studying human-nature relationships beyond this hegemonic discourse reveals the limits of human control and the manifold ways in which other-than-human beings have influenced human history and social organization.

This overall focus on understanding life, whether human or non-human, as emerging from an unfolding field of relations, at the same time material and semiotic as well as natural and social, is also beginning to shape and refocus anthropological studies of wildlife conservation and human-wildlife interactions. These are increasingly interested in understanding the agency of other-than-human beings, including of material processes, in shaping and affecting conservation practice and peoples’ relations with wildlife more broadly (e.g., Whitehouse, 2009; Münster, 2014; Kiik, 2018; Gruppuso, 2020; Meulemans, 2020; Chao, 2021).

For example, building on Tim Ingold’s notion of the “taskscape”—a relational approach that understands landscapes as emergent through human and non-human *activities*—anthropologist Germain Meulemans (2020) explores

farmer-water vole coexistence in the French Jura uplands. Through ethnographic description, Meulemans explores the ambiguous relationships between farmers and water voles as being situated both within particular ecological but also historical, and socio-cultural contexts. By investigating the relationships between changing agricultural practices, farmers' expertise as well as the changing rhythms of vole and other-than-human ways of life, Meulemans shows how the agricultural upland landscapes are shaped by farmers' and water voles' active modes of learning and responding to each other and their environments. Far from being simply antagonistic or peaceful, coexistence in this ethnographic account emerges as ambiguous, situated and constantly negotiated achievement of both humans and voles in shared places.

CONSERVING “CONVIVIAL RELATIONS” AS ETHICAL AND POLITICAL PROJECT

The development of relational rather than dualist frameworks, within the social sciences and humanities, has consequences for the study of coexistence in and beyond theoretical and applied conservation science. Once we are starting to question the logics and universality of nature-culture dualisms, it makes it difficult to regard the practice of conservation as involving the management of a detached, objectified nature out there beyond the human, social realm. Rather, as Whitehouse (2015) has argued, it helps us to refocus attention from natural “objects” to be conserved, to instead safeguarding particular, situated “convivial relations” (Whitehouse, 2015, p. 99)⁵—relations emergent in particular places amongst humans, wildlife and their environments. Concerning the question of how conservation may be able to “facilitate” (as formulated in the call for papers to this special issue) coexistence in increasingly fractured, human-dominated landscapes, a shift toward focussing on relations and the *practices* that sustain them has important conceptual and practical implications.

If *relations* (culturally, historically, ecologically, and biologically situated) become the *central unit* for understanding and managing coexistence, this enables us to openly approach conservation as being fundamentally *ethical* and *political*. As anthropologists have shown in diverse places, peoples' relationships to the environment—to land, animals and other living beings—are primarily shaped by ethical concerns regarding appropriate conduct and the maintenance of relationships (e.g.,

Cruikshank, 2006; de la Cadena, 2015; Anderson et al., 2017). People involved in conservation themselves are no exception and are guided by historically situated values and ideas that shape both conservation science and practice (see also Parreñas, 2018). Anthropologist Sophie Chao (2021), for instance, shows how corporate conservation zones in Indonesian West Papua rupture the abilities of Indigenous Marind communities to maintain bodily, affective, and spiritual relations to the forest, which need to be sustained by ongoing practices of hunting, foraging, walking, and remembering.

At the same time, a focus on emplaced (ethical) relations also foregrounds the political, as it involves attention to relationships of power and the limits and possibilities of leading a liveable life. Studying coexistence, then, can neither be divorced from questions of social and environmental justice nor from taking a clear stance against neoliberal politics and economic structures. This notion of the political has to be able to encompass more than the interests of human beings and their future possibilities for life; by acknowledging the interdependence of human and other-than-human ways of life, it also needs to be open to an understanding of agency that moves beyond the Western imaginary of the only true person—the rationally acting individual human being (e.g., see de la Cadena, 2015). As Latour (2004) has argued, non-human beings have always been already incorporated in the very fabric of what constitutes human society and politics. However, this active participation and co-constitution is rendered invisible through hegemonic ideologies that place other living beings in the “out there,” in the realm of nature.

When addressing the possibilities and limits of human coexistence with wildlife in “shared multi-use landscapes”—landscapes that in many ways bear the mark of capital-driven overexploitation and ruination—the situated ethical and political foundation (and obligation) of coexistence studies, in particular, and conservation, more broadly, cannot be ignored.

This significant shift toward a relational rather than dualist ontological, epistemological, and methodological basis of coexistence studies, would also open up a stronger collaboration of scholars across disciplinary boundaries, such as that Pooley et al. (2020) call for. As others have discussed, social science and humanities approaches to conservation problems are already receiving greater respect within conservation science (see Mascia et al., 2003; Bennett et al., 2017). However, this is the case primarily when it comes to understanding the “human” or “social” dimensions causing or leading to certain conservation issues. In turn, these issues (e.g., the decline of global biodiversity) are usually approached as being at the core related to safeguarding ecological or biological processes to be studied by the natural sciences.

A push toward relations, as also argued by Whitehouse (2015), would help to further question the dominant hegemony of science-centered discourses in conservation expertise. This would mean moving beyond delegating social science or humanities perspectives to the role of useful “communicators” of scientific ideas or “translators” of “local” views on “nature” as the true object of scientific inquiry (for work that aims to achieve such collaboration, see Chua et al., 2020). It would also involve, as

⁵I understand convivial here in its literal meaning as ‘living with’; the term does not automatically indicate a ‘positive’ or ‘harmonious’ state of being but refers more broadly to situations in which diverse human and other-than-human beings live together in particular places (this may include relations of detachment/engagement, rupture/continuity, and conflict/peace). The term conviviality has been used by several other authors, for instance, with regards to conservation (Büscher and Fletcher, 2020) and multispecies relationships (van Dooren and Bird Rose, 2012). There are several points of convergence between what I am arguing here and these diverse approaches, yet the main aim here is to emphasise the conceptual point about shifting the core of conservation's attention from predefined ‘objects’ of conservation to place-centred approaches following ‘convivial relations’ as suggested by Whitehouse (2015).

Métis anthropologist and scholar of Indigenous studies Zoe Todd (2016) has argued, a greater awareness of the continued colonial imperatives of the academy in which Indigenous scholarship is too rarely acknowledged and included (see also Watts, 2013; Sundberg, 2014).

BEYOND CULTURAL RELATIVISM: CHALLENGING GLOBAL VS. LOCAL EXPERTISE

An approach toward coexistence with wildlife in human-dominated landscapes focussing on maintaining convivial relations would inevitably be “centered on place” (Whitehouse, 2015, p. 100), places constituted by the diverse activities of people, wild animals and their wider material-semiotic ecologies. Now, some may argue that this is already expressed in approaches of community-based’ or “place-based” conservation that aim to integrate local peoples’ views in order to inform decision-making processes and implementation of conservation projects (e.g., Hackel, 1999). However, as Whitehouse has shown, these approaches still take place within a discourse of conservation that is essentially *global*, rather than place-centered, hence operating within a dualist logic of global-local distinction making (see also Ingold, 1993). It is not following the logic of relationality in which all knowledge—including that of scientists—is necessarily *situated and emplaced* (Despret, 2004). A key text in the anthropology of conservation conflicts—Friction (Tsing, 2005) by Tsing—describes and explores the ways in which apparently local issues of conservation conflicts are in part manifestations of global discourses and concerns that interact with other knowledge practices in complex and not always expected ways.

Following and responding to relations as they are practiced rather than as preordained objects of knowledge may help overcome the global-local binary, and would also allow us to address the *asymmetries of expertise* that it inscribes. Scientific knowledge involved in conservation contexts often assumes an elevated position above and beyond other possible ways of knowing and engaging with the world. It has been acknowledged that the various perspectives of “local” and “Indigenous” people on what constitutes human-nature relationships *for them* have to be taken into account (as much as possible) in order to achieve the goals of conservation. Yet the answer to the question of what constitutes “nature” or “wildlife” remains firmly *outside* these kaleidoscopic views—understood as *mediated* through different cultural lenses (see above). This kind of cultural relativism—that is, the idea of many cultural viewpoints on one detached, objectified, material reality—perpetuates problematic colonial legacies based on a universal assumption of Nature outside the social realm. This view has been critiqued by Indigenous scholars and (some) anthropologists and resulted in the call to include Indigenous people as experts and authors of knowledge, rather than their anonymous and generic subsumption under local and cultural ideas (e.g., Todd, 2016).

Critiquing simplistic versions of cultural relativism in anthropology and related disciplines has also resulted in questions around how anthropological knowledge—and Western understandings of human-nature relations more widely—may

be otherwise rethought and, in the process, even transformed. This could be usefully expanded to coexistence studies and conservation more broadly. It would require that we follow the ethos of relationality in which thinking and acting, mind and body, practice, and theory are always intertwined. Paying attention to relations does not involve “just another framework for understanding the same problem.” It implies acknowledging that the ways we imagine and conceptualize the world have deep consequences for the way we act, experience, and perceive within it and *vice versa*.

What kind of transformational force might attention to alternative ways of thinking and acting in the world bring to coexistence studies and conservation more broadly? What other diverse imaginaries of the good life, land ethics, sentience, or personhood may exist that could result in more sustainable ways of life within places? What can be actively *learned* from diverse ways of knowing and acting in the world—if engaged carefully and without romanticizing, flattening, and/or stereotyping them. And how might the status quo be changed in the process?

CONCLUSION

I am aware that most of the diverse people involved in conservation science and practice are very much aware of the complexities, ambiguities and political and economic structures that underlie science, environmental governance, and decision-making. Conservation work is dependent on multiple factors, not the least competition for funding, through schemes that often prescribe the types of questions it is possible to ask. The ideas sketched above are an invitation to continue questioning hegemonic discourses underlying the ways in which conservation problems are defined and approached. This involves acknowledging them to be at the root ethically and politically situated—requiring an opening both to the expertise of diverse people that live in particular places but also to collaborative work across diverse scholarship in the sense described above. It also means that coexistence studies—as an academic field—has an ethical and political responsibility: it needs to speak out against the economic and political status quo not only through explicit critique but also by actively involving itself in the search for alternatives.

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The author confirms being the sole contributor of this work and has approved it for publication.

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Corrigendum: The Arts of Coexistence: A View From Anthropology

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In the original article the following footnote is missing from the end of the first sentence: The title 'Arts of Coexistence' derives from a collaboratively organized workshop of the Oslo School of Environmental Humanities and the EASA network Humans and Other Living Beings, organized together with Ursula Münster and Hugo Reinert at the University of Oslo in May 2019.

The author apologizes for this error and states that this does not change the scientific conclusions of the article in any way. The original article has been updated.

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Ranchers' Perspectives on Participating in Non-lethal Wolf-Livestock Coexistence Strategies

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Potential impacts to rural livelihoods by large carnivores, such as gray wolves (*Canis lupus*), increase economic liability and fear among residents, resulting in social conflicts over wildlife issues. Strategies have been developed to promote non-lethal predator management in rural communities, but there is limited understanding of why ranchers choose to participate in such programs. We conducted semi-structured interviews ($n = 45$) of ranchers in Washington state, United States, asking open-ended questions to explore their perspectives on conflict mitigation. Interviews were analyzed using Grounded Theory. Ranchers mentioned five broad types of mitigation strategies: state agency intervention (i.e., calling the state agency in charge of wolf management to request either compensation or lethal wolf removal), biological measures (e.g., use of guard animals), physical measures (e.g., fences), human interference (cowboys and cowgirls), and indirect measures (e.g., husbandry practices). Motivations for participating in non-lethal mitigation strategies included previous positive interactions with wildlife agency officials, an understanding of the importance of wolves to the ecosystem, and clearly outlined guidelines on how to deal with wolf interactions. Barriers that hindered rancher participation included disdain for regulation both regarding the Endangered Species Act and the state's requirements for accessing damage compensation, which were perceived to be extensive and over-reaching. Negative attitudes toward wolf recovery included fear of wolves and perceived damage that wolves inflict on rural lives and livelihoods. Ranchers' motivations and perceived barriers for participating in mitigation strategies included sociopolitical and economic factors. Thus, we suggest that in addition to mitigating economic loss, wildlife managers address the intangible social costs that deter ranchers' participation in mitigation strategies through continued dialogue.

Keywords: **wildlife coexistence, conservation social science, *Canis lupus*, non-lethal strategies, ranching, carnivores, qualitative interviews**

INTRODUCTION

Arguments to conserve large carnivores, such as wolves (*Canis lupus*), are often based on their ecological (Beschta and Ripple, 2009; Prugh et al., 2009; Wirsing et al., 2012; Newsome et al., 2015), intrinsic (Soulé, 1985; Vucetich et al., 2015), or cultural value (Nie, 2002; Naidoo and Adamowicz, 2005; Chan et al., 2012). Yet, these species may also disrupt rural livelihoods by increasing economic liability and creating fear among some residents, thereby inciting social conflict between those who wish to conserve biological diversity and those making a living in carnivore habitat (Redpath et al., 2013; Frank, 2016; Manfredo et al., 2017). In order to address this conflict, non-governmental organizations (NGOs) and government agencies tasked with wildlife management often reimburse rural residents for their losses and promote non-lethal strategies for mitigating carnivore impacts (Linnell et al., 2010; Ravenelle and Nyhus, 2017; van Eeden et al., 2018; Macon, 2020).

Previous studies have approached the topic of mitigation effectiveness through expert understanding of carnivore population ecology, and have recommended physical preventative strategies to reduce depredation (Karanth and Sunquist, 1995; Wagner and Conover, 1999; Graham et al., 2005), as well as quantifying costs (Muhly and Musiani, 2009) and compensating for the economic loss (Wagner et al., 1997; Dickman et al., 2011; Karanth et al., 2012). In addition to ecological methods, researchers have utilized interdisciplinary studies that engage sociology and psychology to understand the human-dimensions of interaction with wildlife and what would motivate ranchers to participate in various management measures (Manfredo, 2008; Kansky and Knight, 2014; Hill, 2015; Nyhus, 2016; Drinkhouse, 2018). Non-lethal approaches can reduce livestock damage (Kansky and Knight, 2014; Scasta et al., 2017; van Eeden et al., 2018) and reimbursing all or some of the costs associated with limiting carnivore-stock encounters (cost-sharing) is presented as one way to motivate ranchers to coexist with carnivores (Bruskotter, 2013; Drinkhouse, 2018; Frank et al., 2019). However, our understanding about rural people's perceptions of cost-shared mitigation strategies and why certain mitigations are adopted over others is limited (Dickman, 2010; Kansky and Knight, 2014). Studies that only recommend cost-sharing programs provide incomplete knowledge about why rural dwellers would or would not enroll in those cost-sharing programs and are therefore insufficient to increase participation in such programs. Here, we extend knowledge on rancher participation in non-lethal measures by investigating the perspectives of ranchers toward participating in cost-shared, non-lethal strategies. This study forms part of a broader project that seeks to increase participation in existing coexistence programs and determine the feasibility of establishing new programs (van Eeden et al., 2021a).

With the recent return of wolves to the state, ranchers in Washington, United States (U.S.), have once again come into conflict with a native carnivore. Wolves naturally returned to areas of Washington from Idaho, U.S., and British Columbia, Canada, after being extirpated for more than 70 years (Wiles et al.,

2011; please see Rashford et al., 2008 and Treves and Naughton-Treves, 2005 for a comprehensive history of wolf management in the western United States). Areas inhabited by wolves coincide with those supporting beef cattle ranching, so wolf recovery has been a source of contention because of livestock depredations. Some ranchers lease public lands to graze their livestock and large private ranches also provide open spaces that can be used by wildlife including wolves (Macon, 2020). Historically, ranchers sought to reduce predation risk by lethally removing carnivores (Treves and Naughton-Treves, 2005), but with the changing lifestyles and demographics of the U.S. population, killing of wolves is no longer preferred by the public as a wildlife management tool (George et al., 2016; van Eeden et al., 2021b). Real and perceived contention over lethal control have resulted in conflicts over approaches to wolf management and polarization of attitudes toward wolves (Mazur and Asah, 2013; Treves et al., 2005).

The Washington Department of Fish and Wildlife (WDFW) is responsible for recovering wolves in the state of Washington and as such discourages ranchers from killing wolves and encourages use of non-lethal mitigation strategies. To promote non-lethal strategies, WDFW invited ranchers to sign a Damage Prevention Cooperative Agreement for livestock protection (DPCA-L) that enrolls them in a cost-sharing program that would provide financial and technical resources for implementing non-lethal measures that prevent wolf depredations. WDFW established Damage Prevention Cooperative Agreements (DPCA) initially to help alleviate the crop damage that can be caused by elk and deer. With the recovery of wolves, in 2012 the same template of DPCA was adopted for livestock i.e., DCPA-L to alleviate damage that could be caused to livestock by wolves. The DCPA-L cost-share approach was to offset financial losses that ranchers may incur when they have wolves on their property. The tools the DCPA-L pay for include range-riders, sanitation programs (removing dead carcasses from ranch), specialized lighting, fencing and guard animals. Provisions of the DCPA-L are voluntary and are in addition to existing strategies that the WDFW is involved in with ranchers which includes compensation programs for livestock that have been preyed on by wolves, and wolf removal from some areas. DCPA differs from these other strategies in that it is proactive and invites ranchers to participate before they have any wolf damage on their property. Besides getting non-lethal preventative measures on the ground, one major purpose of the DCPA-L is to build connections and develop long-term relationships between WDFW and ranchers. In 2020, WDFW spent \$110,035 in reimbursements to 33 livestock producers under the DCPA-L (Washington Department of Fish Wildlife, 2021). In addition, WDFW compensates ranchers for damages owing to wolves (Washington Department of Fish Wildlife, 2018). Despite these efforts, many ranchers are reluctant to participate in this cost-shared program. For example, at the end of 2017 only 37 out of more than 8,420 livestock ranchers (Census of Agriculture, 2012) had signed a DCPA (Washington Department of Fish Wildlife, 2021).

We aimed to understand what affects ranchers' participation in cost-shared mitigation strategies intended to foster human-wolf coexistence, which is a key step in conserving wolves

(Manfredo and Dayer, 2004). Specifically, we addressed the following questions: (1) What do ranchers perceive about the current return of wolves to Washington? (2) What mitigation strategies are currently utilized by ranchers in Washington? (3) What motivates ranchers to use their mitigation strategies? (4) What discourages ranchers from participating in mitigation strategies? We then leveraged our understanding of what affects participation to suggest how to increase the adoption of mitigation strategies.

METHODS

General Approach

We used semi-structured interviews to explore ranchers' perspectives about mitigation strategies to coexist with wolves. Before the interviews, topics and questions to be discussed were preselected. During each interview, the wording of the questions and the order of asking the questions varied depending on how the interviewee was responding. We adopted a qualitative research design because we assumed that our understanding of wolf recovery and mitigation measures to increase human-wolf coexistence might differ from those of the ranchers who live and work locally on the landscape shared with wolves. The explorative nature of qualitative approaches can reveal the social context of ranchers' attitudes and motivations, allowing beliefs to emerge that would otherwise be missed by the researcher (Krueger and Casey, 2000; Schüttler et al., 2011). We used constructivist Grounded Theory (Charmaz, 2014) to relate the observed patterns in the responses to broader themes that better explained the data. Grounded Theory is a qualitative data analysis method with systematic guidelines for gathering and analyzing data to generate understanding from empirical data such as interviews (Charmaz, 2014). The analytic process consists of comparing, coding, developing, checking, and integrating the data into theoretical categories. Based on Charmaz (2014), we used an inductive data analysis process whereby we began with a wide range of individual interviews from which we formed patterns that provided the foundational understanding that we further analyzed to answer the research questions (more in section Recruitment and interviews on Data Analysis).

Theoretical and Analytical Framework

To catalyze change for better carnivore conservation that aims to identify common interests, human dimensions of carnivore conservation have been promoted as one of the tools to better understand human-carnivore coexistence (Mattson and Clark, 2009). To effect lasting changes, however, scholars need to move beyond only social surveys and outreach/education programs and promote structural solutions that address the affected people's concerns, policy and governance-oriented professionals (Mattson and Clark, 2009; Dickman, 2010; Heberlein, 2012). Therefore, for this study we utilized qualitative interviews with ranchers in a geographic area where wolves had only recently recovered, and analyzed the interviews using Grounded Theory to examine ranchers' own words and frames of reference to explore what they participated in, as well as the conditions that motivated or constrained ranchers from participating in

non-lethal strategies to coexist with wolves. Although ranchers may differ in their attitudes about coexisting with wolves, studies suggest that both economic and social costs incurred in coexisting with a new predator on the landscape matter (Carter et al., 2020).

The narratives we analyzed were shaped by respondents and our interpretation of the narratives is shaped by literature on trust (Dietsch et al., 2021), risk perception (Carter et al., 2020) and group dynamics including culture and social identity (Manfredo et al., 2017). Trust is relevant in conflict resolution as it can build partnerships and facilitate processes whereas distrust leads to disagreements (Dietsch et al., 2021). Where ranchers have trustful relationships with wildlife agencies, they are more likely to participate in coexistence strategies, whereas with lack of trust there is little buy in for wolf coexistence strategies. Stakeholder groups like ranchers and hunters typically having lower agency trust than the general public, and such groups can be considered as kinds of social identities (Schroeder et al., 2021). Group dynamics and social identity in conflict resolution can cause individuals to take positions in contrast to the outgroups, consequently hindering successful debate and inhibiting conservation action (Dietsch et al., 2021). In the case of our research, with ranchers as one group and WDFW and conservation organizations as the other groups, ranchers could choose positions that are in contrast with the conservation agency and organizations because they are adhering to their ingroup dynamics.

Recruitment and Interviews

We recruited ranchers by cold-calling from a list of contacts provided by the Washington Cattlemen's Association and Stevens County Cattlemen's Association. Over the phone, we briefly explained the study, and sought their participation to be interviewed at a place and time of their choosing. We then used a snowball method (Goodman, 1961) to recruit additional ranchers. We contacted some ranchers directly from information provided on their websites.

We developed a list of questions about wolves and mitigation strategies, and pre-tested the questions for relevance and appropriateness prior to implementation in the field (Kvale and Brinkmann, 2008) with two ranchers outside the study area in Idaho and Montana. Questions explored in this study were part of a longer interview script (**Appendix A**). This study was approved by the Institutional Review Board (IRB) at the University of Washington (Human Subjects Division study #45684).

Eligible participants read and signed an informed consent form (**Appendix B**) with the understanding that there was no monetary compensation for participation. We encouraged ranchers to participate in the interviews because their opinions would contribute to the discussion about wolf recovery and conservation in Washington. During the interviews, which were audio-recorded, we documented rancher demographic information including age, gender, and location by county. Other rancher characteristics noted included the size of the ranch, the type of operation, whether they graze on private or public land or both, whether they had experienced any wolf interactions by 2013, and finally whether their children would inherit the

ranching operations for the future. All rancher characteristics are summarized in **Appendix C**. Sampling continued until theoretical saturation was reached (Charmaz, 2014; Saldaña, 2015). Theoretical saturation is the phase during qualitative study in which the researcher has continued sampling and analyzing data until no new data appear, i.e., the new respondents are not giving any new information (Charmaz, 2014).

Data Analysis

All interview recordings were transcribed verbatim (Poland, 1995) and analyzed with NVivo v.11 (QSR International Pty Ltd, 2014). Two researchers coded a sample of interviews to test intercoder reliability of the interviews. Using the *Coding Comparison Query* in NVivo v.11, we determined the intercoder reliability *Kappa* coefficient for the data to be >96% across the two coders, so we proceeded to code the rest of the interviews.

We used the inductive data analysis process of Grounded Theory (Charmaz, 2014). Under this process, patterns of constructs based on either similarity or differences among respondents are grouped together into themes (Ryan and Bernard, 2003). During the initial coding we used the open-coding process whereby we read and re-read the text line-by-line to determine whether text was meaningful to our understanding of what motivates and constrains ranchers' participation in mitigation strategies. In the next round of analysis, we used the *Query tool* in NVivo to contrast the ranchers' coded responses to the research questions and to rancher demographic attributes (**Appendix C**). Querying the response codes enabled us to identify relationships, attempt to recognize logic to connect them, and realize emerging patterns from the data about what ranchers felt about wolves and mitigations to better coexist with wolves.

RESULTS

We interviewed 45 ranchers in Washington state from the following counties: Kittitas ($n = 11$), Okanogan ($n = 7$), Spokane ($n = 1$), Stevens ($n = 18$), Walla Walla ($n = 1$), and Yakima ($n = 7$). The interviews ranged in duration from 35 to 159 min (**Appendix C**). Ten ranchers were below the age of 45, 12 between 45 and 55 years old, 14 between 55 and 65, and 9 above 65 years old. Eighty percent ($n = 36$) were male. Most of the interviewees were at least third generation ranchers (29/45); eight ranchers each from first- and second-generation ranching families were interviewed. The themes that arose from the data included (i) ranchers' attitudes toward wolves were integral in selecting mitigation strategies they chose to implement, (ii) ranchers implemented carnivore mitigation strategies irrespective of whether they had wolves on their property or not, and (iii) past experiences with and trust of wildlife agency officials were identified as factors that motivated ranchers to participate in non-lethal mitigation strategies.

Attitudes of Ranchers Toward the Current Return of Wolves to Washington State

Ranchers had a range of attitudes toward the return of wolves to Washington. Many ranchers were opposed to wolf recovery in Washington, citing various reasons including fear and the

inconvenience wolves would bring to their ranching lifestyles. Most ranchers felt that the return of wolves was an inconvenience that they wished they did not have to deal with but could tolerate wolves in wild areas unless they depredated their livestock. Some ranchers accepted that wolves were recovering in the wild in Washington and did not mind coexisting with them.

Among the ranchers we interviewed, those who said they were tolerant of wolves had small- to medium-sized ranch operations, and some of them were also ranching as a new profession in retirement. The few large operation ranchers who tolerated wolves had experienced wolf interactions on their ranches, whereas those who said they were intolerant of wolves never had direct experienced wolves on their ranches. Notably, we found that ranchers with large operations and who had been ranching for multiple generations and were dependent on ranching as their only source of income were least willing to participate in mitigation measures.

Ranchers mentioned that wolves were necessary for a well-functioning ecosystem, which helped inform their positive attitudes toward wolf recovery and participation in non-lethal mitigation strategies. Other ranchers cited the moral obligation of humans to restore extirpated biodiversity including wolves in the wild for intrinsic value that wildlife have. The quotations below depict the positive attitudes ranchers had toward wolves:

"The reintroduction. Well [pause] that's pretty important to re-establish a natural ecosystem, but that can't be just the wolves you've got to have the elk and even the beaver...create an ecosystem in the creeks and river valleys... and when you restore the deer and the elk, the grazing animals will defeat it unless you have wolves to keep them dispersed and moving." [Respondent 19, November 2013]

"I think it is a good thing. They were here for many centuries I assume, and there is lots of habitat for them here and of course not as much as there used to be so I personally think that it is a good thing that wildlife exists in as many places as possible especially if it used to, and it is too bad that it was brought to such close to extinction from their normal land, due to probably more than just misunderstanding in our State than anything else." [Respondent 1, August 2013]

The reasons ranchers mentioned for the negative attitudes toward wolf recovery included fear of wolves, and the perceived damage that wolves will have on their lives. Many ranchers did not like that the government was involved in wolf management. The following quotations portray the negative attitudes that ranchers held toward the return of the wolves in Washington state:

"We cannot coexist! There's no coexistence. If somebody's trying to kill you, you cannot let them do that! You either kill him or he's going to kill you. That's what this wolf is going to do to us... knows why they brought them back." [Respondent 34, November 2013]

"...it's really about all of that government, you know, overshadowing everything. To me, that, there's nothing to do with the wolf itself" [Respondent 39, November 2013]

Mitigation Strategies That Ranchers in Washington Are Using: Motivations and Constraints

All ranchers we interviewed implemented some form of mitigation strategy to protect their livestock from predators. None of the ranchers interviewed reported practicing or knowing anyone who used lethal control to mitigate for wolf depredation. Ranchers mentioned five broad types of mitigation strategies that included: state agency intervention measures (e.g., calling WDFW), biological measures (e.g., use of guard animals), physical measures (e.g., fences), human interference (cowboys and cowgirls), and indirect measures (e.g., husbandry practices). The mitigation measures are not exclusive to each rancher; that is, a single rancher could discuss and participate in none, one or a combination of more than one of the strategies.

State Agency Intervention

Most ranchers sought state agency intervention as their first line of reporting when faced with any suspected wolf sighting, interaction, or depredation by contacting the WDFW, the state agency in charge of wildlife including wolves. Eleven ranchers we interviewed had indeed contacted WDFW regarding wolves. State agency intervention mitigated conflict in two ways: first, the agency was expected to translocate or eliminate the offending wolf; and secondly, in case of a depredation the department provided compensation, in accordance with the state regulations and procedures, to cover their monetary loss. According to Washington State Law (WAC 220-440-170) commercial livestock owners who have worked with the WDFW to prevent depredation but continue to experience livestock losses or injury to livestock injured by bears, cougars or wolves are eligible for compensation using state funds. The claimant is required to submit to WDFW documentation that includes the commercial value of the lost livestock, an estimate of the percentage loss of value for the injured livestock and a completed claim form. WDFW investigated the claims and may have a forensics team confirm or give a probability that it is indeed it is a wolf depredation before proceeding with payments. For confirmed depredations by wolves, the rancher will be paid for verified losses on acreage of <100 acres. For ranches larger than 100 acres, the payment is twice the verified losses to account for the assumption that multiple animals are missing.

Some participants discussed compensation as one of the existing mitigation strategies; however, only one participant had actually received compensation, another had refused the compensation because he perceived that accepting the compensation was indicative of him accepting wolves, and the remaining interviewees never experienced any depredation that required compensation. Complexity of obtaining and the inadequacy of the compensation were common reasons ranchers avoided WDFW intervention after a wolf incident. Ranchers reported that the compensation value given for dead livestock was insufficient to cover the actual impact, for example weight loss caused by reduced grazing in the presence of wolves. Ranchers further cited regulatory burden and elaborate paperwork as deterrents to contacting WDFW. For example, in

response to suspected depredation, ranchers are required to file an account and treat the location as a crime scene.

Three ranchers had signed a Damage Prevention Cooperative Agreement for livestock (DPCA-L) with WDFW at least once since the DPCA-L's inception in 2012: two of those DPCA-Ls were active whereas one rancher had discontinued theirs. These ranchers engaged in state-led non-lethal strategies to leverage the Department's willingness to reduce ranchers' economic losses due to wolves. Some ranchers considered compensation an advantage because it covered the direct economic loss of livestock due to wolves and suggested some ways to improve it. To improve compensation ranchers suggested reducing the paperwork required for repeat depredations and streamlining the process so that ranchers do not have to wait too long before they receive compensation. Another suggestion was to change the compensation program to a wolf insurance plan so that ranchers who experience depredation apply for reimbursement from a private insurance company, like they do for all other incidents that arise in ranching. Furthermore, ranchers who signed the DPCA-L found it to be an advantage because it offered a step-by-step protocol that ranchers could follow to protect their livestock. Some ranchers referred to the depredation of cattle in Steven's County by the Wedge Pack in 2012 as an example of the advantage of reporting wolf incidents to WDFW because the Department eliminated this pack. By removing the pack, the ranchers perceived this as a sign that WDFW was to some extent attentive to the ranchers' plight and acted in the ranchers' favor. This act by WDFW was perceived by some ranchers as positive past experience with government.

On the other hand, some ranchers felt that enrolling in a formal agreement brought too much government regulation in their day-to-day affairs telling them how and when to manage their ranch, for example, by recommending the age at which ranchers should release their cows out to graze or what type of cowboy they should hire. Some ranchers felt that agreeing to the recommended non-lethal measures prescribed by the DPCA-L would reduce their ability to utilize lethal control when needed. Some ranchers noted that there were many endangered species negatively affecting the ways they managed their ranches and grazing lands (e.g., spotted frog, *Rana pretiosa*, and bull trout, *Salvelinus confluentus*) and that mitigation for wolves would encourage more restrictions and regulations on behalf of these other species, which could negatively affect the ranchers.

Previous working relationships between ranchers and state agency officials influenced reporting. Ranchers referred to past experiences where reported depredation incidents were either overlooked or ignored by WDFW officials. These past interactions produced a lack of trust of the WDFW and a reduction in reporting incidents. Some ranchers preferred working with local existing agriculture-related agencies such as the Farm Bureau, conservation districts or county commissioner's offices. The following quotations illustrate the perceptions ranchers held about reporting wolf incidents to WDFW:

"This wolf management shouldn't come up from officials in the State, they all divert us all off to a side road every time. It's got to

be either individuals or small groups or better yet, far better is our county commissioners and our local elected officials take care of it.” [Respondent 30, November 2013]

“For ranchers to be willing to accept them (wolves), I think a compensation program where it would pay for any wolf kill. But that program and process has to be streamlined. Boom! Done. If there’s paperwork and conversations then and a couple meetings and phone calls, it is just going to be more screwing around than I think most people would want to contend with. Certainly, more than I would want to contend with.” [Respondent 1; August 2013]

Use of Guard Animals

Ranchers cited the use of guard dogs (*Canis lupus familiaris*) as their primary mitigation strategy. Three ranchers actively kept guard dogs or cattle dogs that were used to protect their livestock at all times, whereas others suggested that they would get a guard dog when wolves recolonize areas near their properties. Two ranchers also had llamas (*Llama llama*) or donkeys (*Equus asinus*), respectively, which acted as guard animals in case wolves ventured near their ranches.

Having guard animals was easy for ranchers because they often maintain these animals for a variety of ranch duties besides preventing wolf depredation (Scasta et al., 2017). However, the financial cost of purchase, training and maintaining new guard animals is substantial and borne entirely by the rancher (Gehring et al., 2010). Ranchers also feared that their dogs could hybridize with wolves, which would cause complexities in the local wolf population. Some ranchers were wary about the possibility of domestic stray dogs in the community forming packs with cattle dogs and together depredating smaller farm animals such as chickens and lambs, while others worried that wolves would kill their guard dogs.

Physical Barriers (e.g., Fences)

Ranchers regularly constructed and modified fences to reduce predation by carnivores, such as coyotes (*Canis latrans*), and several believed that these structures would also help deter wolves. For example, one rancher constructed a modified fence to protect free-range chickens from predators by extending the fence-wire vertically and horizontally several feet underground; thus, the modified fence prevented canids from digging below the fence to prey on the chickens. Two ranchers who had sheep operations mentioned that they used fences effectively to graze their sheep while protecting them from predators. Other physical deterrents were often mentioned, such as having bells on cows that would frighten wolves and allow the rancher to better track their stock. Other mitigation measures that were suggested but not currently implemented by any of the interviewed participants included: fladry, Radio Activated Guard (RAG) boxes, and lethal control (Bangs et al., 2006; Shivik, 2006; Brown, 2011).

Ranchers were motivated to have physical barriers such as fences that are easy and effective for some types of livestock operations, such as chicken rearing and sheep herding. Most small- to medium-sized ranches already had fences in place, so it was easier for them to improve on the existing fences than build completely new fences. However, ranchers mentioned that implementing specialized fences to prevent negative interactions

with wolves would require increased operating costs and time incurred on the ranch, thereby reducing their already meager profits [We note here that the state of agriculture in Washington is good with the commercial crop and livestock products valued at \$7.9 billion (Washington State Department of Agriculture, 2019, <https://agr.wa.gov/>)].

Human Interference (Cowboys, Cowgirls, and Ranch Hands)

Another mitigation strategy mentioned was the use of human interference, usually in the form of cowboys, cowgirls, and ranch hands, to monitor the livestock and keep wolves at bay. The primary purpose of human interference was focus on the wellness of the livestock and maintain smooth running of the ranch, while deterring wolves was the secondary role. Ranch hands rode on horseback, either daily or weekly depending on where the cattle were, to check on the livestock out in the grazing allotment(s), and as they ran the day-to-day affairs of the ranch, they kept wolves and other predators away from the livestock. Some ranchers occasionally hired a cowboy/girl to ride the ranch when they thought there might be predators on the land. The hired hands rode at least once to several times a week and regularly checked on the livestock to ensure that predators did not prey on them.

In addition to ranch hands, WDFW and NGOs offered range rider programs for which they solicited the ranchers' participation. A range rider is an individual who keeps a constant presence, either through riding a horse or driving an all-terrain vehicle (ATV), on a landscape where both wolves and livestock occur in order to reduce wolf-livestock conflicts (Parks and Messmer, 2016). If a rancher agreed to have a range rider on their ranch, WDFW would provide the range rider with real time locations of wolves so that the range rider could keep the wolves and cows apart. Two WDFW/NGO-supported range-rider programs were active among the ranchers we interviewed, while one rancher had discontinued the program on his ranch citing his reason for discontinuation as that he realized he could do his own riding sufficiently without external help whose intentions he did not trust.

Ranchers were motivated to use human interference as a mitigation strategy because it was already part of their cultural lifestyle and livelihood. However, some challenges to this strategy were noted, including the concern that some riders cannot be with the herd at night when wolves hunt, the difficulty of navigating forested mountainous landscapes, and the potential habituation of wolves to non-offending human presence. Ranchers with small operations stated that they did not need to ride because their operations were small enough for them to respond quickly by All-Terrain Vehicle (ATV) to the threat of a wolf on their livestock. Some ranchers despised the use of the term “range rider” rather than cowboy, perceiving this as an appropriation of the ranchers’ culture by environmentalists.

Some ranchers stated that government-led programs including the range-rider program were less favored

than locally led ones because ranchers trusted their local organizations more than the state ones. For example, the rancher who quit the range-rider program mentioned that they had been on the WDFW DPCA-L program in 2012 but had decided to discontinue their participation in DCPA and thus give up access to wolf GPS-collar data in 2013 because they did not trust the intentions of the WDFW and did not want to work with them anymore (the rancher continued riding in the traditional way without GPS data guidance).

Husbandry Practices

Seventeen ranchers mentioned that they employed specific husbandry practices that reduced the likelihood of depredation. For example, rotational grazing is a husbandry practice where cattle are temporarily constrained to a specific paddock of pasture for a period of time, and after grazing that paddock are moved to another paddock, eventually returning to the first paddock with newly grown pasture (Butterfield et al., 2006). This approach is different from where cattle freely graze the entire allotment without restriction (Butterfield et al., 2006). Keeping cattle in a smaller area enables the rancher to inspect their herd more frequently and monitor the conditions of their cattle more closely. Other ranchers waited until their calves reached an ideal heavier weight before releasing them to the summer grazing allotment in order to increase the calves' chances of defending themselves against wolf attacks, thereby reducing negative interactions with wolves. The ranchers mentioned that bigger older calves have a higher chance of surviving the wild allotment; they can run faster, and thus have a better chance of defending themselves against wolves than smaller calves. One rancher mentioned that he raises aggressive cow breeds that are able to defend themselves and their calves from wolves.

Ranchers were motivated to use husbandry practices focusing on the wellness of their livestock instead of confronting wolves, and ranchers seemed to be more willing to implement these measures than others. Some ranchers mentioned that as they increased vigilance over their livestock, it enabled them to remove the sick and injured animals and return them to the safety of the ranch, thereby reducing livestock losses (Parks and Messmer, 2016). For example:

“...here [referring to the geographical area] if you want to be a good rancher in top rate with good animal husbandry you bet, a lot more time you spend with cattle. And in course of doing that you run out horse shoes, burning gasoline or diesel if you got a very big territory, and they are bothering you real bad you need extra men to be there with them” [Respondent 31, November 2013]

“I get nervous if I don't see them [livestock] for too long of a time, it's like, what are they doing, so, and with the wolves now it's just made us just a little bit more cognizant of showing up and making sure everybody's doing alright. To see if there's anybody weaker or slower and so cattle run and probably stepped in somewhere and had a hurt ankle, we kind of just look for that. And then if anybody is vulnerable then we'll try to get them. Our idea is either really keep a close eye on them and try to check those cattle closer or try to bring an animal that might look a little slower than the others, try

to bring them back a little closer to the house.” [Respondent_49, November 2013]

Another way ranchers utilized their husbandry practices to increase human presence on their ranches was by engaging in farm tours and horseback trips on their property to increase customer involvement and thereby prevent wolf presence on their ranch. Ranchers who mentioned farm tours owned small to medium-sized farms and had regular farm tours for their clients as a private business venture not involved with the government. Their clients could participate in picking fruit or seeing how chickens and other livestock were managed on a day-to-day basis. Some ranchers regularly invited hunters on their ranch to hunt for deer and elk, and one participant invited recreationists to ride horses on their dude ranch. This mitigation practice allows ranchers to focus their attention on livestock and the ranching operations while the tourists increased human presence that deters predators. This improved the safety of the livestock against predators while earning extra income for the rancher.

DISCUSSION

In this study we investigated ranchers' perspectives toward using non-lethal strategies to coexist with wolves. We found that ranchers expressed a range of attitudes toward wolf recovery, that they practiced an array of non-lethal strategies to protect their livestock from carnivores even in areas that had not yet been recolonized by wolves, and that both social and economic factors enabled and constrained adoption of mitigation strategies. The non-lethal strategies in which ranchers engaged included reporting incidences to the state agency in charge of wildlife, use of deterrents such as guard dogs, fences, and cowboys/girls, and utilizing custom livestock husbandry practices to reduce predation on their properties. We structured our findings in such a way that for every mitigation strategy reported, we outlined its motivations and constraints. Based on these motivations and constraints we first present two themes that arose from this study: (1) the situation of the ranchers when engaging with a non-lethal mitigation strategy to co-exist with carnivores and (2) the nature of the working relationship between ranchers and WDFW (the state agency in charge of wolves). We then offer some approaches that might be used to increase rancher participation in mitigation strategies, and finally discuss the limitations of our study and methods.

The typical rancher respondent in our study owns a cow-calf operation with one or more guard dogs on their property and rides on horseback several times a week to check on their livestock out on the allotment they lease. Under these circumstances, the time spent managing the day-to-day operations of their ranch preclude their ability to learn new mitigation strategies or new methods of ranching. As such, the most common motivation was familiarity with mitigation strategy to the rancher. This included, for example, owning dogs already or just adding a guard dog specific for defending against wolves or increasing the frequency of riding on horseback to increase human presence to deter wolves. Moreover, we did not record any constraints about husbandry practices as a mitigation

strategy. This finding could be because, for many ranchers, modification of husbandry practices entails little added time investment and social disruption given that no new people would have to be on the rancher's property as opposed to, for instance, joining a state or non-profit-run range rider program.

State agency intervention was the most ubiquitously sought form of wolf mitigation, presumably because it involves monetary aspects of compensation for all affected ranchers, technical and financial support for ranchers with active DPCA-L, and the help of agency personnel who work with the ranchers whenever needed to mitigate wolf conflicts. Ranchers also most often cited agency intervention as a constraint to their participation in mitigation, however, and few had enrolled in a DPCA-L. Our findings offer two explanations for why so few ranchers were willing to work with WDFW by way of these agreements. First, the reluctance of ranchers to enroll in a DPCA-L owed to the way these agreements operate. Namely, from the ranchers' perspective at least, these agreements do not add anything new to what the ranchers are currently doing in terms of mitigation measures. On the contrary, enrolling in DPCA-L would add regulatory and logistical burdens to ranchers who participate and potentially require measures that are time consuming and costly, such as fladry, thereby acting as a disincentive to enroll. Moreover, the benefits of compensation for depredated livestock are available to all ranchers, including those not enrolled in the DPCA-L as well as those who are not intentionally implementing any non-lethal measures. Therefore, there is no new benefit to incentivize enrollment into the program.

Second, ranchers' motivations and perceived barriers to participating in the DPCA-L program often involved sociopolitical factors. Namely, ranchers avoided participating in the DPCA-L program because they did not want government interference on their ranch or ranchers felt that they were giving up autonomy of managing their lifestyles and livelihoods. For example, the ranchers inferred that agreeing to coexist with wolves would add these carnivores to a growing list of endangered species that also includes bull trout and spotted frogs, thus increasing restriction on what they can do on their property or allotments consequently making them feel like they are losing any autonomy and control over their land. This perceived loss of autonomy resulting from accepting conservation of wildlife has been documented elsewhere including among farmers in South Africa (Terblanche, 2020) and points to the importance of acknowledging the context of soliciting participation from ranchers or farmers in order to achieve social sustainability of the conservation programs. Furthermore, Inskip et al. (2014) documented that people in the Sandarbans, Bangladesh, were more likely to retaliate and kill tigers (*Panthera tigris*) because of socio-psychological factors including values, history and ideologies, risk perceptions, and perceived failings of the local wildlife authorities than because of actual loss of livestock or damage to people. Addressing social and political barriers can be difficult because they are intangible costs (Kansky and Knight, 2014; Thondhlan et al., 2020). It is more common and easier for government agencies and NGOs to address quantifiable tangible costs like depredation damage through cost-sharing or compensation programs (Nyhus et al.,

2003). However, compensation only solves part of the problem, as it may not improve attitudes toward wolves and other large carnivores and is not the only factor that affects whether or not ranchers adopt mitigation measures (Naughton-Treves et al., 2003; Redpath et al., 2015). Moreover, it has been shown that intangible costs can cause significantly higher negative consequences for human-wildlife interactions than tangible costs (Kansky and Knight, 2014; Thondhlan et al., 2020). An example of intangible cost here is the perceived loss of group identity whereby ranchers felt that working with non-rancher groups to adopt non-lethal methods would imply that they are adopting new non-rancher otherwise outgroup cultures and therefore cause them to be ostracized by their neighbors. This intangible cost may reduce the effectiveness of tangible solutions like enrolling in the DPCA-L to receive cost-shared assistance to coexist with wolves. We acknowledge that the process of addressing intangible costs is difficult because doing so involves behavior change and political dynamics (Manfredo et al., 2017).

With these two explanations in mind, we suggest that, in addition to providing economic benefits through mitigation measures, wildlife managers should address the intangible costs that are more likely to deter ranchers' participation in mitigation strategies through dialogue and discussion. Since our data collection, WDFW has hired conflict specialists as staff in the field to create and encourage dialogue with ranchers over coexistence with carnivores specifically wolves. In complement to this, the WDFW can create avenues for dialogue on the different non-lethal measures that they are promoting or that ranchers are interested in enrolling in. Dialogue should be respectful, include mutual listening, and be inclusive of all views which could be approached through communicative framing (Dietsch et al., 2021). This should recognize and seek to address underlying ideological or identity differences that may shape trust in agency or attitudes toward a coexistence program (Schroeder et al., 2021).

In addition to compensation, WDFW could have an ongoing mediation process that relies on individuals or institutions trusted by both the public and the ranchers. Furthermore, it is imperative that WDFW attempt to keep open and regular communication with ranchers and rancher organizations because increasing the frequency of interaction could increase trust in the agency (Schroeder et al., 2021), which can consequently increase participation of ranchers in WDFW-led non-lethal strategies. We recommend investigating novel strategies such as performance payments (Zabel and Holm-Müller, 2008; Macon, 2020) and economic incentives such as premium prices on ranch products (Bogez et al., 2019) that reward ranchers' efforts to coexist with wildlife. Zabel and Holm-Müller (2008) defined conservation performance payments as monetary or in-kind payments that a conservation agency makes to individuals or groups of individuals in exchange for achieving specific conservation outcomes. The payments are conditioned on achieving specific conservation outcomes, such as number of surviving offspring of a species of interest in a certain area. This recommendation aligns with Macon (2020), who proposed that through performance payments, agencies can ensure that they are accurately paying for achieving conservation goals instead

of the ex-post compensation, which pays for dead livestock and does not reward the landowner for living with carnivores. Such economic incentives could be generated from public or private sources and awarded to trusted rancher organizations for disbursement (van Eeden et al., 2021a). We further recommend that more work be done to understand the intangible costs ranchers could face as they engage in programs to coexist with wolves.

While not all ranchers opposed coexisting with wolves, many expressed a need for more local management of mitigation programs rather than a top-down approach from the state wildlife agency. An important way of addressing this concern would be to harness the strengths of group identity dynamics by encouraging and facilitating ranchers to form their own rancher groups or work with local actors, for example County Extension agents such as the agriculture extension, with whom they have a trusted and existing working relationship (van Eeden et al., 2021a). Accordingly, it would be helpful to categorize ranchers into relevant sub-groups based on geographic location of ranch, size of ranch operation, motivation for ranching (e.g., economics vs. identity), and marketing of the ranch products (e.g., calf sellers vs. niche beef sellers). Soliciting for participation through these subgroups has the potential to enable ranchers to enroll in programs that address their interests (Manfredo and Dayer, 2004; Macon, 2020) and thus spare agency resources that would otherwise be allocated to enrolling all ranchers in all programs. Encouraging such ranchers to self-organize could also promote greater adoption of mitigation measures (Brown, 2011). Participating in specific programs as a group provides a greater sense of community with others, thereby increasing participation (Berkes, 2004). Examples of such self-organized rancher groups include the Blackfoot Challenge and the Tom Miner Basin and Centennial Valley Associations in Montana, USA. These self-organized groups should be considered in decision-making about wolves as the basic governance unit that complements local and regional governing agencies because such multilevel authority can be more effective than top-down approaches in managing biodiversity in complex social-ecological systems (Scarlett, 2011; Ostrom, 2015). Thus, the wildlife agency partnering with institutions that ranchers trust may increase participation in non-lethal measures to better coexist with wolves. The Farm Bill, for example, uses local councils, conservation districts, and state technical committees to strengthen collaborative efforts (Scarlett, 2011). This collaboration arrangement could be applied to wolf and large carnivore conservation and implemented at local levels. For example, conflict specialists could act as the link to collaborate with Conservation Districts to see how to incorporate carnivore conservation on a case-by-case basis with existing conservation programs in which a rancher might already be participating.

This study also sheds light on new pathways that might be used to facilitate human-wildlife coexistence in rural areas. In addition to identifying effective mitigations to protect their livestock, for example, ranchers expressed the desire to educate non-ranching communities about the importance of ranches in preserving wild lands and their importance in the society. This need for increased respect and awareness of ranchers' work could

be leveraged as an opportunity to develop additional resource streams such as agritourism where urban dwellers can travel to farms and ranches to interact with ranchers to learn more about ranching and preservation of private wildlands through ranching. This would be a feasible option to test given that more than 25% (12/45) of the ranchers we interviewed either engaged in some form of farm tour experience on their property or they would consider participating.

The methods underlying our study suffered from several limitations. First, audio recordings have the advantage of acting as a validity check for the data collected and ensuring that interviewee responses have minimal distortion. However, they can have the limitation that they do not pick up on non-verbal cues. We therefore supplemented audio recording with taking notes whenever needed. Another limitation of audio recording is that in the beginning interviewees carefully chose their words because they were on record. We overcame this limitation by holding our interviews for long enough that as time passed the interviewee forgot about or ignored the recording and spoke more freely. Where possible we covered the recorder, usually located on top of the table, with a sheet of paper so that it is not distractive. Nevertheless, we acknowledge that being on record could have caused ranchers to conceal some information such as the use of lethal methods against the wolves. We chose to analyze the data that were received and not assume anything about the underlying intentions of the interviewees, however. Although ranchers expressed willingness to work with existing agricultural-related agencies to implement non-lethal strategies to coexist with wolves, caution should be taken that their actual enrollment may be low because there is a difference between what interview respondents say and what their actual behavior would be faced with the reality of the situation (Frank et al., 2019). We recommend that engaging ranchers who are working with other agencies could be more successful than trying to work with those who are not in any agriculture or natural resources state programs. While Grounded Theory allows to retain the richness and detail of the qualitative data, it comes with some criticisms as well—including that the three foundational school of the methodology have disagreements about the exact steps to be used to analyses the data. That GT either proposes no hypothesis formation or allows for successful modification of hypotheses formulated at the start of the process of empirical research (Goldthorpe, 2000) is less rigorous than scientific methods that use falsifiable hypotheses. Conclusions from GT are not generalizable as GT doesn't rely on causal or correlation factors but on constant comparison of the data collected in a single study thus making it hard to conceptualize beyond the study (Goldthorpe, 2000). In this qualitative study for which the interviewees were not randomly selected, it is not possible to generalize these results to all ranching populations. Generalizability is not the goal of qualitative research, however; rather, the focus is on transferability—the ability to apply findings in similar contexts or settings (Bloomberg and Volpe, 2016). We used purposeful sampling and snowballing to recruit ranchers to interview; this sampling method could have limited the variety of ranchers that we interviewed. We did not use stratification because rancher attributes are not mutually exclusive. For

example, many ranchers use both private and public lands but were categorized as public since part of their grazing land was public. Finally, this study was part of a larger study that investigated the social and economic feasibility of wolves in Washington state. The interview guide and consent forms in the appendix are those used for the larger study, while this study focused on study objective 1 of **Appendix A**.

In conclusion, we offer new insight into what motivations and constraints influence rancher participation in non-lethal measures to coexist with carnivores. Specifically, we show that both social and economic factors motivate as well as hinder ranchers' participation, thereby contributing to the evidence that conservation of and coexistence with wildlife requires addressing both tangible and social/intangible costs. By implication, as wildlife recovers and is restored in ecosystems, wildlife managers should make effort to maintain or restore social relations and trust through forging new collaborations across agencies and encouraging locally formed and led coexistence groups. Whereas, we focused on gray wolves, our results can be applied to other regional carnivore-human interactions, as well as those that occur nationally and internationally (van Eeden et al., 2018; Teixeira et al., 2020). Our findings are relevant more generally in Washington, for example, because ranchers repeatedly mentioned other predators when responding to questions about their perspectives on non-lethal mitigation strategies to co-exist with wolves. Furthermore, the mitigation strategies in which the DPCA-L encourages ranchers in Washington to participate are similar to those recommended in the literature, including deterrence measures such as guard dogs and human interference (Musiani et al., 2003; Linnell et al., 2010; Shivik, 2014; Young et al., 2015; Miller et al., 2016). Some of these strategies that have been used for centuries, such as fladry, guard dogs, and cowboys, are experiencing a renaissance since the recent recovery of predators both in Europe, the United States and elsewhere globally (Inskip et al., 2014; van Eeden et al., 2018; Frank et al., 2019; Teixeira et al., 2020). Finally, we emphasize the use of inter-disciplinary methods such as qualitative interviews to gain a deeper understanding of how to address social issues for the betterment of wildlife conservation.

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DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Institutional Review Board (IRB) at the University of Washington (Human Subjects Division study #45684). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

CB designed the study, collected, analyzed the data, and wrote the manuscript. All authors contributed to interpreting the data and editing the manuscript.

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Wild Boar Events and the Veterinarization of Multispecies Coexistence

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By considering the emergence and threat of African Swine Fever (ASF) in Europe, this paper demonstrates the growing role of veterinary rationales in reframing contemporary human-wild boar coexistence. Through comparative ethnographies of human-wild boar relations in the Czech Republic, Spain and England, it shows that coexistence is not a predictable and steady process but is also marked by points of radical change in form, course and atmosphere. Such moments, or *wild boar events*, can lead to the (re-)formation or magnified influence of certain discourses, practices and power relations in determining strategies of bio-governance. Specifically, this paper highlights how the spread of ASF in Europe has accelerated an already ongoing process of *veterinarization*, understood as the growing prominence of veterinary sciences in the mediation and reorganization of contemporary socioecologies. This example highlights how veterinary logics increasingly influence localized human-wildlife relations and, through analogous practices of biosecurity and control, also connect different places and geographic contexts.

Keywords: African Swine Fever (ASF), game management, hunting, critical event, veterinary medicine

INTRODUCTION

Through ethnographic and historical accounts of human-wild boar relations in the Czech Republic, Spain, and England, this paper considers how the ever-developing process of human-wildlife coexistence is subject to rapid and sometimes destabilizing changes in form, course and atmosphere. To better understand such shifts, the paper draws on the concept of *events* as developed by a number of philosophers and utilized across social sciences (Fraser, 2006). Tracing human-wild boar relations both before and during the recent spread of African Swine Fever (ASF) in Europe, the paper emphasizes how events can dramatically reconfigure politics, knowledges, practices, power relations and ways of living with wild animals. In particular, it identifies the emergence of *veterinarization* as a regulatory mechanism whereby the veterinary sciences, enacted in varying degrees of tension with long-standing modes of management such as hunting, play an increasingly prominent role in the mediation and reorganization of contemporary socioecologies.

Speaking broadly, the paper contributes to a body of literature that has been developing the concept of “coexistence,” moving it from the more singular, anthropogenic lens of conflict to a more nuanced and diverse framing of human-wildlife relations (Carter and Linnell, 2016; Frank and Glikman, 2019; Pooley et al., 2020). Such work highlights the dynamic nature of

coexistence, its complex material and discursive landscapes, and the ways this necessitates an ongoing negotiation between various human, non-human, individual or institutional actors. Bringing to light a particular set of multispecies relations revolving around the ASF virus, the paper proposes that particular critical events (Das, 1997) enhanced the role of biosecurity—the systematic effort to regulate flows of life and prevent their unwanted interactions (Donaldson, 2008; Hinchliffe et al., 2013)—in shaping human-wildlife coexistence. In so doing the paper seeks to further the conversation between the growing body of literature on biosecurity (Dobson et al., 2013; Hinchliffe et al., 2016; Barker and Francis, 2021) and the human-wildlife coexistence scholarship.

Based on research involving a mixture of qualitative approaches, this paper is methodologically and conceptually grounded in multispecies ethnography and more-than-human geography (see Kirksey and Helmreich, 2010; Hodgetts and Lorimer, 2015, 2018; van Dooren et al., 2016). Two researchers have lived periodically in their case locations (Arregui in Barcelona, Spain; O'Mahony in the Forest of Dean, England) and to differing extents have followed local practices and events involving various human (e.g., hunters, vets, conservation biologists, authorities, members of the public) and non-human actors (e.g., wild boar, domestic pigs, dogs), whilst the other researcher (Broz) has analysed game and ASF management practices and conducted a review of historical documents. All three authors have also conducted interviews with key stakeholders and monitored national and international media narratives surrounding ASF.

The paper consists of two main sections. The first begins by outlining a European-scale trajectory of human-wild boar coexistence, before then considering the historical contexts of our three respective research contexts. It then introduces the concepts of *events* and *veterinarization* to consider how the recent arrival of ASF to Europe has been reshaping human-wild boar relations in affected and (currently) unaffected locations.

HUMAN-WILD BOAR COEXISTENCE IN EUROPE

Over recent decades wild boar have become increasingly prominent agents within the global socioecological landscape. Classified by the IUCN as a species of “least concern,” broad accounts of wild boar underline their increasing population and expanding range throughout their “native” and “introduced” geographies (Massei et al., 2015; Keuling et al., 2017). Various explanations have been put forward for this apparent escalation in numbers and the subsequent risks those pose to humans. As a species, wild boar are highly intelligent, ecologically reactive, physically mobile and omnivorous, a combination of which allows them to successfully adapt to and move through a range of habitats (Morelle et al., 2014, 2015). Furthermore, their fecundity and reproductive “elasticity” (e.g., the capacity to delay or accelerate fertility) enables them to adapt according to changing environmental conditions (e.g., food availability, climate and predation risk) and ensure their populations’

persistence (Bieber and Ruf, 2005; Frauendorf et al., 2016). These relational, environmental influences also hint at how humans have influenced wild boar proliferation, too. Accelerated, human-induced climate change and its ecological impacts; modifications to the temporal rhythms and species of arable farming; rural depopulation and its subsequent cultural changes; and urban expansion, to name a few, have all provided opportunities for wild boar to exert agency and actively contribute to transforming socioecological landscapes in Europe (Sandom et al., 2013; Hearn et al., 2014; Massei et al., 2015; Vetter et al., 2015; Keuling et al., 2017; Linnell et al., 2020; Valente et al., 2020).

Localized and global wild boar abundance has often been facilitated by their complex relations with humans, sometimes even through direct human support in the form of feeding or reintroductions by hunters (for example, see Hearn et al., 2014). Primarily, however, human-wild boar interactions are framed as conflictual. Normatively represented as forest inhabitants, “out-of-place” wild boar are seen as transgressing multiple boundaries and causing “damage” to crops; biologically threatening domesticated livestock; endangering local ecosystems and vulnerable species (Massei et al., 2011; Barrios-Garcia and Ballari, 2012; Ballari and Barrios-Garcia, 2014; Snow et al., 2017); and disrupting everyday human activities in rural areas, edgelands, suburbs and even urban centers (Licoppe et al., 2013; Stillfried et al., 2017). In other words, their increasingly conspicuous presence is often perceived as untenable within contemporary ecologies and economies (Schofield, 2010; Day, 2015; Warner, 2019).

Whilst generalized narratives such as this provide a relatively useful contemporary context, they give little understanding of the complicated political, ecological and socio-economic situations that give rise to specific human-wild boar relations in different locations. Importantly, there is also little consideration of how these distinct geographic and socioecological circumstances come to affect one another. Herein, the paper now introduces three accounts from the Czech Republic, Spain and England which help highlight the diverse historical, material and geographic contexts in which human-wild boar coexistence has played out.

Czech Republic: Coexistence Through Rural Change

By 1800, wild boar were nearly extinct in the open landscape of what is now the Czech Republic (Kovařík and Vosátka, 2013, p. 186; Andreska and Andreska, 2016). This was not a slow demise but was likely the result of a swift change in their governance. Namely, as part of reforms introduced by Maria Theresa and her son Joseph II who ruled over what was then part of the Austrian empire, a new hunting act was passed in 1786 which outlawed wild boar from the open landscape (Andreska and Andreska, 2016). Emphasizing economic growth and re-valuing agriculture over aristocratic interests in hunting, the act took away privileges from aristocrats and gave commoners hitherto unheard of rights to shoot or kill wild boar they encountered. Furthermore, they could even get compensation for property damage caused by wild

boar. In turn, wild boar themselves lost their status as knightly game, instead becoming a readily killable animal *non-grata*.

The resulting near extinction of wild boar, seemingly over less than 30 years, coincided with the newly emerging practice of four-course agricultural rotation, adopted in the 1st decades of the 19th century and which led to “unprecedented changes in both crop and livestock productivity and output” (Overton, 1996, p. 117). In this new socio-ecology, wild boar’s only acceptable place was in well-secured game enclosures which further changed who they were. Restricted in movement and now occupying a position akin to domestic swine, their “wild” qualifier merely appeared a reminder of their previous way of being.

However, post-WW2 turmoil allowed wild boar to undertake a gradual yet spectacular comeback from this state of near extinction. Legally backed by the 1947 hunting act which reinstated its presence as a legitimate game animal in the open Czech landscape, wild boar took advantage of a radical landscape change. From 1948, the communist collectivization of farmland and forests led to the creation of huge fields dominated by only a few crops, such as the maize promoted in the socialist bloc by the Soviet leader Nikita Khrushchev (Hale-Dorrell, 2018). While the rapid industrialization of agriculture led to an equally rapid demise of some wild species, for wild boar it apparently created ideal, plantation-like habitats they could colonize, hide within and feed upon. The collectivized countryside thus facilitated a renegotiated coexistence: wild boar suddenly stood between humans and their crops; the crops, especially maize, stood between wild boar and the hunters; and dogs used to drive “game” animals from the cover of vegetation, were increasingly vulnerable, often falling victim to boar groups far away from their human companions at the field edges. Wild boar, according to the numbers of animals hunted annually (the only reliable figures regarding wild animal populations), effectively recolonized Czech lands, their population growing from <4,000 in 1961, to more than 239,000 in 2019 (Andreska and Andreska, 2016; Kahuda, 2021).

Barcelona (Spain): Coexistence in the Urban Wild

In contrast to the broad spatial story of the Czech Republic, the Spanish case turns attention to the city of Barcelona, where the peri-urban population of wild boar has been growing and attuning to the expanding urban environment over recent decades. Key is the adjacent Collserola Natural Park, a 300-m-high massif covered by Mediterranean pine and oak forest which provides an important ecological core for wild boar. Understanding current wild boar demographics here also requires an understandings of socio-economic transformations over recent centuries. During the 19th century, agricultural fields, meadows and cattle enclosures were progressively abandoned as poor peasants started to migrate to cities to work in the emerging industrial sector, leaving behind a depopulated rural landscape (Doñate and Marquez, 2020). This industrial drift and the subsequent rural abandonment was followed by the natural regeneration of agricultural areas, the disappearance of buffer zones around farmers’ plots and fences, and thus enabled

the movement of fauna throughout Collserola park (Cahill and Llimona, 2004).

Over recent decades, as residential zones have expanded into the park, urban resources such as trash containers, water supply infrastructure, leisure zones and grass areas have increased. This growth in human presence and waste around the city periphery, in combination with the acorn-rich suburban forest, has diversified food and water resources for wild boar, leading to their increased presence in these urban interzones (Cahill and Llimona, 2004; Cahill et al., 2012). With an estimate of at least 1,200 individuals in the peri-urban area alone (Mitja Soto, 2019), wild boar currently stir concerns relating to traffic accidents (Gutiérrez, 2020), their disturbance of lawns and trash containers, and their bewildering appearances in central districts (Accini, 2018; Arregui, 2020).

Today, Barcelona is the scene of public debates as to how to cope with the ongoing transformation of the city’s urban ecology. While “expert” and “lay” perspectives come together over the need to recognize urban wild boar’s behavioral, bodily, and demographic changes, there is significant disagreement as to how their relations with humans should look. For conservation agents—scientists and local authorities—the ecological fabric of the outskirts need to return to a point when wild boar were largely absent, a process requiring strategic captures of peri-urban wild boar groups, or removing and euthanizing wild boar individuals which enter the urban hub. For peri-urban dwellers who encounter wild boar in their everyday life, however, experts’ interventions are frequently felt to be an unnecessary mediation, and more emphasis is placed on *personal* negotiations with wild boar individuals as some novel form of urban coexistence.

England: Coexistence as Absence-Presence

Whereas the cases from Czech Republic and Barcelona narrate human-wild boar relations that have grown in intimacy and intensity over long periods of time, the situation in England is somewhat different. Rather than presence, contemporary wild boar relations have been framed by the legacy of their multi-century absence. Commonly, this has been dated back to the late 13th Century and their disappearance from Royal hunting documents and archaeological records (Albarella, 2010; Yalden, 2010). In practice, however, wild boar extirpation from the British Isles was likely a drawn out and indeterminate process, something highlighted by medieval accounts of “wild” boar escaping from estates and “swine parks,” and the likelihood that phenotypically-similar domesticated “English pigs” and wild boar were cohabiting, interacting and interbreeding within woodlands where they both roamed freely (White, 2011; Yamamoto, 2017). Identifying a moment of extirpation, therefore, is complicated not only by patchy historical records, but also complex past modes of coexistence.

The return of wild boar as a rural actor began toward the end of the 20th Century when changing agricultural economies and subsidies led to their (re)introduction as “exotic” livestock, predominantly in southern England (Wilson, 2013; O’Mahony, 2020). Though licenses were given to farms from the 1980s

onwards on the condition their enclosures were secure, wild boar took advantage of lapses in surveillance and deliberate acts of sabotage to transgress farm borders. With no specific policy governing the presence of these unexpected, feral arrivants, locally isolated groups began reconfiguring human-wildlife relations in ways unfamiliar to contemporary Britain. Whilst some animals found space and time in woodlands to establish a multi-generational presence, others were quickly eliminated by agricultural landowners who saw them as an unwanted, risky presence.

In 2004, the sudden appearance of a large group of animals on government managed woodland in west England (the Forest of Dean)—believed “dumped” by a farmer—triggered a series of changes in human-wild boar relations (O’Mahony, 2020). Firstly, in response to the policy void and uncertainty about appropriate management, the government initiated a public consultation in 2005 and the eventual publication of a national action plan (DEFRA, 2008)¹. At the same time, wild boar began settling in the forest and their numbers grew. Initially rare encounters with the general public increased, as did their movements beyond the forest boundary. Early impressions these were woodland inhabitants at home in their “natural habitat” began to shift, and debates intensified over whether, and how, wild boar coexistence should take shape.

MULTISPECIES EVENTS AND THE VETERINARIZATION OF COEXISTENCE

These accounts from the Czech Republic, Spain and England exemplify the geographical, historical and socio-ecological diversity of human-wild boar relations in Europe. More than this, however, they also show that human-wildlife coexistence is not a process that unfolds evenly or predictably but, rather, is temporally unstable and dynamic. Human-wildlife relations are in flux and influenced by, for example, abrupt political enactments, gradual socio-economic changes, unexpected human-wildlife encounters, or individual behaviors and decisions. Some such shifts might prove to have long-lasting ramifications on the way coexistence is lived, perceived and governed.

One way to conceptualize these key moments is as (*critical*) events (Das, 1997; Rabinow, 1999; Donaldson, 2008; Humphrey, 2008; Lynteris, 2014; Seeberg, 2014)². For Veena Das, critical events arise from “unique configurations” which generate “new modes of action,” redefine “traditional categories” and lead political actors to acquire “new forms” (Das, 1997, p. 6). This understanding of events has been applied to research into disease outbreaks and epidemics. Christos Lynteris, for instance, has described how the Manchurian pneumonic plague epidemic of 1910–1911 (in China) “generated a radical rupture” (Lynteris, 2014, p. 65) and social-political transformation whereby new socio-technologies were implemented to exert medical power

over populations. According to Lynteris, subsequent epidemics had not produced such significant shifts, and thus amounted to “crises” rather than “events” (Lynteris, 2014, p. 71–72). Even more pertinently, Andrew Donaldson describes the 2001 outbreak of foot and mouth disease in the UK as an event that established biosecurity as an organizing idea that “shapes the regulatory landscape” of agriculture (Donaldson, 2008, p. 1554). Yet, while the body of literature on biosecurity has been steadily growing, its overlap with the scholarship on human-wildlife coexistence has so far been modest.

In sum, thinking of coexistence as *event-ful* is helpful because it foregrounds its unpredictable nature and the ways in which sudden occurrences can rapidly alter human-wildlife relations. More than just temporally specific moments, *critical events* are watersheds that emerge and rupture processes in ways that significantly alter what comes next. For example, they might create new geographies and political ecologies; lead to the emergence of new knowledges; reconfigure power relations; or radically alter the ways in which different human and non-human actors (re)negotiate their interactions.

The Event of African Swine Fever in Europe

To exemplify the importance of *events* in transforming human-wildlife coexistence, we turn to the case of African Swine Fever in Europe. This viral disease is endemic to Sub-Saharan Africa and primarily circulates through the ecological relations of warthogs and soft ticks, although it is also transmitted through other *suidae*—bushpigs, domestic pigs and wild boar—as well as via infected carcasses or contaminated meat (Chenais et al., 2019; Dixon et al., 2019; Podgórska et al., 2019; Schulz et al., 2019). Fundamentally, the virus is deadly for both wild boar and domestic pigs, meaning it has long-existed as a latent threat to the multi-billion-euro Eurasian pork industry. In 2007, analysis of some mysterious pig deaths in Georgia revealed the virus had been transmitted from Africa to Eastern Europe. This event, its significance perhaps not fully realized by governing authorities at the time, has led some veterinary epidemiologists to term ASF as “probably the most serious animal health disease [the world has] had for a long time, if not ever” (Normile, 2019). Its subsequent spread has disrupted the Asian and Eastern European pork industries, led to various socioeconomic, environmental and human health consequences (Li and Tian, 2018; Bai et al., 2021; Luskin et al., 2021; Xia et al., 2021) and, as this article argues, radically altered the conventional dynamics of human-wild boar coexistence in Europe.

The post 2007 spread of ASF through Eastern Europe and into the Baltic region was gradual, apparently following paths of localized transmission. However, in June 2017, whilst undertaking a passive surveillance scheme, the Czech State Veterinary Administration confirmed a wild boar carcass found in the Zlín region (Eastern Czech Republic) had tested positive for ASF. This discovery was startling, primarily, because the carcass was located hundreds of kilometers from the nearest previous detected ASF case in Northeastern Poland. Like other diseases, ASF once again shown it had the capacity to make unexpected “large jumps” (Smith et al., 2017) that both connected and threatened locations relatively removed. Whilst

¹Due to the devolution of UK government, this action plan covered England only.

²This social scientific literature appropriates the concept that has originally been developed and extensively explored by a range of philosophers such as Whitehead, Deleuze, Stengers and Badiou (for a summary see for example Fraser, 2006).

the story sparked concern for farmers and hysterical responses in various media, the country's State Veterinary Administration orchestrated a rapid and meticulous reaction (Danzetta et al., 2020). This used extreme measures, including the creation of a 50 km² no-go zone that temporarily overrode individual land ownership rights, as well as the deployment of police snipers to shoot wild boar. These drastic top-down measures were successful, the outbreak was contained and the country was declared ASF-free, thus enabling it to recommence its international pork trade in April 2019 (Semerád, 2019).

This ASF outbreak has turned out to be a transformative *event* in human-wild boar coexistence in the Czech Republic. Despite its closure, the biosecurity concerns it raised have remained as the single most important factor determining wild boar population management in the country. Local wild boar specialists were offered substantial research funding to address ASF related questions regarding their behavior and ecology. The annual reporting of hunting bags, hunting plans for the upcoming year and general discussions about the species' biology have, ever since 2017, been considered in dialogue with veterinary experts and in relation to ASF's potential return. The passive surveillance scheme that proved useful in the early detection of the 2017 outbreak has established its critical importance in the species' management. Due to the technical nature of these emerging procedures, veterinarians have increasingly appeared "in charge" and displaced hunters and game managers from this long-standing role of stewardship, whose own historic practices and roles are now being transformed by the requirements of veterinary specialists (see also Emond et al., 2021). This tendency was reiterated in autumn 2020 when, following an ASF outbreak in neighboring Germany, veterinary authorities announced an intensified hunting zone in the border region. This aimed to radically decrease wild boar population density through the promise of bounties paid for every hunted wild boar and carcass found. The hope was that the less dense population would make it harder for the virus to spread and, consequently, could better protect the domestic pig industry.

The event of ASF in the Czech Republic, we believe, has intensified and accelerated a pre-existing, ongoing process of what might be understood as the *veterinarization* of human-wildlife relations. Veterinary expertise represents a potentially powerful body of knowledge, set of practices and network of institutions. Driven by a coalition of factors—advancing knowledge practices, public interests in animal health and welfare, globally connected political ecologies, and growing concerns about biosecurity—veterinary expertise has increasingly assumed a significant role in mediating contemporary human-animal relations. As a phenomenon and analytical tool, this process somewhat reflects *medicalization*, a process through which an ever-growing number of human conditions are "defined in medical terms, described using medical language, understood through the adoption of a medical framework, or "treated" with a medical intervention" (Conrad, 2007, 5; e.g., Rose, 2007)³. Like medicalization, *veterinarization* is

not a simple, singular process, but a complex one that potentially connects individual and state actors, individual animals and populations, and isolated practices of care with overarching strategies of governance. Drawing logics of care and biosecurity together, veterinary knowledges not only assist and intervene in specific human-wildlife relations but, when incorporated into the law-making and executive apparatus of states, hold the power to prescribe, regulate and sanction those relations in the name of human and non-human well-being. Foregrounding safety and security, veterinarians can find themselves responsible for shaping policies relating to agricultural practices and wildlife management. Moreover, the veterinary perspective can also (re)define wildlife presence, intra and inter-national animal mobilities, and the desirable futures of individuals and species.

The Veterinarization of Wild Boar in Spain and England

The Czech Republic experience of ASF was a highly publicized, critical event that enhanced veterinary prominence within human-wild boar coexistence. As we go on to show, it has also had similar effects in other parts of Europe, including those, such as Spain and England, that have suffered no incidence of ASF since its emergence in Georgia in 2007. This is, we argue, because the ASF outbreak—initially emerging in Georgia, slowly spreading through Eastern Europe, and performing a "large jump" (Smith et al., 2017) to the Czech Republic and then Belgium—has effectively connected wild boar populations in distant, transborder locations. This connection has not materialized merely through the circulation of the ASF virus itself, but also the discourses that surround human-wild boar coexistence, the strategies of bio-governance that shape it, and the kinds of knowledge practices that influence these strategies. Put bluntly, the Czech case became a kind of exemplar that simultaneously warned and generated a "success story" to be shared in a vibrant international network emerging around ASF and wild boar management (Charvátová et al., 2019, 2020).

This multidisciplinary milieu centers around a cluster of international organizations, such as OIE⁴, European agencies such as EFSA⁵, and focused multi-institutional groups like ASF-Stop COST Action⁶ or the EU funded Enetwild consortium⁷. Together, these have created an arena to produce knowledges and help translate these into regulations, (best) practices and technologies to be adopted by national regulatory bodies, industries and other stakeholders. These influential actors, clustered around the problem of ASF, are active agents in the *veterinarization* of human-wild boar relations beyond locations where ASF outbreaks have occurred. By mobilizing pre-existing, anticipatory biosecurity logics that foreground prevention and preparedness (Braun, 2013; Keck, 2020), they are re-shaping the boundaries of human-wildlife engagement whilst contributing toward and promoting more interconnected

colonial Namibia. While our understanding of *veterinarization* certainly subsumes that example, we argue for a much broader understanding, analogous, not surprisingly, to the "medicalization of society" concept.

⁴<https://www.oie.int/en/home/>

⁵<https://www.efsa.europa.eu/en>

⁶<https://www.cost.eu/actions/CA15116/>

⁷<https://enetwild.com/>

³To our knowledge, only Giorgio Miescher (2012) has spoken about "veterinarization" in a similar vein, specifically the "veterinarization of police" when referring to the control of stock as an integral part of police work in

forms of bio-governance. This process has influenced the two contexts of Spain and England, countries prone to this enhanced veterinarianization due to their own previous experiences managing animal disease events.

Spain has previously experienced ASF, and although it was eradicated in the 1990s it still foreshadows local strategies of prevention and preparedness. Due to its potentially devastating impact on intensive pig farming, ASF occupies rural Spanish imaginations as an “economic illness” which triggers deep fears of crisis and economic vulnerability (Montoto, 2019; Gutiérrez Fernández de Velasco, 2020). In other words, for pig farmers and other biosecurity stakeholders, ASF has always remained a latent yet intense worry. In the last three decades pig-related epidemic concerns have mobilized funding, institutions, and bio-sanitary policies in discreet ways. As such, Spanish veterinary experts are extremely visible participants in the aforementioned pan-European ASF milieu, notably leading the Enetwild consortium, European ASF reference laboratory⁸ and consortia developing an ASF vaccine⁹.

This deeper context has meant local veterinary agencies were well-positioned and ready to intervene as wild boar have increasingly begun to appear in Barcelona and other Spanish cities (Madrid, A Coruña). In Barcelona, an emblematic moment that saw veterinarians take a lead role in management occurred in 2013, when a wild boar roaming the city center caused turmoil and resulted in an injury of a police officer¹⁰. In response, the Government of Catalonia and the Provincial Deputation of Barcelona signed several research contracts with the Universitat Autònoma de Barcelona (UAB) to conduct an ecological and sanitary study of wild boar¹¹. These agreements effectively put a team of veterinary scientists—the Wildlife Ecopathology Service based at the UAB—in charge of managing the wild boar population in the urban and peri-urban areas of Barcelona. The same veterinarians were also the people to contact and report wild boar related “incidents,” of which more than 300 were officially recorded between 2013 and 2018. All these episodes involved, first, police notification and, second, the intervention of vets who were called to anesthetize and euthanize the animals, and in some cases conduct necropsies before incineration.

Besides these targeted removals, nowadays the vets also conduct regular captures of wild boar groups in critical peri-urban spots. These veterinary interventions have been implemented in parallel to more traditional hunting battues, which are also framed as part of the control of the wild boar

⁸<https://ASF-referencelab.info/ASF/en/>

⁹<https://vacdiva.eu/>

¹⁰On April 2, 2013, a wild boar was seen perambulating in central districts of the city, nearby Sants Train Station. It was 4 a.m., but two police officers believed the animal could cause traffic accidents or attack pedestrians. In a stroke of misfortune, in attempting to shoot the wild boar, a bullet ricocheted into one of the officer's knees, resulting in a serious injury. The boar in question was hit seconds later. The case was widely reported in the media (Redacción, 2013).

¹¹<https://www.uab.cat/web/sala-de-prensa/detalle-noticia/convenio-para-investigar-la-ecologia-de-los-jabalies-1345667994339.html?noticiaid=1345659040511>

“plague”¹². After battues, veterinary scientists join hunters at the so-called *junta de carnes* (meats’ joint), spots where hunters dispose animal carcasses and vets can extract samples to be analyzed. In this context, veterinary scientists have become ubiquitous agents of wild boar bio-surveillance and population control. The increasing presence of these animals in Spanish urban peripheries, along with the persistent news of ASF spread in Europe and other pathogens carried by wild boar (Ruiz-Fons, 2017), have placed veterinary expertise at a central position in local sanitary and ecological policies.

The case in England shows a different yet related trajectory of veterinarianization. Although it has never experienced ASF, a foot and mouth (FMD) outbreak in 2001 which led to the cull of around 6 m sheep, cattle and pigs dramatically affected agricultural practices and the well-being of rural communities (Peck et al., 2002; Convery et al., 2005; Hagar, 2005; Mort et al., 2005). Moreover, ongoing contestations over bovine tuberculosis (bTB), cattle and badgers have also shaped wildlife management and the methods through which multispecies coexistence is negotiated (Enticott, 2001; Cassidy, 2019). Overall, these events have contributed to an ongoing veterinarianization of wildlife and partially influenced responses to the recent ASF emergence in Europe.

Similar to the biosecurity logics unfolding in Barcelona, growing tensions surrounding wild boar encounters and rooting in the villages and towns of the Forest of Dean were presumed to relate to their population growth, and government forestry officials began a cull in 2008 to reduce their numbers. Importantly, however, the appearance of these animals had also spawned several ethically eclectic publics which drew in individuals and groups both enthused and concerned by the prospect of wild boar coexistence. As the forestry began culling, public disquiet grew and counter arguments formed, prominent amongst which was a sense that with no genuine understanding of the wild boar population, authorities could not argue their cull was “scientific.” The response, in 2011, was for the forestry officials to temporarily halt their cull and “ecologize” their practices by implementing a monitoring strategy using distance sampling, thermal imaging and computer modeling. Over the years since, this monitoring has suggested a continuing growth in the wild boar population, one which has meant the cull has continued, as have tensions among local communities, forestry officials and local authorities (O’Mahony, 2020).

The ongoing debates about coexistence have been accelerated by the critical ASF events on the continent, and broadened interest from a local to national scale. Whereas concerns around the Forest of Dean have primarily been around “out of place” animals in settlements, the growth in population and its believed expansion has increasingly worried the agricultural

¹²Further technoscientific measures have been implemented as pilot projects, such as the sterilizations of sows. The city council of Barcelona has also launched environmental education campaigns seeking to reduce human-wild boar interactions (Claverol, 2016). Likewise, some tweaks to the urban infrastructure have pursued to curb wild boar urban presence. Among these changes are fixing trash containers to the ground (to prevent wild boar from overturning them), installing deeper fencing in strategic areas, or reducing the green spaces which have become regular rooting spots for wild boar.

sector. Although the 2008 Action Plan had a specific annex on health and disease, early agricultural concerns around wild boar were, in practice, often framed around crop and grassland disturbance (DEFRA, 2008).

Now, however, it appears ASF disease ecologies are foreground in shaping the future boundaries of wild boar coexistence. Agricultural interest groups (historically, representing a diverse voice which viewed them either as novel game or pest), especially the pig industry, are vocal about the need for a more coherent “control strategy” (see NPA, 2018), and have funded a working group to formulate a more coherent practical management strategy¹³. This is primarily motivated by a need to protect the national pig economy, physically separated from mainland Europe and seen as benefitting from a high welfare status and freedom from notifiable disease (such as ASF), but simultaneously unsettled by the ramifications of Brexit. Coupled with the emotional trauma caused by past FMD and bTB epidemics, there is a powerful driver for change.

The event of ASF on the continent has prompted government departments and veterinary agencies to centralize its preemptive and preventative management. A broader disease control strategy for managing various notifiable diseases now focuses specifically on ASF, and virtual simulations of ASF have been held, while government funding has focused on research into disease modeling and alternative management measures, such as sterilization (Croft et al., 2020a,b). Simultaneously, authorities have increased their effort in communicating biosecurity risks by targeting and responsibilizing farmers (about their on-farm biosecurity practices), stalkers (about the signs of disease and transmission risk), and local residents and tourists (about the risks of feeding food waste). This has incorporated different communities (of practice) and actors into ASF epidemiology. Finally, some more practical steps have also been made, with forestry authorities now sending found carcasses to the Animal and Plant Health Agency (APHA) for sampling, and sniffer dogs being trialed at airports/seaports to monitor potentially infected products¹⁴. Veterinarianization of wild boar in England, thus far less interventionist than in Barcelona and Czechia, appears likely to become increasingly proactive as disease risks grow or feel increasingly threatening.

CONCLUSION: COEXISTING IN VETERINARIZED FUTURES

Foregrounding the ways human-wild boar relations have shifted through *critical events* helps disclose the unstable and open-ended quality of porcine ecologies as they emerge in Europe and beyond. As we have shown, different forms of coexistence are increasingly subject to a progressive veterinarianization. This trend seems relatively clear. Whereas only several decades ago (and, to a degree, still now) human-wild boar relations were seen as primarily situated in the countryside and relating purely to the practices of game management and agriculture, this has

changed. Not only have wild boar actively (re)colonized spaces from which they were displaced, but humans have also colonized some of those spaces where wild boar were emplaced. This has caused a fundamental broadening not only in the geographies of coexistence, but also changes in governance arrangements and the ways in which practices of “management” are performed.

As our three examples highlight, human-wild boar coexistence is not a relationship with only two actors. Rather, it is a complex multispecies web in which other species and lifeforms assume various roles, such as the ASF virus and domestic pigs as this paper has described. We have argued that the 2017 ASF outbreak in the Czech Republic was a critical event in human-wild boar coexistence in Europe, simultaneously an example of a large viral jump and a model for successful intervention. It confirmed the authority of veterinary specialists and justified a growing suite of biosecurity measures, firmly placing them at the center of human-wild boar relations. This veterinary engagement with wild boar has, as the Barcelona example confirms, also altered longstanding practices of “control,” of which hunting and culling is the primary example. Thus, hunters and wildlife rangers are no longer uncontested stewards, but simply one of many stakeholders who undergo compromise and need to comply with prevention and preparedness as two key regimes of epidemiological engagement (Keck, 2020).

Despite our focus on ASF, this is not the only future concern around human-wild boar relations. Another key driver in the process of their veterinarianization is the anticipation of potential zoonoses, i.e., the transmission of diseases between non-human animals and humans. Zoonotic concerns center on the high number of diseases that wild boar can transmit to humans, including respiratory viruses (Ruiz-Fons, 2017). While awareness of zoonoses has largely remained within the domain of “experts,” the COVID-19 pandemic brought it to wider public attention (Arregui, 2020). Zoonosis, as a potential “epidemic ground zero” (Keck and Lynteris, 2018), is now present in both scientific and popular discourse as a very real factor guiding future forms of human and non-human coexistence. While zoonotic concerns may further intensify the veterinarianization of human-wild boar coexistence, they may simultaneously highlight its effective limits, a point resonating with literature on “One Health” and biosecurity (Enticott, 2012, 2017; Hinchliffe, 2015). In such light, to ensure the significant role veterinary rationales have assumed is a positive one, a close dialogue with other knowledge disciplines—for example, human medicine and epidemiology, or the social sciences—should be fostered to sensitively address the social-cultural dynamics of disease in human-wildlife coexistence.

DATA AVAILABILITY STATEMENT

The data is of an ethnographic nature and not available for secondary use or publicly available. Please direct any enquiries to LB, broz@eu.cas.cz.

ETHICS STATEMENT

The three researchers belong to different institutions. The research in the UK was part of wider project involving

¹³<https://www.pig-world.co.uk/news/ahdb-funded-working-group-to-formulate-feral-wild-boar-plan.html>

¹⁴http://www.npa-uk.org.uk/Defra_showcases_sniffer_dogs_at_Heathrow_in ASF_crackdown.html

human subjects which was reviewed and approved by the Cardiff University School of Geography and Planning Research Ethics Committee. The research in Czechia and Spain did not involve any research with human subjects. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

All authors contributed empirical material and conceptual work.

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Sharing Spaces and Entanglements With Big Cats: The Warli and Their Waghoba in Maharashtra, India

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Long histories of sharing space and resources have built complex, robust, and enduring relationships between humans and wildlife in many communities across the world. In order to understand what makes it possible for humans and wildlife to share space, we have to look beyond the ecological and socio-economic study of damages caused by human-wildlife conflict and explore the cultural and societal context within which co-existence is embedded. We conducted an exploratory study on the institution of Waghoba, a big cat deity worshiped by the Indigenous Warli community in Maharashtra, India. Through our research, we found that the worship of Waghoba is highly prevalent, with 150 shrines dedicated to this deity across our study site. We also learnt that the Warlis believe in a reciprocal relationship, where Waghoba will protect them from the negative impacts of sharing spaces with big cats if the people worship the deity and conduct the required rituals, especially the annual festival of Waghbaras. We propose that such relationships facilitate the sharing spaces between humans and leopards that live in the landscape. The study also revealed the ways in which the range of institutions and stakeholders in the landscape shape the institution of Waghoba and thereby contribute to the human-leopard relationship in the landscape. This is relevant for present-day wildlife conservation because such traditional institutions are likely to act as tolerance-building mechanisms embedded within the local cosmology. Further, it is vital that the dominant stakeholders outside of the Warli community (such as the Forest Department, conservation biologists, and other non-Warli residents who interact with leopards) are informed about and sensitive to these cultural representations because it is not just the biological animal that the Warlis predominantly deal with.

Keywords: human-wildlife interactions, indigenous beliefs, social institution, India, carnivore, warli community, sharing spaces, leopard

INTRODUCTION

Human-wildlife conflict emerged as a field of study within conservation research and practice in the 1990s and has since been developing (Woodroffe et al., 2005; Redpath et al., 2015; Pooley et al., 2017; Bhatia et al., 2019). Research pertaining to the study of ecology, diet, geography, distribution of attacks, and mitigation practices associated with the “conflictual” wildlife species dominated the treatment of the issue, often centered in and around protected areas (Edgaonkar and Chellam, 2002; Andheria et al., 2007; Athreya et al., 2013, 2016; Kshettry et al., 2017). Over time, the field

of study has expanded, not only geographically to look at human-wildlife interactions in multi-use landscapes, cities, and other non-protected areas (Athreya et al., 2013; Chapron et al., 2014; Carter and Linnell, 2016; Landy, 2017; Miller et al., 2017; Dhee et al., 2019), but also ideologically to include the study of the numerous dimensions associated with human-wildlife interactions (Ghosal et al., 2013; Aiyadurai, 2016; Crown and Doubleday, 2017; Doubleday, 2017; Bhatia et al., 2019; Nijhawan and Mihu, 2020).

There has progressively been a recognition that these conflictual interactions are far more complex and constitute only a portion of the multiple types of interactions that exist between humans and wildlife (Kolipaka et al., 2015; Carter and Linnell, 2016; Crown and Doubleday, 2017; Linnell et al., 2020). Furthermore, there is also a steadily growing body of research that seeks to understand the social, anthropological, political, inter-institutional, cultural, psychological, and other human factors that shape human-wildlife interactions (Redpath et al., 2015; Landy, 2017; Pooley et al., 2017; Bhatia et al., 2019).

Even though the study of human-wildlife interactions has been a relatively recent development within the conservation literature, it is by no means a novel subject matter to the innumerable societies across the world who have been sharing space with animals for centuries (Ingold, 2000; Messmer, 2000; Bhatia et al., 2019). Consequent to the long histories of cohabiting landscapes with wildlife, all societies have attempted to make sense of their interactions with other species and manage the consequences that these interactions produce (Ghosal, 2013). Societies across the world conceptualize nature and animals in a multitude of ways (Descola, 1992; Gadgil et al., 1993; Descola and Pálsson, 1996; Ingold, 2000; Goldman et al., 2010; Jalais, 2014; Aiyadurai, 2016; Dhee et al., 2019) making it imperative to understand them through their local reality, context and worldview. In some communities, narratives and knowledge surrounding human-wildlife interactions can also be seen entwined into informal social institutions. For example, in Dibang Valley the kinship ties of brotherhood and taboos describing the ill consequence of killing a tiger contribute significantly to the relationship between humans and tigers in that landscape (see Aiyadurai, 2016; Nijhawan and Mihu, 2020).

The Warlis, an Indigenous community from North-western Maharashtra, have, for centuries, shared spaces with big cats. This landscape has been home to leopards (*Panthera pardus fusca*) and historically even tigers (*Panthera tigris tigris*). The Warlis worship a big cat deity called "Waghoba." In this study, we carried out an ethnographic inquiry that explores the emergent themes in oral histories, narratives of worship, power structures, and belief systems. Our aim was to understand narratives related to Waghoba and the negotiation of shared spaces in relation to big cats in multi-use landscapes i.e., a mosaic of agricultural, industrial and forested landscapes. Social institutions can be understood as an enduring set of ideas, beliefs and practices that function to satisfy various human needs (Johnson, 2000). They may be formal such as the state, prisons, schools or informal institutions such as political ideology, cultural norms, belief systems, etc., and form an interrelated system of social norms and roles by people united for a common goal (Abercrombie et al.,

1994). Previously, other studies have established the link between large cats and Waghoba in other parts of Maharashtra (Ghosal and Kjosavik, 2015; Pimpale, 2015; Athreya et al., 2018). In this study we considered not only the deity but the "social institution of Waghoba" as the subject, exploring the multilayered and interrelated features of Waghoba worship and people-leopard relations including facets of religion, politics, and kinship.

Scholars in the past have described the Warlis as animists (Save, 1945; Dandekar, 2005). However, there is growing recognition in academia about the immense heterogeneity in indigenous cosmologies across the world, and how they often cannot be encapsulated into the pre-existing frameworks of animism and totemism. Århem (2016) discusses the ways in which South Asian animism is particularly distinct from Amerindian animism, and the need to decolonize our perspective in order to recognize the existence of various cosmologies. Therefore, in an attempt to broaden the way we interpret and understand the cosmologies we encounter, in this paper we have chosen not to restrict ourselves to using pre-existing animistic frameworks as the only way to understand Warli cosmology.

MATERIALS AND METHODS

Study Site

Fieldwork for this study was conducted in both multi-use landscapes and protected areas. These include hamlets and villages in parts of the Mumbai Suburban (446 km²), Thane (4,214 km²), and Palghar (5,344 km²) districts located toward the north-west of Maharashtra, India (Maharashtra Government, 2018) (Figure 1). These regions encompass the northern hills of the Western Ghats and Maharashtra's western coastal plains bordering the Arabian Sea.

The climate in these regions is tropical, humid, and warm. These regions support both agricultural as well as small and large-scale business industries such as textile, chemicals and steel. Protected areas included within our study site are Sanjay Gandhi National Park (103 km²), Tungareshwar Wildlife Sanctuary (85 km²), and Tansa Wildlife Sanctuary (320 km²) (Maharashtra Forest Department, 2021). Mammalian species such as the leopard, jungle cat (*Felis chaus*), spotted deer (*Axis axis*), barking deer (*Muntiacus muntjak*), sambar (*Rusa unicolor*), common langur (*Semnopithecus entellus*), and black-naped hare (*Lepus nigricollis*) have been recorded here (Maharashtra Forest Department, 2021).

Anecdotal evidence, government records, and media reports indicate both the historical presence of tigers (with recent sightings of an individual from 2003) and the current presence of leopards in the landscape (Anonymous, 1882; Bhagat, 2010). Records indicate that the Warli community have historically been inhabitants of the presently identified regions of Mumbai Suburban, Thane, and Palghar districts (Save, 1945). Our study area was chosen based on the prior knowledge that both Warlis and big cats are present in this region.

The Mahadeo Kolis, Malhar Kolis, Thakkars, and Dublas are other smaller (population wise) indigenous groups in the vicinity that also worship some deities of the Warli pantheon, including Waghoba. However, for this study, we chose to focus on this

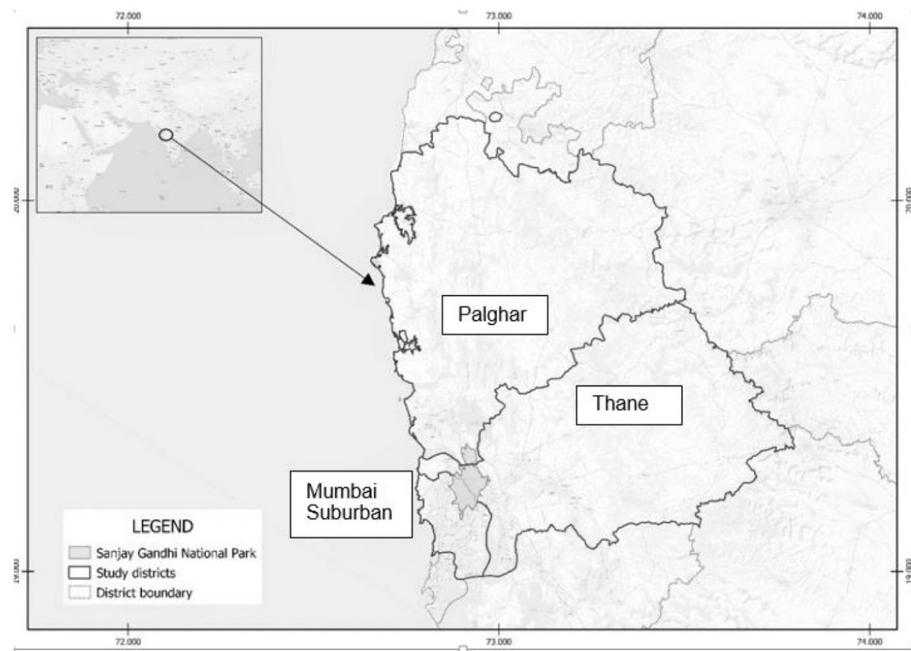


FIGURE 1 | The study was conducted in parts of the districts Palghar, Thane, and Mumbai Suburban in Maharashtra, India. Map credits: Shweta Shivakumar.

institution among the Warlis. We found that the Warlis are the most abundant of the groups mentioned above that share the landscape, giving us a larger group of people to engage with while also allowing our initial inquiry to be focused on one community.

Study Design

Ethnographic approaches are increasingly being employed to study the diversity of human-wildlife relations, particularly in the context of conservation (Goldman et al., 2013; Khumalo and Yung, 2015; Aisher and Damodaran, 2016; Aiyadurai, 2016; Vasan, 2018). Ethnography allows for an exploration into the narratives, myths, stories, traditions, practices, and lived experiences of a group or community and how these shape people's beliefs and attitudes concerning the area of inquiry. Through the use of in-depth unstructured or semi-structured interviews, group discussions, and participant observation, an ethnography can produce rich qualitative data (Bernard, 2017; Vasan, 2018). Hence, we chose this approach to study the social institution of Waghoba among the Warlis of north-western Maharashtra.

Our study was a short-term ethnography (Pink and Morgan, 2013) (as opposed to a traditional in-depth long-term ethnography typically spanning over 6 months in the field), which comes with acknowledging the unfeasibility of getting a complete and detailed understanding of the subject matter. Like all such studies, this paper reflects our understanding and interpretation of these cultural systems.

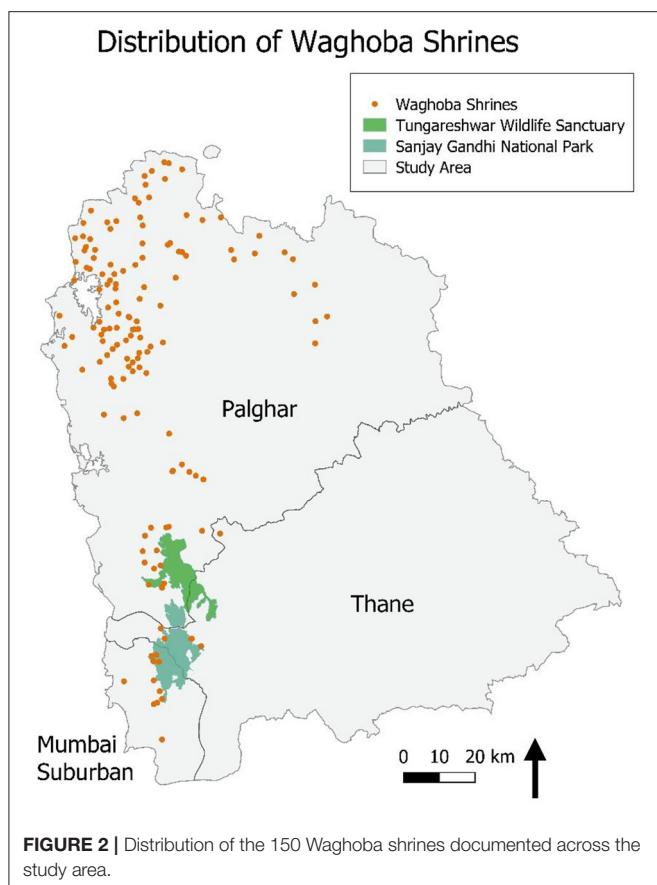
For this study, RN (the first author of this paper) conducted fieldwork for 6 months (November 2018 to April 2019) with the assistance of OP, wherein they spent several days each month living in the study site to build trust and social connections

among the communities and traveled to document Waghoba shrines. Interviews and participant observation were conducted concurrently with the documentation activity. Informed oral consent was obtained from every participant before conducting interviews and obtained from community members for the researchers to participate in, observe and document traditional practices. Three main methods were employed to collect data for this study; the documentation of Waghoba shrines, semi-structured interviews, and participant observation. This study's ethics approval was obtained from the Human Research Ethics Committee at WCS-India (Project no. 2018/6).

Documentation of Shrines

Even though previous studies, as well as anthropological and historical records, have documented the existence of a big-cat deity called Waghoba that is worshiped by Warlis and other Indigenous communities in Maharashtra, they do not provide a clear understanding of its current widespread prevalence and prominence (Ghosal and Kjosavik, 2015; Pimpale, 2015; Athreya et al., 2018). In order to explore the geographical spread of the belief in Waghoba and understand its iconography and physical characteristics, we documented Waghoba shrines throughout the study area.

The initial Waghoba shrines that we documented were identified based on prior knowledge and snowball sampling in the area. Sanjay Gandhi National Park (SGNP) has been known to be home to one of the world's highest population densities of leopards (Surve and Ahmed, 2017). Both SGNP and the adjoining Aarey Milk Colony contain multiple hamlets of Warli residents. We began fieldwork here and expanded north toward the Maharashtra-Gujarat border via National Highway



48 (NH48). Over the period of fieldwork (November 2018 to April 2019) we traveled \sim 2,125 km through Dahanu, Palghar, Talasari, Boisar, Vasai, Wada, and Jawhar regions, all known to have resident Warli communities.

In many cases, a shrine may not evidently belong to Waghoba, as many deities in the region (including Waghoba) have shrines which appear the same to an outsider i.e., sacred stones covered in vermillion paste. Therefore, we always consulted with nearby residents, shamans or elders to ensure correct identification of the shrine. We also asked questions about how old the shrines were, how they were made, who visited them, and how often. The GPS location of each shrine was recorded so as to map the geographical distribution of Waghoba shrines in the study area. All data points were added to a map using QGIS (see Figure 2). To create a visual repository of the deity and understand its physical characteristics, multiple photographs were taken at each shrine (check Supplementary Material). It was ensured that the photographs documented all the relevant details of each deity, and when applicable, its surrounding structure and any other deities in proximity. The process of documentation was also utilized as an opportunity for the primary researcher to become acquainted with people in the study area, establish a social network, and identify potential participants for the semi-structured interviews that were conducted subsequently.

Semi-structured Interviews

A total of 34 semi-structured interviews were conducted with individuals within the study area during the span of fieldwork. A set of questions were prepared prior to the interview (see Supplementary Material for the interview guide), however the researchers exercised opportunistic discretion while asking questions in order to be flexible and sensitive to the flow of the conversation and each participant's particularities. The questions were designed to gain knowledge about and gather narratives on the role of Waghoba in the lives of the Warli, the history of Waghoba worship, associated festivals, rituals and traditions and the ties between Waghoba and human-leopard interactions. Multiple origin stories, narratives and beliefs associated with Waghoba and encounters with big cats were also recorded during the interviews. A purposive snowball sampling method was used to identify individuals in the landscape who had narratives and knowledge to share about Waghoba, a sampling method often used to document cultural phenomena (Bernard, 2017).

During fieldwork, there were typically four researchers who were part of the team. RN and OP conducted the interviews in the presence of two local field assistants, further referred to collectively as "field researchers." The interviews were conducted in either Marathi or the Warli language. All the four field researchers speak Marathi, the state language of Maharashtra, which is linguistically similar to the Warli language, allowing the field researchers to converse with all the participants without much difficulty. The documentation of Waghoba shrines involved extensive travel across the entire landscape. Therefore, the researchers could not spend substantial time in each place to build their social connections. In this case, the field assistants played multiple roles; a bridge between the researchers and participants, a guide to the landscape, and a translator when the researchers encountered unfamiliar variants or tonal differences in language.

Participants of the study included Warli men who were farmers, school teachers, shamans (medicine men, conductor of rituals), *sarpanch* (village heads), and artists. All of these participants were men. The only exception to this was an expert interview conducted with a woman scholar who did not identify herself as Warli, but lived as part of a Warli community and had many insights into Warli culture. A majority of the participants were middle-aged and elderly men within the community. Even though we also aimed to interview Warli women, many factors restricted this. Firstly, our team of field researchers was male-dominated, with only one woman and three men, perhaps making it intimidating for women to participate. Secondly, the Warli community is patrilineal (Save, 1945), making it difficult to approach women directly. Furthermore, we did not spend enough time in each new site for women to grow comfortable enough to participate in interviews. We suppose that due to these reasons, women were hesitant to engage with us and often redirected the conversation to men within the household or village. The interviews were recorded using a handheld audio recorder after gaining informed, oral consent. To safeguard the anonymity of the participants, it was ensured that names and other identifiers were omitted from the interviews. The duration of interviews varied between 10 and 55 min. The

audio recordings were translated into English and transcribed by multiple people, then checked by RN for accuracy. The interview quotes that appear in the text have been paraphrased to make them coherent after direct translation.

Participant Observation

Participant observation is a central method used in ethnographic fieldwork wherein data is produced through direct observations, group discussions, and off-the-record conversations (Bernard, 2017). This allows for a flexible approach to fieldwork and produces valuable data that may be difficult to procure through other methods (Bernard, 2017, p.342; Vasan, 2018).

When enquiring about Waghoba shrines in our field site, participants shared details about an annual festival called “Waghbaras” observed for Waghoba. During this time, a *pooja* or ritual ceremony is conducted, and people make offerings to Waghoba. This was an ideal setting to understand this institution and observe rituals performed for the deity. We opportunistically attended three such ceremonies at different shrines, all of which will be unspecified to protect participants’ and attendees’ identities. RN was the primary observer at all three ceremonies, whereas OP and NS accompanied her at different ceremonies. We took photographic and video recordings of these ceremonies after obtaining consent from multiple attendees. It is not viable to take consent from each and every attendee as people kept flowing in and out of the venue. However, when video shooting any person in particular, consent was obtained from them personally. RN took notes of direct observations of the sequence of events that unfolded through the ceremony. One ceremony was observed during the night, another one was observed through the entire night and the next morning, while the third one was observed only during the morning after its commencement.

Limitations

The exploratory nature of this study bears its own limitations. The fieldwork for our study was conducted over a short period of time and across a large geographic area. This meant that we could not spend as much time as we would have liked in each Warli settlement to gain the kind of depth and nuance that we strive for. Furthermore, the short-term nature of our study did not allow us to engage with the local community in a way that would have allowed us to collaborate and co-produce this paper with them. We recognize that this as a significant shortcoming and strive to be more collaborative in our future research (Smith, 1999; Sultana, 2007; Koster et al., 2012; Dutta, 2018). Another consequence of doing an exploratory study was that we had to be open to more opportunistic methods rather than doing systematic sampling. Even though we attempted to ensure as much representation as possible across age, class and socioeconomic status, stratified systematic sampling would have ensured more representational participant group. Our aim for representation was further compounded by the reality on ground wherein some, especially marginalized parts of society, were not accessible to us as researchers. This was particularly the case with gender representation as most of the Warli women that we approached hesitated to engage with us and often redirected the conversation to men.

Analysis

The GPS locations of all the shrines were mapped using the software QGIS to show their spatial spread. Textual data, consisting of interview transcripts from semi-structured interviews and field notes from participant observations, were analyzed inductively. For this, a grounded theory method was used through which one can identify emergent themes and patterns within the data based on a grounded understanding of the social context gained through knowledge and ethnographic experience, rather than through a predetermined hypothesis. This process involves coding the data followed by developing, checking, and integrating theory and then writing analytic narratives (Charmaz and Belgrave, 2015; Tie et al., 2019).

NVivo software (version NVivo12 Pro) was used to code the data manually. As various themes and narratives emerged from the data, nodes and sub-nodes within NVivo were created. Extracts from each interview that proved explicitly relevant to each node were accumulated from all the transcripts. Relationships between different nodes created on Nvivo were identified and grouped to explore the central themes and narratives that emerged. Parallel to this, origin stories, narratives, and beliefs associated with Waghoba and accounts of encounters with big cats were also accumulated into separate nodes. Notes from participant observations were analyzed manually.

The prominent themes that emerged in this process included the history of Waghoba worship, rituals, and traditions, people’s perception of the big cat (through stories and interactions), negotiation of shared spaces, and social dimensions of the worship. Themes and stories that illuminated the origin of Waghoba were then stitched together manually.

RESULTS

Waghoba and Shrines

Through extensive mapping we documented 150 Waghoba shrines within the study site (Figure 2). A majority of these shrines were found in multi-use landscapes and a few in protected areas (PAs) like the Sanjay Gandhi National Park and Tungareshwar Wildlife Sanctuary which were being frequented by nearby residents. Prior studies on Waghoba (Athreya et al., 2018) have documented the presence of a few shrines in parts of our study site. Further, studies by Ghosal (2013) and Pimpale (2015) have documented the presence of Waghoba shrines in other parts of Maharashtra and Goa, India. We found clusters in various parts of our study site, particularly in the Palghar district where numerous Warli communities live. We noted that all the villages that housed people from the Warli community had at least one Waghoba shrine in their vicinity, if not more. Some of the villagers explained that many villages may have two shrines: one in the village and one on a local hilltop. Though we were able to locate and document almost all the Waghoba shrines that were within the premises of the villages that we traveled to, the same was not always possible of the hilltop shrines. Due to this reason, we cannot claim that we have exhaustively documented all the Waghoba shrines in the study area.

Among the multiple communities that worship the big cat deity, Waghoba is known by multiple names such as *Waghdev*,



FIGURE 3 | Some variants of Waghoba shrines and idols documented across the study site.

Waghya, Waghjai, Bagheshwar, Waghjaimata (female form), with Waghoba being the most commonly used name in our study site (Gadgil and Malhotra, 1979; Newman, 2012; Ghosal and Kjosavik, 2015; Athreya et al., 2018). Waghoba is derived from the Marathi words “wagh” which means big cats and “ba,” a term assigned to an elderly or paternal figure in the community. The interviews revealed that the people in this landscape perceived leopards and tigers to be alike and considered them both to be a form of Waghoba. The word *wagh* is similar to the Hindi word *bagh*, which is used to refer to both the tiger and the leopard in other parts of India (Mathur, 2016); which indicates that people in this landscape have their own taxonomic categorization of these species which may not be concordant within the specifics of modern scientific taxonomy (Shull, 1968; Landy, 2017).

The iconography of Waghoba that we came across was of a feline under the sun and moon, carved on either stone or wood (specifically teakwood) slabs covered with a bright vermilion paste. Some participants explained that the sun and moon symbolized energy. Many villages had Waghoba shrines built at the entrance to the village indicating that Waghoba might be considered as a gatekeeper, protecting the entire village. Shrines that we came across ranged from small, modest monuments to big, elaborate ones that were seen particularly in semi-urban parts of the study site (**Figure 3**).

Participants could not account for the age of the shrines in their respective villages but stated that they were at least a few 100 years old. Wooden idols that decayed were replaced in the same place every 15–20 years. It may be relevant to note that not all shrines consisted only of the Waghoba idols, idols of other deities such as the *Gaondevi* (village goddess), *Zoting* (spirit of a man) or *Veer* (soldiers) could often be seen established within the same shrine premises. This suggests that Waghoba exists within an interconnected network of deities worshiped by the community. However, in many Warli villages, Waghoba was worshiped as the chief village deity or *gaondev*.

Waghoba is worshiped above all for protection from big cats, disease and calamities. Participants spoke of the *wagh* as the

junglacha raja (king of the jungle). One participant also called Waghoba the “main boss.” Furthermore, many of them also stated that the *wagh* is to the forest what the *sarpanch/patil* (village head) is to the village, extending both the deity and the animal a sense of authority (Descola, 2013). They stated that when people roam in the forests, they put their trust in Waghoba because he is their protector.

“The *wagh* is known and accepted as the king of the jungle. We pray to him so that he protects us and does not do us any harm.”

The Warlis are known to commence important life and social events such as weddings, naming a child and building new homes only after receiving blessings from Waghoba. One participant said, “Since Waghoba is a *gaondev* or village god, when there is a wedding, the invitation is first brought to Waghoba before being distributed.”

Origin Story

The institution of Waghoba has persisted over centuries through oral tradition and ritual practice. While there is no single origin story of this deity, we came across multiple parallel narratives that describe myths or instances that gave birth to the deity. While some participants, especially shamans, shared elaborate origin stories, most of the other participants narrated fragments of these stories, containing similar underlying beliefs. Stitching together fragments of stories from different interviews, we learnt of the origin stories that narrate how the deity came into being.

These narratives illustrate a woman, typically a princess or chief’s daughter, who gives birth to a baby out of wedlock. When his mother is out doing chores, the baby shape-shifts into a tiger and hunts the villager’s livestock. Troubled and scared by the tiger, the villagers decide to kill the tiger. To save her child, the mother mediates between the angry villagers and her baby. In the negotiation that follows, she asks her child to go away into the forest and in exchange, the people would install shrines for the *wagh*, and once a year give an offering of the animals he likes (such as chickens and goats) to make peace. That is the story of how the *wagh* then took sanctuary in the forest and Waghoba shrines came to be established across all villages.

Some parallel narratives of peoples lived experiences were also shared to illuminate the birth of local shrines in villages. The local shrine located at Kartod Village was cited by many participants as the foremost Waghoba shrine in the landscape and was among the few shrines that we came across which had been made into a big temple.

Years ago, a *wagh* was terrorizing our ancestral village called Kartod. The *wagh* kept entering people’s houses, which at the time were made of thick leaves. Eventually everyone abandoned this village and moved into other settlements. Then one night, in the new settlement, a crying baby attracted the *wagh* again. However, the baby’s mother beat the creeping *wagh* with a stick, which ended up killing it. After hearing about this, all the scared villagers appealed to the shamans to do something about so as to evade misfortunes. The shamans suggested worshiping the troublemaking *wagh* after which shrines were made in every village to pacify the *wagh*. They were the ones who began offering

animal sacrifice and observing the Waghbaras festival which is now practiced in all shrines.

Rituals

The festival of Waghbaras which literally translates to *wagh*-festival is observed annually to appease Waghoba. It is popularly celebrated on the auspicious day of Vasu Baras which is the first day of the Hindu festival of Diwali based on the lunar calendar. The festival entails celebrations, rituals and traditions to appease Waghoba at the local shrine.

We observed three of these ritual ceremonies at shrines located in both rural and semi-urban parts of our study site. These ceremonies typically last for two days and the intervening night, with traditional music and dancing throughout the night. Relatives and friends of participants from neighboring villages also attend the ceremony. Members of the community, even those that have moved away to other parts of the world return at this time to participate in the annual worship rituals for Waghoba. While one of the observed ceremonies took place in a rural hamlet, the other two took place in semi-urban areas. The shaman led the ceremony and performed all the rituals with the remaining participants following his directive. People offered a variety of things as per their ability, from flowers, coconuts, and incense to toddy (fermented palm drink), chickens and, goats. The idols are also smeared with vermillion paste, which is considered auspicious. Orally passed down chants and songs dedicated to Waghoba were presented throughout the festival days and nights. However, the main feature of the ceremony, was the sacrifice of the chickens and goats. The head of the sacrificed animal was kept at the shrine and the rest of the meat was distributed among people.

During worship rituals, the shaman is believed to take the form of a *wagh* by entering into a state of trance. Participants recall instances of the shaman climbing trees, roaming the vicinity on all fours and also having tremendous physical strength at such times. Shamans are also sometimes believed to be capable of retrieving medicinal plants from the mountains in this state. This happens several times through the night and day when attempting to evoke the spirit of Waghoba. It is also believed that he has a strong intuition or may prophesize, which should be heeded.

“Some bhagats would take the form of a *wagh*, as in the spirit of the *wagh* would come in them. They would behave like a *wagh* would; go on all fours. If there is a region with thorns etc., he will pass through that as well. And after that, until the spirit of the *wagh* is in him, the thorns won’t hurt him.” –Interview participant

Gender

We also observed apparent gendered dimensions associated with the worship of Waghoba that could influence the way men and women perceive leopards differently. Within the Warli community, the role of a shaman is always played by a man. One person stated “*The bhagat leads the rituals and everyone else follows. This knowledge, of how to conduct rituals, has been learned from elders.*” Historically only men participated in the worship ritual and ceremonies, whereas women were traditionally not

permitted to attend the ceremonies. However, in recent times, women are being included and “allowed” to attend the rituals. We observed this particularly during the Waghbaras ceremony in semi-urban areas.

Participant observation during the fieldwork and data collected from key informants revealed a prevailing belief among locals that certain women within the community were well-versed with dark magic. Furthermore, during fieldwork the field researchers experienced instances where they were advised to leave the premise of a shrine or not enter one when particular women (whom locals believed to be witches/holders of such powers) were around. Literature on the Warli people is also indicative of such beliefs. Warli men who are shamans are known to mediate the relationship between people and deities by performing the right rituals which may be considered “good” whereas women are known to practice forms of “evil” magic (Dandekar, 2005). There are also beliefs among the Warlis that witchcraft and its tendencies are innate to women (Save, 1945).

Considering that it was traditionally men who participated in ritual and ceremonial worship of Waghoba, there exists a history of disparity in the ritualistic interaction with the deity among men and women. This denotes that there are gendered dimensions to the worship of Waghoba as well as people’s relationship with the *wagh*. If women have historically been alienated from the direct worship and opportunity to negotiate with Waghoba, it could be having implications on women’s perception toward leopards being different from those of men. As we were unable to engage with many women in our study, we were unable to explore the specific nature of the gender related similarities or differences. However, our data indicates that there is great scope for future studies to investigate the gendered dimensions of Waghoba worship.

The Icon and the Animal

The Sanjay Gandhi National Park and Tungareshwar Wildlife Sanctuary are known to have documented populations of leopards (Surve and Ahmed, 2017). In other parts of our study sites in multi-use landscapes, we noted through anecdotes that leopards were seen and rescued frequently by the local Forest Department and wildlife rescue NGO. This, along with narratives from interview participants indicates that the leopard is not a distant, but an active part of the landscape. The lines appear blurred between the *wagh* and *Waghoba* among the people we interviewed. A participant explained through the analogy: just as our gods have human form, tigers and leopards are forms of the deity Waghoba. Within this belief system, not only are living beings such as leopards worshiped but also “inanimate” beings such as stars, thunder and rain. One participant explained how people pray to the relevant gods for their livestock’s protection from factors such as rain, disease, etc. Likewise, they pray to Waghoba so that the large cats do not eat their livestock. This underpins the Warli worldview which sees *waghs* as stitched with Warli cultural identity, rather than as just a biological being.

Nearly all participants considered the animal to be a god. However, if not propitiated or appeased appropriately, the god can harm them or their livestock, through the animal. Similarities have been noted, not just in cases of other human-feline relations,

but also among human-snake relations in South India by Landry Yuan et al. (2020). They suggest that the snake (animal) and snake-deity are “inexorably connected in the sense that any affliction posed toward snakes, whether intentional or accidental, is believed to bring forth the wrath of the Nagas (serpent-gods) in various forms...” (Landry Yuan et al., 2020). Although there is an element of fear associated with the big cat, there is also trust in the *wagh* as a protector of the people. An example of this can be seen in the story of a little boy who was once looked after by a leopard. The little boy fell asleep at a Waghoba shrine during a ritual and was forgotten there. When his family went back to fetch him they found a *wagh* sitting guard over the sleeping child. Once villagers approached the shrine, the *wagh* went away, having done no harm. It is believed that the *wagh* kept watch over the boy, because it knew that the people worship him. One participant shared a story demonstrating the faith his father had in Waghoba. Such narratives, both of the past and present reinforce the belief among people that their faith in Waghoba is what keeps them safe.

“Let me tell you an incident of 30–35 years ago. My father was going to my mother’s village before they got married, by the road on foot. He saw a *wagh* right in front of him. Now what do you do in these situations? The person cannot attack it right...so my father said “if you are going to eat me then go ahead. You are our god.” Then he closed his eyes. The *wagh* just walked away. Didn’t do anything.”

Another narrative of protection associated with leopards is that when people are walking in the forest or in the dark, leopards walk with people, escorting them back to their homes. Many of the people we interviewed also explained that Waghoba protects not only individual people but also guards the village as a whole.

DISCUSSION

Protection and Kinship

The prevalence of Waghoba across the landscape was extensive. Almost every Warli village in our study area that we came across had a Waghoba shrine where people would regularly conduct ritual ceremonies. With the occurrence of over 150 shrines (and likely many more), we can therefore say that Waghoba is not just a relic whose traces are found in a single place, but an actively worshiped deity who is considered an integral part of the social institutions in this landscape. The full extent of Waghoba’s geographical reach is yet to be documented and holds potential to underscore the deity’s relevance in the larger landscape and daily lives of residents. The origin myth for Waghoba contains elements of what is termed “human-wildlife conflict” or “livestock depredation by big cats” in the conservation science literature. The origin myth narrates how the *wagh* is asked to leave the village for causing mayhem by eating livestock. This shows how, not just the *wagh*, but also livestock depredation as being morally and materially accepted, having found cultural representation. The dominant conservation discourse contains a narrative wherein predators happen to transition over time from eating “natural” or “wild” prey to eating livestock out of necessity

as if livestock depredation is a new phenomenon that we have just had to start making sense of, coping with, mitigating, and addressing. This dilutes the fact that these interactions have been an everyday reality for communities over centuries. The Warli belief system pre-dates the onset of the human-wildlife conflict discourse by at least a few 100 years. The origin story illustrates how; to deal with the losses caused by the *wagh* eating their livestock, the people initiated a negotiation with Waghoba; and by extension the *wagh*.

There have been many studies that explore the relevance of existing belief systems and narratives to conservation, specifically human-wildlife co-existence (Hill, 2011; Kolipaka et al., 2015; Aiyadurai, 2016; McKay et al., 2018; Parathian et al., 2018; Nijhawan and Mihu, 2020). For example Li et al. (2014) discuss how Tibetan Buddhism contributes toward the sharing of space between shepherds and snow leopards. However, Warli narratives are particularly unique because they not only instill an ethic of not killing big cats, they also provide ways in which to comprehend and process the loss and complexities that arise consequent to incidents of human-wildlife conflict (such as livestock depredation).

In many variants of the origin story, Waghoba, is depicted as someone who was born human. They narrate how, as he grew up, he strayed away from his human origin and succumbed to his disposition of being a *wagh*. The origin stories narrate instances where Waghoba, out of his inevitable disposition, kills livestock and the ways in which a negotiated deal is struck between the people and Waghoba to maintain co-existence. Further, it is Waghoba’s mother, rather than an authority such as the king or chief, that initiates the negotiation between the people and Waghoba; making this act entwined in kinship. This allows for people to see him as not just a menacing man-eater but also as someone who is on the one hand bound by his nature of being a *wagh*, while on the other hand bound by a promise he has made with his human kin. The belief in the possibility of negotiating space with the *wagh* perhaps stems from feelings of relatedness and kinship owing to his human origin and familial ties in the origin story (Jalais, 2014). It also allows for this institution to perpetuate shared space for wildlife to flourish in multi-use landscapes.

The festival of Waghbaras acts as a manifestation of this bargain through offering animal sacrifice of livestock to Waghoba in exchange of his benevolence and protection from danger and harm, especially of kinds caused by big cats. Communal gathering, music and dancing, and feasting are all as important as the ritualistic aspects of Waghoba worship, as they strengthen communal bonds and reinforce a sense of Warli identity within all the participating members of the community (Bird-David, 1999). Furthermore, the kinship ties in the origin myth perhaps strengthen people’s belief that Waghoba will hold up his end of the deal, protecting them from big cats. For example, a majority of participants in our study cited reasons such as having conducted the required rituals inaccurately or intermittently rather than annually to justify the adversities associated with big cats. This may also be perceived as a mutual dependence of Waghoba on the people (for propitiation) and of the people on Waghoba (for protection), paving way for a relatedness and

reciprocal relationship. Several scholars note that societies with such human-animal dynamics are built on values of mutual respect and reciprocity (Hill, 2011; Ghosal, 2013; McIntosh and Maly, 2014; Artelle et al., 2018). Hill (2011) puts forward that in such systems, humans and animals enter into obligations and failure to honor these can pose threats and complications. These values, combined with the periodic festival, which reinforces the belief in negotiations and materializes it through sacrificial offerings are perhaps what contributes to sustaining Warli relationships with *waghs*. This also relates to the body of literature describing narratives of retribution for disrespectful acts present in various indigenous cosmologies (Atleo, 2011; Turner, 2014; Artelle et al., 2018; McKay et al., 2018).

When there is an occasional incident of livestock depredation, more often than not, people in this landscape attribute it to their own oversight rather than blaming the predator. It is understood as a consequence of the people not having met their end of the bargain i.e., conducting the required rituals and making offerings. McKay et al. (2018) draw parallels from Sumatra where people perceived tiger-related deaths as retribution for when moral codes (such as unfairly dividing an inheritance or committing adultery) were broken by family members, rather than blaming the tiger alone. Rather than only holding the animal accountable, the process of perceiving negative encounters in this manner, allows for the blame to be shared between the people, leopard and Waghoba. Institutions such as the Forest Department and conservation organizations predominantly understand human-wildlife conflict as rooted in material and socio-economic losses and therefore, respond through techno-managerial measures (such as mitigation and compensation). The institution of Waghoba illustrates how residents could be processing incidents of conflict in a notably different manner to the other stakeholders or institutions in the landscape. This elucidates the need for more recognition of and sensitivity toward local belief systems especially in the context of incidents of human-wildlife conflict, which currently have little to no place in the mitigation-compensation metric.

This is relevant for present day wildlife conservation because such traditional institutions are likely to act as acceptance building mechanisms embedded within local cosmology. Studies have shown that people are more likely to base their perceptions toward wildlife on social factors rather than objective assessments of the threats posed by wildlife (Dickman, 2010; Redpath et al., 2013). While efficiency in addressing real economic losses is an important factor in conflict mitigation, perceived efficiency and perceived risk are also important aspects defining human-wildlife relationships. Addressing human-wildlife conflict has to therefore also stem from understanding the perceptions and belief systems of the range of stakeholders in any landscape (Miller et al., 2017).

Stakeholders of the Institution

While there are cultural narratives that have a discourse surrounding human-wildlife conflicts embedded within them, there are also social structures, politics and relations of power that govern and aid the persistence of these social institutions.

The ethnographic fieldwork shed light on some of the many influences that shape the institution of Waghoba. While we cannot claim any insight about the factors that have historically been a part of shaping this institution, we can illuminate a few factors that shape the institution of Waghoba in the present.

When animals are perceived as persons or spiritual entities, rituals can play an important role in materializing their relationship with people. The shaman holds a key place in many animistic cultures as the mediator between humans and other beings (Hill, 2011). Similarly, the *bhagat*, the local equivalent of a shaman, holds significance when it comes to the worship of Waghoba. While the specific nature of shamanism varies across societies, it typically shares three main elements including (a) belief in the existence of a spirit world, (b) a capacity of the shaman's spirit to enter into the supernatural world, (c) the shaman's ability to treat ailments and help people overcome various difficulties and problems in the real world (Stutley, 2003).

The shamans powers described by our participants parallels with a plethora of narratives concerning therianthropy i.e., human-animal-superhuman transformations (particularly tigers, leopards and jaguars in this context), which have been documented across cultures in Africa (Quammen, 2004), South America (Kohn, 2007), South and South-East Asia (Boomgaard, 2001; Oppitz et al., 2008; Brighenti, 2011; Newman, 2012; McKay et al., 2018).

Paying attention to shamans and such rituals may perhaps be of interest to conservation practitioners or policy-makers due to their strong role in influencing views and beliefs about big cats. As a mediator between the people and Waghoba, the shaman has a powerful, pre-eminent social position. Typically, the Forest Department or other such formal institutions are expected to mediate, especially estranged relationships between people and big cats. Here, we are presented with situations where it could equally be the shaman negotiating between people and big cats, displaying a complimentary role of both formal and informal institutions. So far, very few conservation actions by government authorities or NGOs have acknowledged the influential role of such informal, traditional institutions, let alone inculcated them into the conservation ethos.

Furthermore, the Waghbaras ceremony typically runs through contributions from each household in the village or sometimes just participating members. The animals to be sacrificed, fee for the shaman and other expenses are all covered through these contributions. Hence, the scale of these ceremonies also differs based on how much people from different communities are able to offer each year. In both shrines located in semi-urban and protected area settlements, we observed support from local political parties, city-dwelling allies of the local Warli participants, and other people who can be considered influential, particularly monetarily. Consequently, the ceremonies in semi-urban settlements were grander than the comparatively modest ones observed at the rural settlements. The institution of Waghoba is thus shaped over time and is susceptible to the influence of local politics. Such adaptations also present facets of how non-Warlis interact with this institution and influence its sustenance.

Religion and Socio-Politics

Historically, colonial administrators and ethnographers writing about various communities, particularly marginalized indigenous communities in India, conceptualized them to be in contrast to what they saw as the general and universal features of Indian society, by extension the dominant Hindu society. Consequently, indigenous communities are structurally conceptualized as existing at the fringes of the larger Indian society (Xaxa, 2005). The cultural transitions that these communities are experiencing are therefore understood as a process of acculturation arising from their interaction with, and integration into, the larger, dominant society. One of the many ways in which this integration occurs is through religious conversion. Bose (1941) describes this acculturation of indigenous groups into the wider Indian society, by extension the Hindu society, as invariably providing marginalized societies protection and security. Srinivas (1977) also discusses Sanskritisation, the process through which lower castes in the hierarchy emulate the lifestyle and practices of higher castes (Xaxa, 2005). While the former belief perpetuates the idea that culture is static and unitary, these systems are far more dynamic and fluid. It perceives them as unidimensional rather than a process through which communities interact with the world and incorporate and transform elements over time (Rapport and Overing, 2000).

The Indian Constitution recognizes Indigenous Peoples and notifies them as "Scheduled Tribes." Our field site, the Dahanu sub-district of Maharashtra is listed as a "Full Schedule Area" indicating that a majority of its resident population are Indigenous. Participant observation revealed a melting pot of religious practices and beliefs in the region pertaining to Christianity and Hinduism in these regions. Additionally, literature on the history of these regions indicated that Christian missionaries have been active in the region for several decades (Save, 1945). The presence of multiple shrines and temples of Hindu deities were also noted in these regions. While some Warli participants in the study claimed that Indigenous people like themselves do not participate in idol worship like Hindus do, some others affirmed that they also worship deities from the Hindu pantheon. Moreover, idols and pictures of Hindu deities were observed at some participant's residences, where interviews were often conducted. We also came across narratives of Waghoba entangled in narratives of Hindu deities. For example, some participants declared that Waghoba was a form of the Hindu deity Hanuman as they are both unmarried. Some said Waghoba is a form of the Devi's (goddess) vehicle which is a tiger. It appears as though worship for the Warlis has amalgamated Waghoba and deities from the Hindu pantheon. This indicates more plurality in religiosity among the Warli than we had presumed.

Despite the prevalence and layering of other religious beliefs among Waghoba worshippers, the commitment to continue performing traditional rituals in order to continue their relationship with the deity appear to remain strong. West (2005) notes that one of the main changes that is associated with religious conversion include changes in the structure of

the workweek and beginnings of a loss of knowledge about mythology. However, even in instances where conversion takes place across entire landscapes, it may still be common to see people retain some of their erstwhile beliefs and practices (West, 2005; Oppitz et al., 2008; Shaffer et al., 2018).

Participant observations revealed that members of the community who have converted or expanded their religious beliefs continue to worship Waghoba as one of their chief deities and take part in the Waghbaras festival. This indicates that Waghoba is not just a deity who is worshiped within the confines of one belief system but is an integral part of the cultural fabric, entwined with the traditions and social life of this landscape. This has also been observed by Ghosal and Kjosavik (2015) who studied this institution among the Thakkars and Mahadeo Kolis in Akole, Maharashtra.

Similarly in the Sundarbans, Bonbibi is worshiped as the woman of the forest who was sent by Allah to save people from tigers. Bonbibi's worshippers think of her as a "forest superpower" rather than in terms of "Muslim" or "Hindu," who extends her protection to all her worshippers regardless of the community identities. Bonbibi, who serves a particular role as the woman of the forest and is worshiped for that in particular, cannot be replaced by other deities worshiped in the landscape like Krishna or Kali (Jalais, 2014). In this manner, even though the Warlis now also worship other deities, the worship of Waghoba continues, owing to specific role he has of protecting people from big cats, rendering the deity irreplaceable in the landscape. We suggest that such relationships enable the communities who have such relations with wildlife to be more accepting of the presence of big cats in their landscapes. Furthermore, we propose that the presence of such relationships in a landscape makes it easier for large carnivores such as leopards and tigers to reclaim the areas they used to once live in. This is because there is already a pre-existing and very powerful relationship the people of that landscape have with these animals through the icons in their culture.

Conservation Implication

When addressing conservation concerns in areas where local communities share intimate, multi-layered relationships with wildlife, the discourses and practices of people sharing the landscape are often diminished to give way for the narratives attached to the species of concern. When conservationists focus on only the ecological aspects of conservation without engaging with its social dimensions, it leaves local communities (who face direct impacts) feeling neglected and often pitted against the species being conserved at the interest of powerful governments, scientists, urban elites etc. This can perhaps result in uncooperative responses from the community when approached for conservation initiatives (Jalais, 2008; Dickman, 2010; Mishra et al., 2017). Acknowledging these beliefs and integrating them into bureaucratic practices lends these communities the respect and justice they deserve, especially owing to the lack of representation in decision making on their own land. An understanding of this can help dominant stakeholders outside the Warli community (such as the Forest

Department, conservation biologists, and non-Warli residents who interact with leopards) develop the required insight and sensitivity to work in such landscapes as it is not just the biological animal that the Warli are predominantly living with.

Further, Waghoba exists not only in remote, rural landscapes, but also in cities such as Mumbai fostering the capacity to capture the imagination of a larger urban population. Such belief systems have largely been external to urban policy and planning in India. Narayanan and Bindumadhav (2019) propose species-inclusive cities which imagine and build new kinds of urban ecosystems that allow for reconciliation between human development and biodiversity (in this case, along with people's varied relations with biodiversity as well). In such systems, species are also considered as social actors. Such ways of thinking already exist within the Warlis, who live in the heart of Mumbai.

When it comes to conservation ethics and pro-conservation behavior, group dynamics and positionality plays a huge role in defining individual behavior (Hare et al., 2018). Bhatia et al. (2021) argue that identifying areas of societal or individual motivations which are either complimentary or contrasting to biodiversity conservation, particularly through examining folklore can provide knowledge to design culturally meaningful strategies which facilitate human-wildlife coexistence. Further, conserving and integrating diverse sets of knowledge, both biophysical and sociocultural, can give greater adaptive capacity to such strategies allowing them to sustain through societal and environmental changes (Berkes et al., 2000; Gavin et al., 2015). Waghoba is exemplary in underlining how as systems, values and people's surroundings evolve, institutions adapt to these changes in order to persist (Berkes and Turner, 2006; Artelle et al., 2018).

In many landscapes, people have an antagonistic relationship with predators and returning species are not accepted (Boomgaard, 2004; König et al., 2020). Acceptance of large predators in human dominated landscapes is then viewed as an aberration despite many societies having a history of shared spaces with them. In this way, myths and narratives that build on local institutions, such as that of Waghoba, carry relationships forward even though the animals themselves have gone. Through this paper, we would like to propose that these relationships could be crucial for enabling the return of carnivores, such as large cats, in areas where they have been extirpated; because the relationships that people have with them still exist in the landscape.

CONCLUSION

Through our study we have explored some of the myriad ways in which the Warli and big cats have interacted though history, ranging from various degrees of conflicts to forms of coexistence, that shape their present day relations. The institution of Waghoba reveals that there is a long history of engaging with issues surrounding human-wildlife interactions and trying to comprehend the consequences associated with sharing space with potentially dangerous or conflictual predators. The festival of Waghbaras exemplifies the presence of systems arisen from such continued engagements. As negative interactions

(such as livestock depredation) may still occasionally occur in the landscape, they are likely to be more accepted under the institution of Waghoba, notwithstanding the spiritual complexities and economic losses people face. We believe these complex and nuanced relations have a role in aiding shared spaces.

Our aim was to document shrines and narratives, explore the prevalence of this institution and describe its relevance for conservation. What this groundwork has brought to light is the potential for a detailed enquiry into the nuances of the institution of Waghoba. This can widen the scope to present insight on the different meanings of Waghoba worship and how this institution impacts how humans and big cats share space and resources.

An underlying aim of our study is to contribute toward diversifying the ways in which we understand and approach human-wildlife interactions. It does so by shedding light on how local institutions that contribute to co-existence are not devoid of conflict, but have a role in negotiating the conflicts that arise. Locally produced systems that address issues surrounding human-wildlife interactions may exist in several other cultures and landscapes. While conservation interventions have shown a movement toward the inclusion and participation of local communities, there is still a lack of recognizing that landscapes have a history before our own point of entry into them, which is valuable to consider. Conservationists are often looking for scalable interventions across landscapes. This paper however, forces us to reconsider the precedence of scalability by illustrating the role of localized specificities and histories of landscapes which would necessitate its own intervention model, if intervention is needed at all. It is worth reflecting on how fleeting our conservation interventions can be in comparison with something as resilient as the institution of Waghoba.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Human Study Ethics Committee, Wildlife Conservation Society-India. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

VA, RN, and Dhee conceived and designed the study. AA provided funding for the study. RN and OP collected the data. RN and Dhee analyzed the data and led the writing of the manuscript. NS helped in coordination of fieldwork and supported data collection. VA and JL provided guidance, critical reviews, and editing. All authors have contributed significantly to the drafts of the manuscript and have given their approval for publication.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fcosc.2021.683356/full#supplementary-material>

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Beasts in the Garden: Human-Wildlife Coexistence in India's Past and Present

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Human-wildlife encounters are characterized by a diverse array of engagements located on the continuum between the negative and the positive. In India, protracted conflict with wildlife is reflected in violence across a range of rural and urban ecologies, but is only one aspect of the multiple facets of ongoing human-non-human encounter. Within these shared spaces, there are often equally significant elements of acceptance, tolerance and reverence. Together, these are dependent on context, and can be explored via lived experiences and worldviews, and a moral economy of human-wildlife and human-human relationships. Historically, though hardly static, such relationships have been mediated by the ontological positioning of traditional societies and their embedded rules and practises. In recent years, these tenuous equilibria have been disrupted by top-down catalysts, including universalist conservation agendas percolating from the state and the global arena. This study aims to explore the changing nature of coexistence by using several historical and contemporary vignettes in relation to key species that routinely “transgress” from their primary natural habitats into the “garden” spaces of human cultivation and habitation. The study will argue that insights at the intersection of environmental history, political ecology and anthropology can improve our understanding of human-wildlife coexistence in India as well as across the world.

Keywords: coexistence, conflict, India, human-animal relationships, conservation

INTRODUCTION

Violent conflicts are an increasingly common feature of the developing tropics where attempts to conserve charismatic, yet dangerous flagship species, face resistance from people whose lives, livelihoods and worldviews are impacted. Conflict typically takes on two overlapping forms. The first pertains to fine-grained, negative interactions between local communities and wildlife, and the second, to differences between groups of people with divergent aspirations for land and nature (Redpath, 2013). In India, both forms of conflict are prevalent and their significance is reflected in the numbers of human and animal casualties: ~500 people lose their lives each year to elephants (Panda et al., 2020), and annually over 1.2 m snake bites result in 30,000 to 40,000 human fatalities (Surawewera et al., 2020). Human casualties to other species such as large carnivores are also considerable as are those of their animal counterparts.

Across the country, there is mounting evidence of increasing conflict in zones of overlap between formally protected wild spaces and human habitation (Anand and Radhakrishna, 2017). As is the case elsewhere in the developing world, an overwhelming majority of human victims of these

encounters belong to poor and marginalized communities living around protected areas (West et al., 2006; Barua et al., 2013). In most situations, the understanding of conflict is restricted to highly visible impacts such as loss of life and crop-raiding, and inputs towards reconciliation are similarly restricted towards the provision of compensation or more effective separation of people and wildlife. Conservation scholars have only recently begun to explore seriously, the hidden dimensions of conflict such as a range of opportunity and transaction costs as well as significant disruptions to psycho-social well-being (Barua et al., 2013).

However, a narrative of conflict, despite its significance, is not the only storey. In India as well as across the world, a singular focus on violent encounters often neglects the multi-faceted nature of entanglements in geographies where people and wildlife have interacted and coexisted over the span of several millennia (Sukumar, 1994; Morris, 1998; Knight, 2004). The engagements between the rich variety of Indian megafauna as well as equally diverse historical and contemporary human societies offer an axis of exploration for contrasting engagements in conjunction with parallel shifts in their social, economic and cultural situations. Across many rural communities and traditional societies, we find that wildlife, including dangerous species involved in conflict, are an integral part of networks of reciprocity, reverence and kinship (Athreya et al., 2013; Aiyadurai, 2016; Oommen, 2019; Thekaekara, 2019; Nijhawan and Mihu, 2020). While communities sometimes retaliate with violence towards animals, local conceptualisations may also align simultaneously with accommodation, worship, and propitiation, frequently considering wildlife attacks as punishment or retribution by animals for human misdemeanours. As pointed out in the scholarship of Norton (1991), Morris (1998, 2000), Franklin (1999), and Ingold (2000), a community's relationship with animals is neither monolithic nor homogenous, but a complex one that is contingent on circumstance, social relations and history. Therefore leaving out any set of engagements, positive, negative, or ambivalent, provides a misleading picture of human-animal relationships.

In understanding the nature of coexistence, of particular significance are India's diverse ethno-sociological traditions that range from mainstream religious affiliations to traditional animistic cosmologies, folklore, and worldviews incorporating animals into relational frameworks of giving and reciprocity, and management outcomes evolved as a consequence of ritual and taboo. While a large number of these have been of a local or regional nature, a few religious traditions have garnered widespread acceptance. Further, upheavals caused by major watersheds such as colonialism and recent discontinuities that came in the form of post-Independence legislation have nationwide significance with strong connexions to perceptions about distributive justice and the moral economy. These are in turn translated to retaliation to animals and other forms of negative human-animal encounter, and conflicts between different groups of people. While colonial laws and policies set the stage for exclusionary conservation throughout most of the Indian subcontinent, of key significance for the post-Independence era is the impact of the Indian Wildlife (Protection) Act, 1972, the country's flagship conservation legislation which cemented the

separation of people and wildlife; as well as recent laws such as the Forest Rights Act, 2006 which attempt the redressal of "historical injustices" (including loss of land and rights for conservation) to forest-dwelling communities. Modern conservation sensitivities driven by urban communities and mediated by a range of domestic and outside influences too play a significant role and often faces resistance from local communities.

APPROACH

This manuscript attempts to provide snapshots of coexistence in India via an exploration of engagements between people and wildlife that are typically categorized as "problem species." In other words, these are species that are traditionally regarded as boundary crossers (as defined by humans) that frequent human-dominated spaces and interact with people, often causing different forms of conflict. In attempting to understand coexistence, the aim has been to review and synthesise using an interpretive approach, numerous empirical sources ranging from historical and anthropological accounts to recent work from conservation science that addresses the issue of coexistence (without delving much into anthropological theory). An effort was made to select widely distributed species on which adequate empirical scholarship on long-term interactions was available and accessible. The latter condition was instrumental in framing an adequate historical narrative as informed by historical and contemporary scholarship. The author's own long-term research has focused human interactions with two of the species (elephants and pigs). It has to be noted that the accounts of individual species presented in this manuscript are not exhaustive with respect to their historical or contemporary relationships with people and vice versa, rather, the intent has been to highlight a selection of accounts that encapsulate or highlight specific aspects of coexistence between people and animals.

While the definitions of coexistence vary according to different conservation researchers (e.g., Madden, 2004; Frank, 2015; Konig, 2020 and references there in), this manuscript follows the definition provided by Carter and Linnell (2016, p. 575) who define coexistence as "a dynamic but sustainable state in which humans and wildlife co-adapt to living in shared landscapes, where human interactions with wildlife are governed by effective institutions that ensure long-term wildlife population persistence, social legitimacy, and tolerable levels of risk." In the opinion of the author, coexistence does not entirely preclude elements of conflict, rather, it refers to a multidimensional and multifaceted situation in which engagements are often simultaneously located at different points on the continuum between accommodative strategies and negative interactions, but nevertheless ensures the continued existence of wildlife populations.

BEASTS IN THE GARDEN

In India, free-ranging, wild species that attack people or livestock, raid crops or cause other forms of damage to human lives and livelihoods are very much part of the dynamic of zones

of overlap between formally protected wild spaces and human habitation. Many are widely distributed generalists that can adapt to multiple habitats, and especially human use landscapes with their abundance of agriculture, livestock and other benefits compatible with the “merits of margins” (Peterson, 1977). Most, if not all of these species, have a long history of interaction with human communities. Human-animal relationships in such zones evolved with context and are highly contingent on local lived experiences over an extended period of time. These can be examined through a series of explorations of several widely distributed species that routinely “transgress” from the forest and other natural habitats into the “garden” spaces of human habitation—big cats (tigers and leopards), elephants, wild pigs and other ungulates—which have not only figured significantly in conflict in India but are also accommodated within positive, ambivalent and contradictory relationships.

Tigers

In his seminal article on “the war against ‘dangerous’ beasts in colonial India,” Rangarajan (1998) points to the subcontinent’s diverse heritage of entanglements with large carnivores such as tigers, that simultaneously symbolise power and danger. In some quarters, tigers were considered the inveterate problem species, to be eliminated on account of their attacks on livestock and their occasional propensity to kill and devour people. In others, especially during the late colonial era, they assumed a new reputation as the saviours of agriculture and even as embodiments of “gentlemanly virtue” (Rangarajan, 1998, p. 299, see also MacKenzie, 1988). While the latter sentiments were attributed to colonial officers as well as the Indian elite who questioned the wisdom of removing this top predator which brought down the numbers of crop-raiding ungulates, tigers were also extensively hunted for sport by the very same constituencies.

On the whole, neither conflict nor peaceful cohabitation were a given, prompting Rangarajan (1998, p. 299) to point out as misleading, a universal romanticised notion of harmonious coexistence or that of all-out conflict. Cohen (2012) too points to the dynamic and anthropocentric nature of human-tiger interactions ranging from the extermination and subjugation under colonial hunting and vermin control to their representation as charismatic conservation icons and playthings in contemporary tourism. Tracing engagements with tigers in diverse contexts before, during and after the colonial watershed provide further support to this.

Local historical conceptualizations of man-eating tigers and leopards, especially beliefs in human to animal transformation, and vice versa, are useful avenues for exploration in this regard, and find parallels with other situations such as the werewolf in European folklore (MacKenzie, 1988). Shapeshifting and therianthropy are informative with regard to coping strategies that benefit coexistence, as well as community cohesion and related social dynamics. Liminal areas of the fringes of human occupation were particularly conducive to the development of such beliefs (Brighenti, 2017). An example is the historical (and even contemporary) belief among the Kondh communities of Odisha that a man-eating tiger or cattle lifter was a were tiger (practitioner of *krādi mliva*) or person whose soul or life force

entered a tiger by divine facilitation and carried out malicious acts (Brighenti, 2011). Related accounts equated the man-eater with the earth goddess (*Darni Pēnu*) herself, who, enraged at the lack of human sacrifices (traditionally known as *Meriā*) devoured her victims (Macpherson, 1852). The belief in human to animal transformations not only cut across class and caste boundaries but was geographically widespread encompassing the central and eastern parts of the subcontinent. For instance, the colonial official William Sleeman was informed by the Raja of the princely state of Maihar (in the Bagelkhand region of Central India) that the tigers who killed large numbers of people were in fact men who had mastered the “science” of converting themselves into tigers. In the latter’s opinion, Gonds and other “wild people from the jungles” were to be paid sums of money for propitiating marauding tigers by prayers and sacrificial offerings (Sleeman, 1844, p. 165).

Tigers were venerated as part of the Saiva cult in many places; tiger worship in Central (by the Santals of Chota Nagpur, the Kurku and Bhomkas of Hoshangabad) and Northwestern India (by the Baghel Rajputs and the Bhils in Rajputana) was common and the species figures prominently in totemic representations (Bhattacharya, 1947). While killing of tigers under the colonial bounty system for exterminating vermin was commonplace in these regions (bounties were paid for an estimated 56,000 tigers between 1875 and 1925, excluding about 13 years for which data is unavailable), vermin killing itself was viewed differently by different communities: the Baghel Rajpiuts who claimed descent from tigers, refused to provide baits for white hunters, as did the Khonds in Ganjam who believed tigers to be their ancestors (Rangarajan, 1998). In many instances, forest-dwelling communities such as the Gonds responded with physical resistance, refused to divulge information about the whereabouts of tigers or admonished white hunters when tigers and other carnivores were killed (Rashkow, 2014a,b). Others killed tigers when there was a necessity, or avoided them on the whole.

Individual animals were sometimes identified as just cattle-lifters or as individuals that did not harm humans, with some constituencies viewing these individuals as somewhat affable predators that also needed to eat to survive (Interesting parallels can be drawn here between modern conservation contexts such as those in parts of Scandinavia where hunters support the rights of large carnivores such as wolves to exist—including reinstating populations by reintroduction—but favor the extermination of individual animals that are perceived to be behaving unnaturally, i.e., deviating from normalcy in behaviour, genetics or spatial boundaries, Von Essen and Allen, 2020). For many local communities, the relationship depended on the amount of the reward offered or the nature of local exigencies. The whole scenario was tied up heavily with agrarian practises, arming of the population (the iniquities of the Arms Act which prevented local populations from keeping firearms was particularly problematic), and the politics of sport hunting (Rangarajan, 1998).

Similarly, in northeastern India, the Garos, Rabhas, Bodos, Mikirs, Karbis, Tiwas and Khasis and the Naga communities have folklore about tigers and leopards, and several clans also claim kinship with tigers (Aiyadurai, 2016; Lyngdoh, 2016; Brighenti,

2017). Different forms of human-animal transformations that were conceptualized by the communities as either malevolent entities or special individuals selected by deities to execute certain roles, or ancestral spirits embodying the essence of clans (Lyngdoh, 2016). While some of these relate to warriorhood and headhunting, and even the use of “animal doubles” to attack their enemies, others consider it a curse or disease, and yet others such as the Mishmis claim strong kinship with tigers (Aiyadurai, 2016; Lyngdoh, 2016; Brighenti, 2017). Some, such as the Khasi attribute attacks on livestock to the needs of a local tiger deity (Lyngdoh, 2016).

Despite a heavy influence of modern Western education and Christianity, there is evidence of a continuing presence of traditional animistic beliefs in which tigers and different forms of human-animal transformations in which the misdemeanors committed by these individuals are somewhat condoned (Brighenti, 2017). A significant aspect is that the presence of these traditions do not preclude the hunting of tigers by some groups. However hunting and lethal control itself in many traditional societies was historically guided by different forms of rules, ritual and taboo though in the contemporary period there has been an erosion of strong community rules and control in many places.

For groups such as the Mishmi of Arunachal Pradesh who continue to acknowledge strong kinship links with tigers (they consider tigers as their brothers born of the same mother) and typically refrain from their killing, modern conservation has been problematic. In situations of last resort, i.e., when individual tigers become dangerous, they follow a pragmatic approach and occasionally kill or trap their “problematic brother” bringing them into direct conflict with India’s conservation laws (Aiyadurai, 2016, p. 312). In recent years, these communities have opposed a unilateral, top-down decision by the government to declare parts of their richly forested landscapes under the Dibang Wildlife Sanctuary and further plans by conservationists and the state to elevate its status to that of a Tiger Reserve. These designations entail restrictions on the community on access and use of the forest. The Mishmi who consider themselves to be conservationists and guardians of the forest, managing their resources through ritual and taboo, view such acts as detrimental to their livelihoods as well as infringing on their cultural rights (Aiyadurai, 2016). This signifies that even in spaces with high levels of organic “cultural capital” (Bourdieu, 1986) and close kinship ties with key species such as tigers, the imposition of conservation can not only disrupt a largely peaceful set of relationships but also result in conflict with a community’s own cultural icon which received some amount of protection. Modern conservation with its exclusionary ethic (evidenced by continued efforts to maintain pristine spaces for tigers) is seen by most local communities as immensely problematic.

In certain persistent regional epicentres of man-eating such as the Sunderbans of Bengal, though tigers themselves were not venerated, Dakshin Ray or Dakshinraj, and other presiding deities of tigers such as Badagazikhan, Kalugazikhan and Bonbibi (Banabibi) were worshipped by local groups such as woodcutters, hunters and boatmen belonging to both Hindu and Muslim communities (Bhattacharya, 1947). This syncretic tradition involved a number of prayers and propitiation exercises.

However, in recent years, as pointed out by Jalais (2008), nationalistic passions and universalist notions (both Western and upper middle class) engendered the “cosmopolitan” tiger (see also Cederlof and Sivaramakrishnan, 2007 for cosmopolitan/metropolitan and native/ indigenous conceptions of nature) far removed from its local counterparts in places such as the Sunderbans. Such a disjunct is detrimental to coexistence. A recent set of incidents in Yavatmal in Central India involving a tigress that had killed several people is also a case in point. Officially known as “T1” the tigress was rechristened by activists and the media as “Avni” (Earth), the killing of this tigress witnessed protests from large sections of urban animal lovers who objected to this decision.

Further, the oft quoted, yet contested (e.g., Carter et al., 2012; Rai, 2012; Goswami et al., 2013) conservation mantra that tigers and humans cannot coexist has been used as a justification to create exclusionary spaces for tiger conservation in India (Bejoy, 2011). Relocation of local forest-dwelling communities has been one of the hallmarks of protected area establishment in India (Rangarajan and Shahabuddin, 2006). In the case of tiger conservation, a significant criticism of the government’s displacement and relocation of forest-dwellers contrasts with its accommodative stance on tourists and other urban visitors into protected areas (Bejoy, 2011). Some tiger conservationists consider bringing “a tiger in the drawing room” via tourism a pragmatic conservation tool through a protectionist conservation and by the outward expansion of tiger habitats through incentivizing private land holders, agro-corporates and tourism entrepreneurs (Karanth and Karanth, 2012). Others point out that this amounts to colonial style “green grabbing” (Vidal, 2008) of rural land with its already known undesirable outcomes: agrarian distress, migration, exclusion, and alienation and loss of ties with land, and rights of local communities (Rai, 2012). However, on the question of coexistence, at least some carnivore ecologists have been known to support a pragmatic, context specific strategy. For instance Karanth and Gopal (2005) suggest that “tactics ranging from lethal control of tigers at one end of the spectrum to relocation of human settlements at the other would have to be part of the mix...” in establishing “sustainable landscapes.”

Leopards

The leopard, unlike its more charismatic cousin, the tiger, is mostly unseen, yet emphatic in its presence in many human-modified landscapes. While historically, problems such as man-eating had a very regional dimension, in contemporary times, this adaptable species not only continues to exploit the farmland niche, but has on occasion successfully crossed over into urban spaces, living off livestock, domestic dogs and occasionally attacking humans (e.g., Athreya et al., 2013; Ghosal and Kjosavik, 2015). The most notable regional geography with regard to conflict with leopards is the Himalayan state of Uttarakhand (particularly the districts of the Garhwal Himalaya) where attacks on people have been a chronic phenomenon at least since the colonial period and continue to report an average

of about 60 incidents each year (Sondhi et al., 2016). The presence of a “man-eater” is a significant daily stressor for local communities, which combined with ineffective mitigation measures (typically limited to payment of compensation and translocation) continues to generate negative perceptions and occasional retaliation against leopards. In other parts of India, leopards figure much less prominently in conflict. This is exemplified by the situation in the Valparai Plateau, a plantation landscape in southern India, where largely neutral perceptions of leopards and associated accommodative human behavioral responses are the norm with occasional shifts towards negative reactions (coinciding with attacks on humans) (Sidhu et al., 2017). At the positive end of the spectrum, in other sites such as Rajasthan, in northwestern India, leopards have received some amount of active protection by local Jain and Gujar communities and community-based organizations (Kumbhojkar et al., 2019).

As is the case of tigers, leopards too have been incorporated into networks of social relations both historically and in the contemporary sphere. Like tigers, individual leopards involved in conflict (especially predation on humans) have long been considered to be possessed by malevolent spirits. The Rudraprayag leopard (which killed over a hundred people) which was shot by Jim Corbett in 1926 was emphatically regarded an evil spirit that could not be vanquished. (An interesting parallel can be found in Patterson’s 1907 account that the Indian coolie labourers on the Kenya-Uganda Railway—many of whom fell victim to the lions—considered the Tsavo lions to be evil spirits). In many parts of the country, the wearing of claws and teeth of leopards and tigers as amulets and pendants is supposed to ward off misfortune and provide the wearer with courage, health and wealth. There is a widespread perception of leopards as protectors in parts of Himachal Pradesh, where they are strongly embedded in local myth and folklore and considered the *vahana* (vehicle/mount) of the local goddess (like the tiger is to the Goddess Durga) (Dhee et al., 2019). Ethnographic characterised research in these systems reveal that local communities view leopards as complex, thinking individuals and with whom the sharing of space is negotiated (Dhee et al., 2019). In the central Indian state of Maharashtra, which is by relatively lower levels of conflict in agrarian habitats with a high density of leopards, Athreya et al. (2013) report a high level of social tolerance to leopards and other predators and suggest an exploration of “social carrying capacity” that promotes coexistence with carnivores in such spaces.

A closer examination of this situation by Ghosal and Kjosavik (2015) arrives at two sets of relations borne out of distinct ontologies that operate together in the same spatial setting by mutual accommodation and co-opting. The first, revolving around the village deity Waghoba (represented by tiger or leopard iconography, *wagh* denotes tiger or leopard) is prominent among tribal communities and involves a network of reflexive and reciprocal relations with leopards that inhabit the landscape. Livestock depredation within this framework is viewed either as retribution for disrespect or as an act of benevolence or necessity by Waghoba (Ghosal et al., 2015). The annual festival of Waghbaras celebrating the benevolence of the deity (in livestock protection) is characterized by ritual sacrifices and feasting, which are also considered to promote

social stability and cohesion as well as contribute critical animal protein. The second, the “legal-scientific leopard” of state-sponsored conservation has a heritage of dualism of people and nature. Local forest managers, however, negotiate both spheres and enable both sets of practises. This integration of traditional and the modern ontologies engenders a hybrid coexistence perspective that appears to be somewhat beneficial for the continued survival of the species in this landscape without too much conflict.

Modern conservation and tourism have combined to provide another axis of interaction between big cats and the Indian public. While tiger-viewing safaris in national parks are more popular in terms of scale, leopards too are increasingly considered part of the attraction. Sightings of known individuals leopards are particularly sought after. This is exemplified by the case of a melanistic leopard inhabiting the environs of the Kabini forest in southern India. Known variously as *Karia* (lit. translation Blackie), *Saaya* (shadow) and Blackie, this black leopard and his encounters with other local resident leopards (Cleopatra, Scarface) are widely anthropomorphised in the media, and spark frequent interest among urban wildlife enthusiasts (e.g., Bangalore Literature Festival, 2020; The Indian Express, 2020). However, in stark contrast to these positive sentiments, individual leopards involved in conflict cause fear and apprehension among local communities, and typically suffer a different fate in relocation or lethal control.

Elephants

For sentient species with high behavioural plasticity and adaptability, the immediate local context and embedded interactions with local communities are of paramount significance. The types of entanglements in such interactive contexts reveal as much about the elephants as the human societies that live within their range. Although highly visible negative incidents and interactions receive inordinate focus, recent nuanced explorations shows that elephant landscapes can be broadly placed along a continuum of more or less peaceful coexistence (e.g., Thekaekara and Thornton, 2016), episodic conflict (e.g., Oommen, 2019), or more continuous and protracted conflict (e.g. Münster and Münster, 2012a). Generalising interactions as peaceful coexistence or conflict, however, beyond an immediate regional or even local geographical unit is problematic as elephants are capable of a wide range of behavioural repertoires. Similarly the diverse human communities living within elephant landscapes tend to display an equally varied set of responses between and within social groups.

As pointed out by Sukumar (1994), elephant incursions into human habitation and vice versa have been an ongoing feature throughout the range of this species. Early references to agriculture-centric interactions as well as a range of multi-faceted engagements with elephants can be found in numerous Indian historical and literary sources (Sukumar, 2011). The bardic poetry of the Sangam literary tradition of Early Historical (300 BCE to 300 CE) Tamilakam (the ancient Tamil microregion comprising most of southern India) exemplifies this. Crop-raiding and everyday conflicts, ivory extraction and elephant

capture figure extensively in these representations, along with an equal diversity of allusions to the sentience and sociability of elephants (Oommen, 2019). Coexistence with this species, therefore has had many dynamic and contradictory facets over millennia.

As a more general pattern, human-elephant relationships are known to have a strong temporal dynamic that is often directly linked to the length of time local communities have spent with elephants. Migrant communities, especially recent agriculturalist settlers who have poor familiarity with elephant movements and behaviour are often located on the negative end of the spectrum (Thekaekara and Thornton, 2016; Oommen, 2019). This is exemplified by the case of early- and mid-twentieth Century Syrian Christian migrants to the frontier forests of the Western Ghats who either continue to be in conflict with elephants in many places or have begun to develop accommodative relationships after decades of occupation (Münster and Münster, 2012a,b; Thekaekara and Thornton, 2016; Oommen, 2019). This is often in stark contrast with indigenous forest-dwelling groups whose engagements with elephants are traditionally less confrontational and reflective of ways of life that have evolved from constant interaction and accommodation between both parties. For these communities, elephants are not only part of the landscape but are important deities and community members embedded within relational networks. To cite an example, Bird-David (1990, 1999) studies report how the Nayaka (Kattunayaka/n) of southern India often relate to elephants that pass by without reacting to them or harming people as “*devaru*” (superpersons/ divine persons) or “*anadevaru*,” whereas elephants that they encounter in some form of conflict are simply referred to as elephants (*ana/e*). Such forms of justification and discrimination of elephants as persons or individuals, or as objects, are highly contingent on situation.

As intelligent and interactive social beings, elephants provide fascinating opportunities for exploring issues related to nonhuman personhood and its role in coexistence outcomes. While traditional societies typically attribute personhood to many species, elephants on account of their high levels of sentience and consciousness have often been accommodated within a wider network of intimacy and trust than most other species. The behavioural peculiarities of individual wild elephants that frequent human habitation are sometimes known to village communities resulting in both positive and negative views. For example, a mostly harmless *makhna*, Nadodi Ganesan (*nadodi* can be roughly translated as “village loafer”) was fondly regarded by local communities in the Gudalur landscape in southern India (Thekaekara, 2019) (Here, parallels can be drawn with the Finnish “yard-wolf,” a designation given to a wolf that is habituated to and frequents human-dominated spaces, resulting in legal and ethical dilemmas for its removal, Ojalammi and Blomley, 2015). A long history of capture and training, and heritage of working elephants have also contributed to the public understanding of elephants as individuals and nonhuman persons.

In India, the elephant figures extensively in religion and mythology both on account of its links with mainstream, non-sectarian gods such as Ganesha/Ganapati in Hindu, Buddhist

and Jain traditions. Elephants as totems of autochthonous clans and the havoc caused by wild elephants figure among the various origins suggested for this non-sectarian deity worshipped widely under various appellations across the Indian subcontinent and beyond as the remover of obstacles (e.g., Michael, 1983; Ayuttacorn and Ferguson, 2018). Even Judaeo-Christian traditions within India such as those of the Kerala Christians established strong connexions with this charismatic species. For instance, construction rules of most early Syrian Christian churches in the erstwhile kingdoms of Travancore and Cochin (part of present day Kerala) mandated prominent iconographic representation of a working elephant and a wild elephant, as well as a number of elephant related features (Menachery, 2014).

As in the case of large carnivores such as the tiger, in the colonial era, elephants represented a paradox. In many places, the government had to walk the tight rope balancing elephant populations by keeping agriculturalists safe and sportsmen happy, while at the same time ensuring revenues from ivory extraction and elephant labour. In many regions of the subcontinent, elephants, due to their economic and symbolic importance, received a greater degree of formal protection before mainstream conservation laws were enacted. In some regions, post-Independence conservation with its blanket laws for preservation created zones of anomaly where conflict with forest fringe farmers escalated; in others especially those occupied by traditional forest-dwellers, their status as a highly sentient species positively entangled in religion and folklore continued.

To understand and enable a dynamic perspective on human-elephant encounters within temporal and regional (e.g., the Wayanad District) frames, Münster and Münster, 2012b use “the notions of ‘frontier,’ ‘fortress,’ and (precarious) ‘conviviality.’” Planning on-the-ground coexistence strategies in elephant landscapes is likely to be a complex process given the history of interactions with the species in a particular area, the nature of land use as well as that of the wide diversity of local communities that interact with it. However, it has to be kept in mind that positive relationships with elephants unless organically evolved are difficult to engender or sustain.

Pigs

One of the most iconic images of prehistoric representations from the Bhimbetka rock shelters in central India is that of a mutant boar chasing a tiny fleeing human. While it is not known what the primateval artist exactly intended to communicate, legends, myths and iconography of ferocious giant boars appears at frequent intervals throughout India’s recorded history. The legend of Komban, the wild boar that destroyed crops in the Tamil province of Kongu Nadu and the “*veeragallu*” (hero stones) scattered across Karnataka—many of them commemorating deeds of valour against ferocious boars—are examples (Oommen, forthcoming a). Enigmatic and intelligent, pigs are known to challenge farmers, trappers and hunters in as many ways that have been devised to outwit them. But the “heavy” meat of wild pigs was equally sought after in ancient Indian zoology that was a “catalogue of meats” and Vedic pharmacopoeia that treated the “universe as a kitchen” (Zimmermann, 1982). Local communities

as early as the Sangam period benefited not only from the meat of pigs, but planted their grain in the soft soil of hillslopes rooted around by wild boar (Oommen, 2019).

When viewed through the lens of history, the Indian wild pig shared a diverse set of relationships with local communities across the subcontinent. However, in the contemporary conservation scenario dominated by influences from the Global North, wild pigs, despite their cultural significance and impacts on fringe cultivators, remain a forgotten species due to their supposed lack of charisma and sentience [e.g., (Oommen, forthcoming a)]. This contrast is particularly stark when compared with conservation icons such as elephants, dolphins, etc. which are frequently highlighted in conservation discourses as being imbued with sentience and sapience. The long-term engagement between people and pigs on the subcontinent has resulted not only in widespread conflict with agriculturalists, but also a range of complex socio-economic and cultural arrangements ranging from religious proscriptions among mainstream societies to ritual and taboo among hunting communities (e.g., Oommen, forthcoming a; Oommen, forthcoming b).

Worship of the boar-headed god Varaha (an avatar of the god Vishnu represented iconographically as half man-half boar, or in completely zoomorphic forms) who lifted the Earth from the primordial flood (by bodily rescuing the earth goddess, Bhū), and the reputation of Varaha and his offspring as creators of mayhem, likely alluded to the crop-raiding tendencies of wild swine. Similarly, the wrathful Vajravarahi (the female form of Varaha) in Tāntric traditions was believed to transform the novice nuns of her monastery into sows and unleash them on her enemies. Despite, or because of their destructive nature, propitiation rituals and sacrifices towards enhanced human and livestock fertility, improved agricultural yields and soil fertility, the foretelling of rain, and protection from epidemics were common, and sacrifices involving pigs were particularly significant for many Dravidian rituals (Oommen, forthcoming a).

In parts of Northeast India as well as the Andaman and Nicobar islands, pigs are not only considered to be critical elements for nutrition, but also considered to be of great significance for a range of cultural engagements of local tribal communities. Andamanese communities such as the Jarawa and the Ongee, for whom wild pigs provide critical sustenance, regulate their hunting through different forms of resource habitat taboos (RHTs) as well as rituals and myths (Pandya, 1993, 2009). In northeastern India, the etymologies of several Naga clans originate from pigs, as do several storeys of village establishment which involve farrowing sows, runaway pigs and hunted boars (e.g., Hutton, 1921; Mills, 1922). Such diverse multifaceted engagements including origin storeys, folklore, and hunting rituals from both the islands as well as India's northeastern region are beneficial for conservation in these regions (Oommen, forthcoming a; Oommen, forthcoming b).

Most historical societies (as well as contemporary traditional ones) managed at least an uneasy level of coexistence with wild pigs. Numbers were kept under control as part of management of populations, utilisation for nutritional sustenance and a range of cultural practises that also promoted tolerance and reverence.

On the other hand, coercive top-down control that prohibited people from hunting or culling of this species has been hugely problematic as it neglects the enormous impact wild pigs have on agriculture. During the colonial period, local prohibitions on the removal of wild pigs were effected in order to manage adequate number of boars for pig-sticking, a form of hunting favoured by colonial officers and members of the Indian royal families. While a number of other lesser problematic species were declared as vermin, pigs were spared despite their daily depredations on village agriculture, leading to extensive rule breaking and illegal killing of pigs (Hughes, 2014; Oommen, 2020). Gold and Gujar (2002) analysing peasants' memories from the erstwhile kingdom of Sawar in Rajputana report that prohibitions on killing pigs by local rulers led to impoverishment and revolts by villagers.

The recent dynamics of forest fringe villages across the country tell a similar storey of wild boar depredations as a consequence of wildlife preservation laws. In addition to being a persistent and highly effective crop raider that often results in farmers abandoning agriculture (wild boar pestilence has occasionally led to local famines among farming communities—e.g., Sunseri, 1997; Walker, 2001), wild pigs are highly fecund animals whose numbers tend to explode when provided adequate protection. Moreover, a lack of understanding by urban people and conservationists about how dangerous pigs are also figure prominently in discussions with local communities. Studies from both Kerala and Uttarakhand show that local people frequently blame government apathy and mismanagement in dealing with wild pigs, leading to a disruption of already tenuous coexistence scenarios with the species (e.g., Govindrajan, 2018; Oommen, 2019). In the Uttarakhand region, local people believed that that pig numbers increased after a pregnant sow escaped from the Indian Veterinary Research Institute. Continuing protection to pigs accorded by the Forest Department led to claims that the government was needlessly sympathetic to the descendants of an errant domestic pig instead of being concerned about the welfare of local people who suffered from their depredations (Govindrajan, 2018). Such claims have strong links with concerns about distributive justice and have been highlighted in other studies as well.

Other Ungulates

In 2015, “*Bishnois: Environmentalists since the fifteenth Century*” authored by Franck Vogel, a photojournalist specialising in environmental issues was one of several catalysts garnering worldwide public attention to the Bishnois, a small, yet significant community primarily comprised of agriculturalists, residing in northwestern India. The community observes strict prohibitions against killing animals and cutting trees, Bishnoi women are known to even occasionally breastfeed orphaned offspring of blackbuck (*Antilope cervicapra*) and chinkara (*Gazella bennettii*) fawns. The community are believed to have derived their name from the 29 (*bish noi*) divinely-ordained rules (handed down in the fifteenth century by Guru Jambheshwar/ Jambhoji) that are integral to their central goal of purity. The history of the Bishnoi is steeped in the legend of the Khejarli massacre in which more than 300 community members, led by a local woman, Amrita Devi, sacrificed their lives protecting a *khejiri* (*Prosopis cineraria*)

grove from the king's army. As part of their rules, each Bishnoi village also maintains an *oran*, or common land reserved for planting trees and for grazing land for wildlife. Ungulates such as blackbuck and chinkara are also allowed to feed on crops to a large extent.

Although syncretic in origin (a mixed transitory origin including Islamic antecedents for the now Hindu Bishnoi has been suggested—see Jain, 2011; Reichert, 2015), Bishnoi “environmentalism” provides an interesting backdrop to explore coexistence in relation to several mainstream aspects of morality, duty and virtue embodied in Hindu *dharma* (which can be translated, albeit simplistically, as moral code). While the scholarship on this is extensive and complex, an examination of early (c. 1500—c. 1000 BCE) and later Vedic (c. 1000—c. 600 BCE) philosophies that give rise to fundamental religious texts of ancient India provides basic insights. As opposed to the *dvaita* (duality) early Vedic conceptualisation in which the ultimate reality (*Brahman*) and the individual soul (*atman*) existed in distinct realities, the later Vedic *advaita* (non-duality) conceptualisation viewed duality only as illusory (*maya*) in nature. The central, recurring themes of the latter include the interconnectedness of the elements as well as that between human and non-human beings, and the omnipresence of the divine in everything including non-human animals (Chapple, 1993; Dwivedi, 2003). The ideas of rebirth and cyclical change (*samsara*) and the transmigration of the soul through various animal bodies, especially the concept of “*Vasudhaiva Kutumbakam*” (the world is one family) as outlined in the Upanishads encourages kinship with animals.

The central ideas of *advaita* philosophies align with respect for animals and concomitant duties towards them. This is reflected in traditional beliefs such as those of the Bishnois as well as modern movements in the region such as Swadhyaya (Jain, 2011). However, as pointed out by Sivaramakrishnan (2015), the presence of sacred elements alone does not reflect a deliberate environmental ethic. Many traditions both historical and contemporary, do not label their own work as environmental in nature, rather along with a number of religious and social outcomes, sustainability and kindness to animals are nevertheless, beneficial collaterals (Jain, 2011). The debate as to whether some of these Indic theologies are genuinely environmental in nature is still unresolved despite an extensive body of scholarship (e.g., Doniger, 1976; Patton, 2000; Nanda, 2005; Nelson, 2006), however, they provide an interesting set of insights to understand human-nature relations.

Harking back to the Bishnois, a closer analysis of the community's worldviews and day-to-day engagements with animals reveal complexity and contradiction. While on the one hand several aspects of the teachings of Jambhoji is definitely in place (e.g., the community's traditional opposition to hunting and prosecution of hunters, protection of trees), there are also other characteristics which seem to be in opposition with the stereotype as a peaceful community and their idealised representation as a group with an entirely harmonious relationship with nature. For instance, in contrast with articulated ethical mandate to protect animals, pigs are an exception and are often viewed by community members with revulsion. From time to time, the

community also appears to be in violent opposition with other caste groups. Further, Reichert's 2015 interviews with Bishnois themselves point to an acknowledgement of different forms of romanticisation as well as a recent “greening” of the community by both insiders and outsiders,” occasionally for the benefit of Western audiences.

DISCUSSION

Key Learnings From the Indian Context

In India, as well as among traditional societies elsewhere, longer range histories of human-animal interactions can be characterised by a lack of dualism between people and nature. Communities with longer-term engagements with predators and other problem wildlife typically evolved a range strategies that appear to be on the whole beneficial to coexistence in shared spaces. In his wide-ranging, yet controversial commentaries on mythology and religion, Frazier (1922, p. 413) points to numerous examples of worship and propitiation of “obnoxious” species ranging from locusts and birds that decimate crops, rats and mice that destroy grain, and crocodiles that attack humans. As pointed out in the preceding sections, there are close parallels here with Indian traditions where nearly every species characterised as causing harm or conflict appear to have links with propitiation. Anthropological scholarship from across the world supports this, and shows that many species involved in predation on people and livestock, crop-raiding and other forms of harm have been long accommodated by local communities and assume sometimes contradictory spiritual and material roles (e.g., Lopez, 1978; Knight, 2004; McGregor, 2005; Pooley, 2016).

Coexistence between humans and wildlife was typically facilitated by what can be understood as different forms of balanced reciprocity and affordances by interacting parties. Human relationships with animals are often guided by informal institutions consisting rules, norms and prohibitions that are derived from autonomous decision-making by traditional communities. A long history of anthropological explorations have affirmed the effectiveness of adaptive responses that not only ensure the long-term sustainability of species and natural resources (though rules may not be explicitly directed at conservation) but also promote social identity and cohesion of communities themselves (Rappaport, 1968; Harris, 1971; Reichel-Dolmatoff, 1976; Johannes, 1981). Among these, different types of resource and habitat taboos (RHT) (e.g., food, hunting and seasonal and habitat-related taboos), which are the result long-term adaptive engagements of a society in a landscape often serve overlapping social, ecological and psychological ends (Gadgil and Guha, 1993; Colding and Folke, 2001).

Measures that promote coexistence, especially in relation to hunting and utilisation species that figure predominantly within such systems of rules can still be gleaned from examinations of traditional societies in parts of central (e.g., Ramnath, 2015) and northeast India (e.g., Aiyadurai, 2016; Nijhawan and Mihu, 2020) and the Andaman islands (e.g., Radcliffe-Brown, 1922; Pandya, 1993, 2009). Hunting rituals and taboos that require a strict adherence to various rules such as refraining from overhunting, asking for permission and forgiveness to take life,

and entreatments to ensure the future availability of animals are a large part of these local coexistence frameworks. The perception and treatment of individual animals is also significant and context driven. In some contexts, local communities may favour the elimination of individual animals on account of their idiosyncrasies including ecological and behavioural features that deviate from a commonly accepted species norm (for close parallels with other contexts, see Von Essen and Allen, 2020). In others, the behaviour of individual animals (e.g., man eating tigers), despite being involved in catastrophic attacks of people, is justified in some contexts through explanations such as therianthropy, where the blame is in effect shifted from the animal to that of misbehaving or malevolent humans.

In contrast with a lack of separation between people and nature as embedded within indigenous and traditional ontologies, colonial and post-colonial policies which enabled the creation of exclusionary protected areas and strengthening hands-off approaches to most species appear to have created a strong rift in the once-operational organic relations between the two. This strict separation between people and wildlife has been detrimental to long-term coexistence as, in most of the country, local communities began to view wildlife as government property, contest the presence of wild species outside protected areas, and question the impact of top-down conservation on local livelihoods and rights.

When viewed through the lens of moral economy (Thompson, 1971; Scott, 1977, 1990), the nature of conflict and coexistence underwent a distinct shift towards the articulation of resistance and inequality and in ensuing power struggles with the state and outsider stakeholders including conservationists. As pointed out by Pooley et al. (2017) in the context of human-predator relations, working out what conflicts are really about is critically important. As these authors point out, what may superficially look like human-wildlife conflicts may have more to do with underlying differences between human actors with incompatible goals related to land and wildlife. Their embedment in wider societal conflicts and power equations, and the social constructions of landscapes has also been pointed out by several others (e.g., Ghosal et al., 2015). Conflicts between people as well as the historical contexts of these differences are therefore critical to understanding the dynamics of coexistence. As exemplified by the case of the Mishmis opposition to the establishment of a tiger reserve in northeast India (Aiyadurai, 2016) or that of Chenchu hunter-gatherers asked to make way for a tiger reserve acerbically suggesting to conservationists for the same to be instead established in the urban centre of Hyderabad (Guha, 1997), conservation entails resistance and discontent. Hegemonies imposed by the state and powerful outside groups go a long way in disrupting local equilibria, and bring to the surface concerns about the loss of rights and autonomy, and a lack of distributive justice.

In this context, a recurring phenomenon relates to conjectures circulating among local inhabitants that allude to secret introductions of wildlife by the government. Both Ghosal et al. (2015) and Oommen (2017) point to instances where local communities believe that tigers from zoos (local inhabitants claim that these individuals are easily identifiable on account

of their preference for livestock and poor hunting skills) were introduced into their landscapes by the Forest Department in Maharashtra and Kerala. There are similar accounts relating the introductions of leopards in Himachal Pradesh (Dhee et al., 2019 and references therein), though these could have some links with relocation of individuals involved in conflict from other human-dominated landscapes. To local communities, such acts often signify the government's heavy handedness and apathy to people. Similar parallels can be read in the storey of the runaway domestic sow and government protection for pigs in Uttarakhand (Govindrajan, 2018). Accounts of clandestine wolf reintroductions in Norway (Ghosal et al., 2015) show that such conceptualisations incorporating conspiracist theories and claims of introduction of tame animals, hybridisation, etc. are as much a part of modern, Western ideas of wildlife as they are in India.

The relationship between the state and its local citizens is paramount here. Through the delineation of PA boundaries and exertion of ownership over animals (through overarching legislation such as the Wildlife (Protection) Act), the post-independence Indian state denied legitimacy to existing local relations between people and animals (e.g., Ghosal and Kjosavik, 2015). In the process, potentially fruitful alternatives for governance were also likely lost or diluted. As discussed before, in many cases, what people may in effect be resisting, is conservation which is imposed without adequate consultation or buy in. In yet others, it may be the lack of rights, tenure and autonomy that turn people against wildlife.

The dynamics of coexistence is also guided by newer developments that are strongly entangled with a suite of factors that fall under the umbrella of modernization including technological change, globalisation, proliferation of media and other influences (for a modern Scandinavian parallel, see Von Essen, 2018). For instance, proliferation of firearms as well as roads have resulted in expanding the scale of hunting in India's northeastern region. In this region, other influences that have brought about shifts in values and ethics include conversion from animism to Christianity (e.g., breakdown of some taboos) as well as the increasing influence of urban conservation groups that have campaigned against hunting (e.g., surrender of firearms and other hunting weapons). In recent years, the influence of social media is extremely relevant in mediating public perceptions of conflict and coexistence, both positive as well as negative. Coexistence is therefore contingent on a dynamic and changing set of interlinked values.

Concerns, Caveats and Ways Forward

The Indian context is very expansive, from multi-ethnic and multi-religious scenarios, to the influences of mass movements, public intellectuals and external factors. These are overlapping influences. On the one hand, interpretations of the Indian context in support of modern environmentalist sensibilities tend to be shoehorned into a valorization of Eastern traditions and religious practises such as Hinduism, Buddhism and Jainism based on superficial similarities. For instance, similar to Inden's 1986 caution about Orientalist constructions of India in general, Patton (2000) points to the common tendency among

both ecologists and Indologists to privilege passages in Hindu scriptures that allude to a Romantic ideal of harmony with nature. Strong critiques of simplistic religious environmentalism can be found in the work of several scholars including Nelson (2006), Doniger (1976), and Nanda (2005). As these authors point out, such readings are problematic and have consequences in modern interpretations that allow only a narrow set of acceptable human relationships with animals and the adoption of specific and limited environmentalist ideologies such as those encompassed within the Hindutva mobilisations of the Hindu Right (to the exclusion of others) (Sivaramakrishnan, 2015). For example, in the modern sphere, despite limited overlap in fundamental philosophy and traditions, PETA mobilises the diasporic Jain community for promoting its arguments in favour of veganism and animal liberation (Laidlaw, 2010). Similar examples can be found in Sivaramakrishnan's (2015 and references therein) explorations which analyse environmental ethics within Indian environmental history, and also frequently highlighted examples such as Bishnoi environmentalism (Jain, 2011; Reichert, 2015).

Similarly, an unpacking of the term "tolerance" in the context of wildlife pestilence is also required. In spaces of unequal power relations, what may be viewed as tolerance is likely to have strong political ramifications it is difficult to ascertain if expressions of tolerance by local communities is just limited to social and cultural acceptance of a particular species, or a coping mechanism used to justify and overcome helplessness in the face of such problems.

On the other hand, there is the question of understanding Indian contexts for coexistence against categorisations imposed by Euro-North American conceptualisations of environmentalisms (Nadasdy, 2005). In the same way that a universal moral ethic for conservation is highly problematic, so is a monolithic, narrow view of coexistence defined only by scientists or environmentalists. Looking at the broad spectrum of environmentalism (see Nadasdy, 2005) for instance, a "dark-green" perspective of coexistence derived from radical ecocentric notions is likely to vary significantly from that of the broader conceptualisations of "light-green" or reform environmentalists which may include including some level of lethal control of problem animals or continued hunting, or harvesting at viable levels. In fact, many traditional societies that were discussed in previous sections conceive of hunting as essential to their very existence and identity, as has been pointed out emphatically in other contexts as well (Nadasdy, 2007). As pointed out by Morris (1998) and Ingold (2000), human-animal relationships are never homogenous or monolithic, but complex, multifaceted and locally co-constituted.

Therefore, the need to accept pluralism in knowledge and practise embodied in calls for "cognitive justice" (Visvanathan, 1997) is particularly relevant in the case of coexistence. Nadasdy's 2007 recommendation for accepting the ontological assumptions of indigenous groups as *literally* and metaphorically valid is also food for thought. This means that views of local communities living with wildlife who are the custodians of situated knowledges, local traditions and lived experiences need to be privileged and accepted in ways that may be anathema

to the ontological boundaries and barriers of scientists and conservationists. In the same way that Baviskar (2011) cautions against "bourgeois environmentalism" and Jalais (2008) argues for accommodating the views of the people who live with "wild" tigers as opposed to those who embrace the "cosmopolitan" tiger far removed from reality (see also Cohen, 2012), the nature of local coexistence could be defined by the lived experiences and conceptualisations of communities who actually share spaces with wildlife. Different forms of social and cultural capital (Bourdieu, 1986) embedded within the lived experiences of local communities are particularly relevant as they provide for alternate ways of knowing, interacting and coexisting with wildlife. A phenomenological approach to coexistence that privileges the subjective, lived experiences and sensibilities (e.g., Husserl, 1913/1963; Heidegger, 1971) as opposed to a universal ethic would be pragmatic. These need not be just for indigenous animist societies, but for the vast majority of rural populations for whom traditional practises and modern lived experiences intersect to form sometimes hybrid or newer relationships with wildlife. This may also mean diverging from "hands-off" preservationist conservation ideals and the re-examination of "third rail" issues such as hunting, culling, etc. that are pragmatically appropriate or culturally embedded within a particular geography.

Further, this also means questioning the patronising assumptions of the knowledge/ information deficit model—in this context, that local communities do not really know their animals or are not already aware of the positive interactions and social relations with wildlife. An emerging acceptance by conservationists of the simplistic conceptualisations on human irrationality (e.g., Knopff et al., 2016; Bombieri et al., 2018) as put forward by the heuristics and biases school (e.g., Tversky and Kahneman, 1992) is also at play when it comes to the public understandings that may impact human animal relationships. This politics of conservation is reminiscent of Kipling's exhortation (in *The White Man's Burden*, *The Times*, February 4, 1899, London) to serve the best interests of "new-caught, sullen peoples...", a civilising mission that is all too familiar in the Southern conservation contexts that is based on a widespread mistrust of the ability of local communities to manage on their own. In reality, while there have been examples of indigenous destructions of environments, for some communities and contexts, religious and spiritual leanings engender an organic/unconscious conservation ethic including that of "animal persons," (Snodgrass and Tiedje, 2008). Sponsel's argument for a "middleground" (Sponsel, 2001, p. 170) between "romantic myth" and "oversimplified counter to romanticism" in viewing indigenous communities either as protectors or destroyers of nature is, therefore, relevant (Snodgrass and Tiedje, 2008, p. 8).

Academic scholarship aligning with radical protectionist conservation paradigms such as compassionate conservation (e.g., Wallach et al., 2018) promote an impression that sentience, sapience and sociality in animals is a new discovery that calls for support of a universal moral conservation ethic that shuns any form of violence. However, as mentioned before, ontological equality and personhood figure prominently, if

not fundamentally, in many traditional animist cosmologies, but within the communities' own cultural models and social relations that are locally contingent (Hallowell, 1960). Hunter-gatherers and rural communities routinely incorporate animals into such frameworks, understanding animals as individuals with consciousness, morality, spiritual power and intentionality, and people and animals are located within webs of reciprocal relations. In some contexts, animals may be exterminated but in others, there may be explicit injunctions against destroying even individual animals that are involved in catastrophic conflict. Within local systems, these serve as critical anchors for social cohesion and ecological sustainability and form important ingredients of coexistence. However, their significance is highly specific to context as opposed to recent cosmopolitan theorisations that argue for a universal conservation ethic such as that espoused by the proponents of compassionate conservation and associated ideologies (e.g. Wallach et al., 2018; Wallach, 2020). The difference is important as these are not shared equally/ uniformly (either by communities or even by individuals within them), are of varying ethical obligations, and are activated depending on context (Snodgrass and Tiedje, 2008). Such a shift away from moral monism towards a pluralistic system of values aligns strongly with Norton's 1991 convergence hypothesis which encourages local freedom and determination, and context specific adoption of priority rules and decisions. Here, Neumann's 2004 caution to conservationists against moral extensionism or the attribution of moral standing to non-human animals outside traditionally located human spheres of ethics and morality is also critical. The consequences of viewing animals a certain way (e.g., humanising wild animals) are strongly related to our perceptions and treatment of our own species who behave differently from us. Using the example of African Parks, he points to the influence of such moral and discursive narratives in normalising violence against poachers. Similarly, as has been shown elsewhere, injunctions against hunting, meat eating, animal sacrifices and similar practises situated outside modern Western ethical frameworks could align with intolerance related to race, ethnicity or religion (Boaz, 2019; Oommen et al., 2019).

Learning coexistence from traditional societies is not easy either. Anthropological scholarship on different ontological positionings of communities have shown that these notions can vary across different cultures (e.g., Viveiros de Castro, 1998; Ingold, 2000; Descola, 2013). Nijhawan and Mihu (2020) point out that efforts by conservation organisations to co-opt them into formal conservation strategies have often been ineffective, and may in fact create unintended adverse consequences. Efforts in other countries such as Madagascar (Sodikoff, 2012) have shown that simplistic translation of such rules are unlikely to succeed, and the embedded, context-specific nature of such rules within traditional systems cannot be emphasised enough.

Species such as elephants, pigs and some large carnivores are particularly adept at responding to local stimuli especially those relating to fear, risk and opportunities whereas in landscapes occupied by others (e.g., snakes, though many such species have

more complex social dynamics than we typically assume) human behavioural modification or the removal of problem individuals may be the more pragmatic approach. In India, human relationships with snakes is a particularly interesting subject for potential insights as regional pockets such as Agumbe in Karnataka and Burdwan in Bengal have scenarios in which snakes live in close (sometimes intimate) proximity to people without being harmed (Romulus Whitaker, personal communication).

A take home lesson is that within spaces of interaction, the actions of both animals and people influence each other. When viewed from this perspective, contact zones remain negotiated spaces, with the boundaries of engagements and "transgressions" being drawn both by opportunity and fear. Further, violent, traumatic events, though relatively rare in number, are often strongly imprinted in memory, calling for further research on such interactions. In wild spaces, human fears are more immediate and pressing whereas the opposite holds true for animal interactions resulting in differently viewed landscapes of risk. While technical definitions vary according to disciplinary focus, the concept of "landscape/s of fear" has been examined from ecological (Laundré et al., 2001, 2010) and social (Tuan, 1979) perspectives, for both people and animals, and could serve as a useful starting point for local evaluations of violent as well as non-violent encounter. As pointed out by Tuan (1979), fear is one of the primary forces that shape us (fear of animals, darkness and heights being key universals among humans). Similarly, studies of predation risk in animal systems reveal numerous anti-predator responses that involve substantial costs and trade-offs for individuals and "risk effects" that prevent them from engaging in other useful behaviours, as well as resulting in increased physiological stress, and eventually "fitness costs" that translate to long-term demographic changes (Lima and Dill, 1990; Brown, 1999) could serve as the ethological extension of coexistence studies. For example, for several species, conservation has resulted in a watering down of "landscapes of fear" (Laundré et al., 2001, 2010), as hunting, harvesting and persecution of animals has reduced in some spaces. These topics require further research and exploration.

CONCLUSION

In the preceding sections, a range of explorations of historical and contemporary engagements between people and wildlife were examined. These provide empirical evidence for both positive as well as negative or ambivalent relationships. As pointed out by Frank (2015), such interactions are emphatically context-laden, and dynamic as opposed to being fixed to any particular location on the continuum.

A general pattern that emerges here, especially in the context of historical relations is that in many instances, indigenous ontologies typically engendered multifaceted engagements ranging from reverence and propitiation to elimination of wildlife, but nevertheless enabled coexistence, at least in the generic sense of the term. These have been disrupted by modern conservation whose predominantly top-down nature privileges

only a narrow set of acceptable relationships while excluding and marginalising a range of human practises. Modern conservation's adherence to moral and ethical positions aligned with urban sensitivities (e.g., wildlife watching in protected areas from which local communities have been excluded) has been particularly problematic as this has contributed to the disruption of organic relationships and the emergence of distributive justice concerns, eventually leading to discontent and even retaliatory attacks. While the clock cannot be dialled back, it is nevertheless important to look towards local and rural worldviews that are synergistic with coexistence at a broad scale. As opposed to exclusionary measures that create and reinforce dualism between people and nature, they tend to be more inclusive especially on account of their potential for shared decision-making, and their legitimacy with respect to organic origins and lived experiences.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article, further inquiries can be directed to the corresponding author.

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ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements. Ethical review and approval was not required for the animal study because this is not a field study involving animals.

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

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Welcoming Wolves? Governing the Return of Large Carnivores in Traditional Pastoral Landscapes

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Wolf populations are recovering across Europe and readily recolonize most areas where humans allow their presence. Reintegrating wolves in human-dominated landscapes is a major challenge, particularly in places where memories and experience of coexistence have been lost. Despite the observed expansion trends, little has been done to prepare communities for the return of these apex predators, or to understand what fosters and perpetuates coexistence. In this study, we present a theoretical framework for resilient coexistence based on four conditions: Effective institutions, large carnivore persistence, social legitimacy, and low levels of risk and vulnerability, nested within the social-ecological systems (SES) concept. To empirically show how the conditions can be manifested and interconnected, and how this knowledge could be used to improve local coexistence capacities, the framework is applied in a case study of human–wolf relations in Spain. We examined three traditionally pastoral landscapes at different states of cohabitation with wolves: uninterrupted presence, recent recolonization, and imminent return. We found that both the perceptions of wolves and the capacity to coexist with them diverged across these states, and that this was largely determined by a diversity of vulnerabilities that have not been recognized or addressed within current management regimes, such as economic precarity and weak legitimacy for governing institutions. Our results illustrate the importance of working in close contact with communities to understand local needs and enhance adaptive capacities in the face of rural transitions, beyond those directly related to wolves. The framework complements emerging tools for coexistence developed by researchers and practitioners, which offer guidance on the process of situational analysis, planning, and resource allocation needed to balance large carnivore conservation with local livelihoods.

Keywords: wolves, biocultural diversity, coexistence, traditional landscapes, human-large carnivore relations, co-adaptation

INTRODUCTION

Current plans for socio-ecological transitions, such as the EU biodiversity strategy (The European Commission., 2020) and the UN Decade on Ecosystem Restoration (UNEP., 2019), call for new ways of thinking about how humans and wildlife might share space. In Europe, expanding large carnivore populations (Chapron et al., 2014; Cimatti et al., 2021), rural land abandonment

(Bürgi et al., 2017), and a growing rewilding movement (Ceausu et al., 2015) have brought human–carnivore relations (HCR) into focus, meaning the multifaceted interactions between humans and large carnivores. In recent decades, European conservation policies have supported the integration of large carnivores within human-dominated landscapes (Boitani and Linnell, 2015; Cretois et al., 2019). As carnivore populations increase, institutions across the continent face the challenges of (re)integrating these species, balancing the aims of biodiversity conservation, livelihood protection, and the welfare of carnivores and domestic animals (Redpath et al., 2013; van Eeden et al., 2018).

Large carnivores often become symbols of incompatible human–nature worldviews, primarily between those who uphold traditional rural practices, and those with urban lifestyles (Pooley et al., 2017; Ericsson et al., 2018). The negative impacts of large carnivores are disproportionately experienced in rural communities, some of whom are vulnerable due to market globalization, rural depopulation, and inequitable agricultural policies (Leal Filho et al., 2017; Pe'er and Lakner, 2020). Growing carnivore populations will result in increased overlap between these communities and carnivores (Milanesi et al., 2017; Hinojosa et al., 2018). However, little has been done to proactively enhance their ability to adapt to this. Moreover, while research has revealed the causes and components of dysfunctional HCRs, mostly through the lens of human–wildlife conflicts, there are fewer studies on what constitutes functioning human–carnivore coexistence (Lozano et al., 2019; Pooley et al., 2020). This could give the impression that conflict is a dominant and inevitable outcome of living with large carnivores, rather than one of multiple possible and often simultaneous relations (Peterson et al., 2010; Rode et al., 2021). Identification and amplification of functioning HCRs could greatly benefit conservation agendas, by providing effective and optimistic messages and examples (Madden, 2004; Bennett et al., 2015).

In response to calls for in-depth research on coexistence (Carter and Linnell, 2016; Pooley et al., 2020), we explore the conditions that influence human–wolf relations in traditional pastoral landscapes, focusing on the factors that enable coexistence. We present a theoretical framework of resilient coexistence, and apply it to human–wolf relations in three rural communities in Spain that are at different states of coexistence with wolves; uninterrupted presence, recent recolonization, and imminent return. Through key informant interviews and participant observation, we explore how coexistence conditions are manifested and interconnected at each location, and how capacities to coexist are influenced by socio-ecological trends. Finally, we explore the associated lessons and aspirations for carnivore governance in the future.

THEORETICAL FRAMEWORK

This research draws on recent advances in the study of human–wildlife interactions, which aim to understand the factors that shape coexistence in multi-functional landscapes (Peterson et al., 2010; Lozano et al., 2019; Pooley et al., 2020). In the case of large carnivores, the desired states of HCR are usually described

as “resilient coexistence” (Carter and Linnell, 2016, p. 575), in which both humans and carnivores flourish without substantially compromising the means of the other, and where effective and legitimate institutions have the capacity to address problems and disputes as they arise (Chapron and López-Bao, 2016; Hovardas and Marsden, 2018).

What makes coexistence resilient is location specific and influenced by various social and ecological processes, which improve or undermine communities’ coexistence capacity (Lischka et al., 2018; Lozano et al., 2019). In order to facilitate the analysis of coexistence in different contexts, we theoretically expand on each condition necessary for resilient coexistence: effective institutions, large carnivore persistence, social legitimacy, and tolerable levels of risk (Carter and Linnell, 2016), and nest them within the social-ecological systems concept (SES; see **Figure 1**). The framework draws on insights from multiple fields, including adaptation (climate change), anthropology, ecology, and human–wildlife interactions, which are necessary to understand the links between human society, the environment, and large carnivores (Hartel et al., 2019).

Social-Ecological Systems and Biocultural Diversity

The SES approach understands people, communities, economies, societies, and cultures as embedded parts of the biosphere. It takes into account the spatial, temporal, political, and organizational processes (including considerations of power and justice) that influence human and animal behaviors and how they shape and are shaped by the system (Folke et al., 2016; Lischka et al., 2018). For coexistence in traditional landscapes, the overlap of human and large carnivore activities, the historical presence, absence, and governance of the species, and the characteristics of the landscape are especially important considerations (Linnell and Cretois, 2018). Traditional landscapes are a product of the connection between people and place, which form part of local identities, memory and heritage (Pretty et al., 2010). It is the setting for an area’s biocultural diversity; a coevolving convergence of historical and ongoing environmental and social processes and its resulting flora, fauna, and cultural expression (Pretty et al., 2010; Agnoletti and Rotherham, 2015). Combining these perspectives allows us to view nature and culture not as separate, but as coevolving entities whose interactions continuously shape the conditions of coexistence (Pooley et al., 2017; Gavin et al., 2018).

Effective Institutions

We define institutions as the bodies and/or systems of formal or informal rules that structure social interactions, i.e., all customs and practices, organizations, and agencies, and policies and laws (Hodgson, 2006; Decker et al., 2016). Institutions must be attuned to SES dynamics if they are to enable humans and carnivores to co-adapt, such as in response to changed cultural values of nature. They must also be accountable across multiple scales to ensure public trust and stewardship, from international agendas (such as the Habitat Directive) to local communities (Trouwborst, 2010; Decker et al., 2016). Institutions can facilitate or constrain the behaviors and activities that underpin HCRs

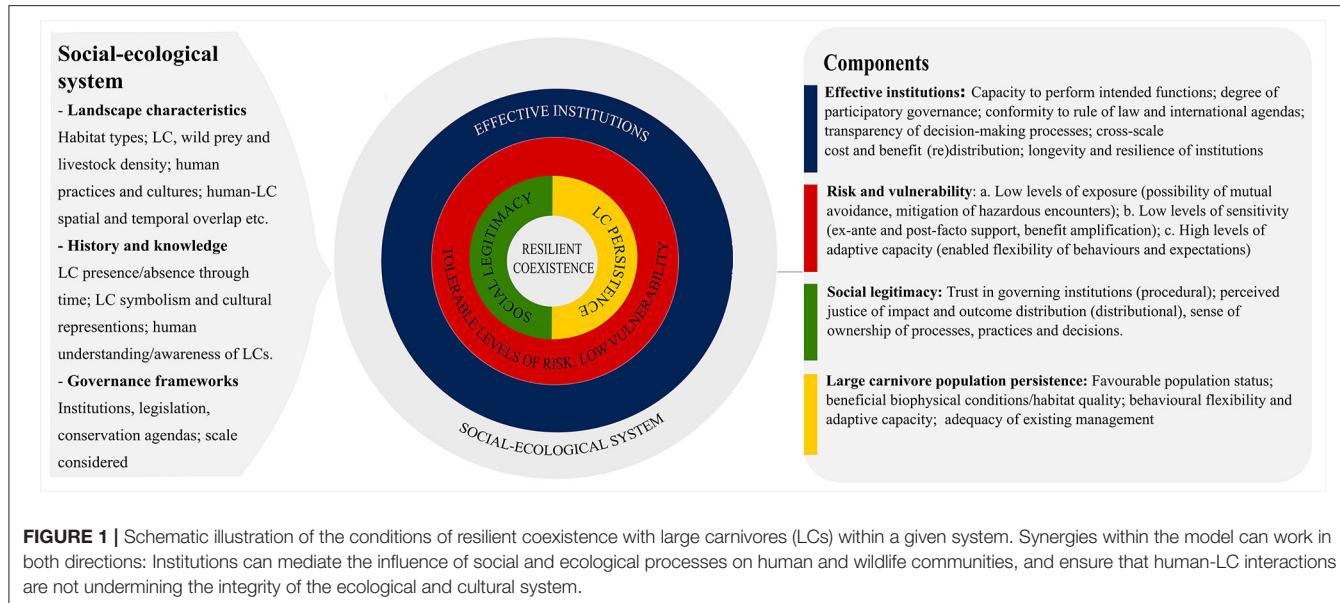


FIGURE 1 | Schematic illustration of the conditions of resilient coexistence with large carnivores (LCs) within a given system. Synergies within the model can work in both directions: Institutions can mediate the influence of social and ecological processes on human and wildlife communities, and ensure that human-LC interactions are not undermining the integrity of the ecological and cultural system.

in many ways, for example by implementing conservation laws and habitat management actions (e.g., protecting and restoring habitat conditions); providing incentives (e.g., conservation payments); support (e.g., information sharing and provision of infrastructure); and by impacting frames of thought (through regulation, education, and staking out future visions) (Carter and Linnell, 2016; Milanesi et al., 2017). By appropriately combining these measures, institutions can have an instrumental role in enhancing the other conditions of the framework (see Figure 1). Effectiveness refers to the capacity of formal or informal governing bodies to carry out decision-making and interventions in a way that is adequate (meeting social and ecological needs) and just (distributive and/or procedural) so that benefits of coexistence are amplified and drawbacks mitigated for both humans and carnivores (Walker, 2009; Lockwood, 2010).

Large Carnivore Population Persistence

Population persistence implies that local conditions enable the long-term presence of self-sustaining large carnivore populations (Trouwborst, 2014; Chapron and López-Bao, 2016). Specifically, this means that the risk of local extinction of the species is kept low over long time scales, which can be achieved through favorable habitat conditions and connectivity, abundant prey populations, and genetic diversity within the populations (Brook et al., 2000; Lacy, 2018). Ultimately, the size and range of large carnivore populations are constrained by humans, influenced by what risk levels are acceptable to people in a particular place (Bruskotter et al., 2017; Mech, 2017). This is impacted by heterogeneous ethical and moral considerations relating to rights, responsibilities, and costs, where social power dynamics influence which viewpoint gains prominence, and which scale is considered (i.e., the local, regional, or national state of populations; Wilhere, 2008; Vucetich et al., 2018).

Social Legitimacy

The presence of large carnivores strikes at the heart of relationships between conservation, development, and justice. Achieving a state of coexistence that is legitimate to as many stakeholders as possible is therefore essential in order to ensure its resilience (Jacobsen and Linnell, 2016; Ceaușu et al., 2018). Social legitimacy refers to both input legitimacy, and output legitimacy. Input legitimacy, connected to procedural justice, is based on judgements about whether decision-making bodies and processes are morally fair, transparent, and appropriate for affected parties. Output legitimacy refers to the quality and equity of policy outcomes, and the extent to which an institution delivers its stated aims (Walker, 2009; Bennett et al., 2019). Governing bodies gain and maintain the social “license to operate” afforded by legitimacy by winning the trust and respect of constituents, and by relating policies to local priorities and values (Jepson, 2005). Public trust in governing institutions can enable public acceptance of expanding large carnivore ranges and populations, notwithstanding the potential risks (Jepson, 2016; Treves et al., 2017).

Tolerable Levels of Risk—Low Levels of Community Vulnerability

The impacts of large carnivores and humans on each other depend on their use of local resources, their spatial and temporal overlap, and their ability to withstand stressors (Treves and Karanth, 2003; Redpath et al., 2015). Resilient coexistence does not imply a risk-free state. Rather, the risks are mitigated so that they become “tolerable” (Carter and Linnell, 2016, p. 575), although this is not well-understood or contextualized. It is not only the risk to livelihoods that affects people’s willingness to coexist, but also whether the risk is perceived as inherent within the system or imposed, and by whom (Redpath et al., 2017; von Essen and Allen, 2019). Of equal importance is subjective judgement about how coexistence may affect well-being, way of

life, identity, and community (Madden, 2004; Pooley et al., 2017). Within the framework, we therefore expand this condition to consider vulnerability of coexistence communities. Vulnerability is a function of exposure, sensitivity, and adaptive capacity to change and shocks within a system. Together they illuminate the probability and severity of an event, and the ability of the impacted party to cope (Adger, 2006; Nelson et al., 2007). This contributes to a more holistic understanding of the long-term well-being of both people and large carnivores in an area, beyond simply an assessment of livestock and wolf mortality or economic impacts.

Exposure

Large carnivores in Europe predominantly persist outside of protected areas (Chapron et al., 2014), which increases the probability of interactions with humans (Crespin and Simonetti, 2018; Rode et al., 2021). Reducing negative interactions is possible by spatially or temporally segregating human and large carnivore activities (Bruskotter et al., 2017; Reinhardt et al., 2019). To achieve this separation, large carnivore behavior can be influenced by ensuring favorable habitat conditions in areas away from human settlements, and using physical deterrents to protect livestock, such as fences and guardian dogs (Eklund et al., 2017; van Eeden et al., 2018). Human behavior can be influenced by restricting activities, e.g., grazing of livestock in certain areas (regulation and zoning), social and economic incentives, and information campaigns (Penteriani et al., 2016; Linnell and Cretois, 2018).

Sensitivity

Sensitivity refers to the degree to which a community is affected by perturbations (Adger, 2006), such as the return of a species. Low sensitivity implies that the adverse impacts that large carnivores and humans have on each other are moderated to a level at which the identity, function, and feedbacks of the system can persist, while retaining flexibility to develop (Nelson et al., 2007). Approaches to reduce sensitivity are usually based on economic instruments. They can be important to increase perceived distributive justice, since they enable the (re)distribution of resources to those whose livelihoods are directly affected by large carnivore conservation (Hovardas et al., 2017; Kojola et al., 2018). Instruments can consist of compensation and insurance schemes (ex post facto), payment based on risk (ex-ante), or incentives for conservation outcomes (e.g., payment for presence) (Ravenelle and Nyhus, 2017; Linnell and Cretois, 2018). Their success is contingent on cost-effective and viable verification (of carnivore range or predation), fair and timely payments, incentives for damage prevention and financial sustainability (Wilson-holt and Steele, 2019).

Adaptive Capacity

Adaptation refers to the ability of individuals or groups of humans or carnivores to adjust their behavior to better withstand changing conditions or hazards (Smit and Wandel, 2006). Large carnivores exhibit several behavioral and spatial-temporal adaptations to anthropic environments (Chapron et al., 2014; Carter and Linnell, 2016). Some decrease risk of negative interactions, such as nocturnal or crepuscular activity patterns

(Gaynor et al., 2018), while others increase predation on livestock or exploitation of urban food sources (Milanesi et al., 2017; Evans et al., 2018). By understanding and addressing population and individual behavior, wildlife managers can decrease risks to both humans and carnivores (Linnell and Cretois, 2018). Human adaptive capacity is an emergent property connected to social and psychological characteristics, as well as the physical and economic elements that impact willingness and ability to adjust behavior (Nelson et al., 2007; Dorresteijn et al., 2016). For cultures to persist, communities need to be able to build on traditional knowledge while adjusting and forming new expectations that enable well-being under social and environmental transitions (Smit and Wandel, 2006; Pretty et al., 2010). With regards to large carnivores, physical and psychological barriers that inhibit adaptation are often present, such as certain farming practices or perceptions about large carnivores and what they represent. By identifying and addressing these barriers, it is possible to influence people's expectations and narratives of HCR and local landscapes (Hovardas et al., 2017).

MATERIALS AND METHODS

Case Study Rationale

We operationalized the framework through a case study on human–wolf relations in three rural areas of Spain. The areas are characterized by traditional land-use systems, specifically extensive rearing of sheep and/or goats (small-scale, low input family farms), which are experiencing changes in the presence or impacts of wolves. The wolf is a highly adaptive apex predator, which may attack livestock and pets, and can be perceived by hunters to compete for game (Linnell and Cretois, 2018). Wolves are moreover considered a flagship species, invoking opinions, feelings, and meanings among those who live alongside them as well as those who don't (Mech, 2017; Kuijper et al., 2019). Exploring the conditions of coexistence with such a multi-faceted species in traditional landscapes could thereby inform work with other species often involved in disputes over wildlife.

We selected three states of wolf presence since the 1970s, when the population was at its lowest point. Location A has had an uninterrupted experience of cohabitation with wolves; location B has experienced their recent return; location C is anticipating their arrival within the next decade (see **Figure 2**). This approach allows us to shed light on processes of co-adaptation by piecing together insights across the three locations. Within each state, we selected locations that appeared to have favorable conditions for coexistence; marginal; and/or mountainous areas with relatively low human population density, abundant game populations, and some type of area designation, see **Figure 4**. The selection was based on literature searches and consultation with national experts.

Case Study Characteristics: Three States of Wolf Presence in Spain

Increased wild prey populations and vegetation cover have since the seventies led to improved conditions for the Iberian wolf (*Canis lupus signatus*) in Spain. Widespread and government incentivized persecution had during the twentieth century

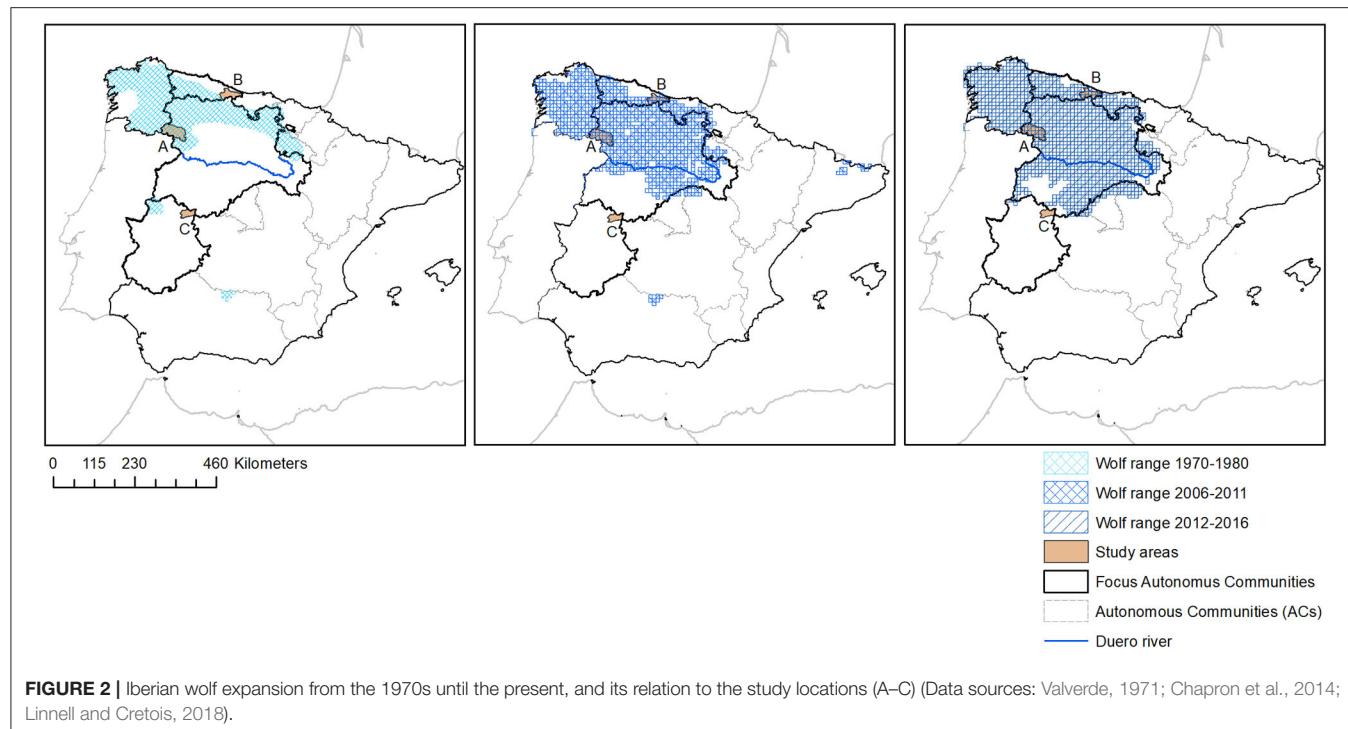


FIGURE 2 | Iberian wolf expansion from the 1970s until the present, and its relation to the study locations (A–C) (Data sources: Valverde, 1971; Chapron et al., 2014; Linnell and Cretois, 2018).

limited the population to the northwest of the country (Blanco and Cortés, 2009). In 1970, the status of the wolf changed from “vermin” to game species, which restricted the time and methods with which they could be hunted (Jefatura del Estado, 1970). When Spain ratified the European Habitats Directive in 1992, wolves in northwestern Spain were listed on Annex V, which must ensure favorable conservation status, while populations south of the Duero river became strictly protected on Annex II and IV (Trouwborst, 2014). Wolf populations have consequently been recovering, and the species can now be found across northwestern Spain (see Figure 2). Their diets vary—some packs mainly predating on domestic cattle, and others mainly on wild fauna (Llaneza et al., 2000; González-Díaz et al., 2020). Today Spain harbors one of the largest populations of wolves in Europe, estimated at 2,000–2,500 individuals in close to 300 packs (MAPAMA., 2016; Blanco, 2017).

In Sanabria-La Carballeda (S-LC), Zamora (**location A**, see Figure 3), wolves have had a constant presence, and hunting has remained legal due to the flexible regime of Annex V (Trouwborst, 2014). The area is dominated by a low mountain range (800–1,200 MAMSL), which contains the 67,000 ha regional Sierra de la Culebra hunting reserve, and the 23,000 ha adjacent Lake Sanabria Natural Park. The landscape is dominated by a mosaic of forests and rangelands, with marginal soils, traditionally grazed by free-roaming sheep and smaller numbers of cattle and goats (Fernández Gómez, 2013). Traditional protection measures for livestock have remained in use, including accompanied shepherding, night-time enclosure, and management of livestock guardian dogs (Vicente et al., 2000). La Culebra has become notable in recent decades for its dual

fame as an exclusive wolf trophy hunting reserve and as one of the most prominent wolf-watching destinations in Europe, both facilitated by its smooth topography which makes wolves easier to observe (Martínez, 2019). In 2015, an interpretation center dedicated to the wolf was inaugurated in Sanabria (The Iberian Wolf Center), reinforcing the area’s emerging reputation as “Tierra de lobos,” lands of the wolf (Lora Bavo and Villar Lama, 2020).

Wolves in Oriente de Asturias (**location B**, see Figure 3) became extinct in the 1950s or 60s (Llaneza, 2017). Their absence enabled communities to abandon protection measures and let livestock (sheep, goats, and cows) graze unsupervised, which facilitated the expansion and diversification of farm operations (Cayuela, 2004; Llaneza et al., 2016). In recent decades, a burgeoning artisanal cheese industry has emerged, including several cheeses with protected designation of origin. This has maintained a local market for milk and a relatively high profitability among producers, despite challenging conditions that restrict flock size and management (González-Álvarez, 2015; López and Pardo, 2018). The landscape is characterized by abrupt limestone peaks (0–2,600 MAMSL), intermingled with forest patches and biodiverse temperate grasslands (García Manteca et al., 2018; OECC., 2019). The region contains Spain’s first national park, Picos de Europa (PENP, 67,455 ha), declared in 1917. It is one of only two national parks that are inhabited by people, and is the third most visited in Spain (López and Pardo, 2018). Wolves started recolonizing the area in 1986 (GPA., 2016). Although wolves in Asturias are listed on Annex V, they have been declared a non-hunting species since 1991 (Trouwborst, 2014).

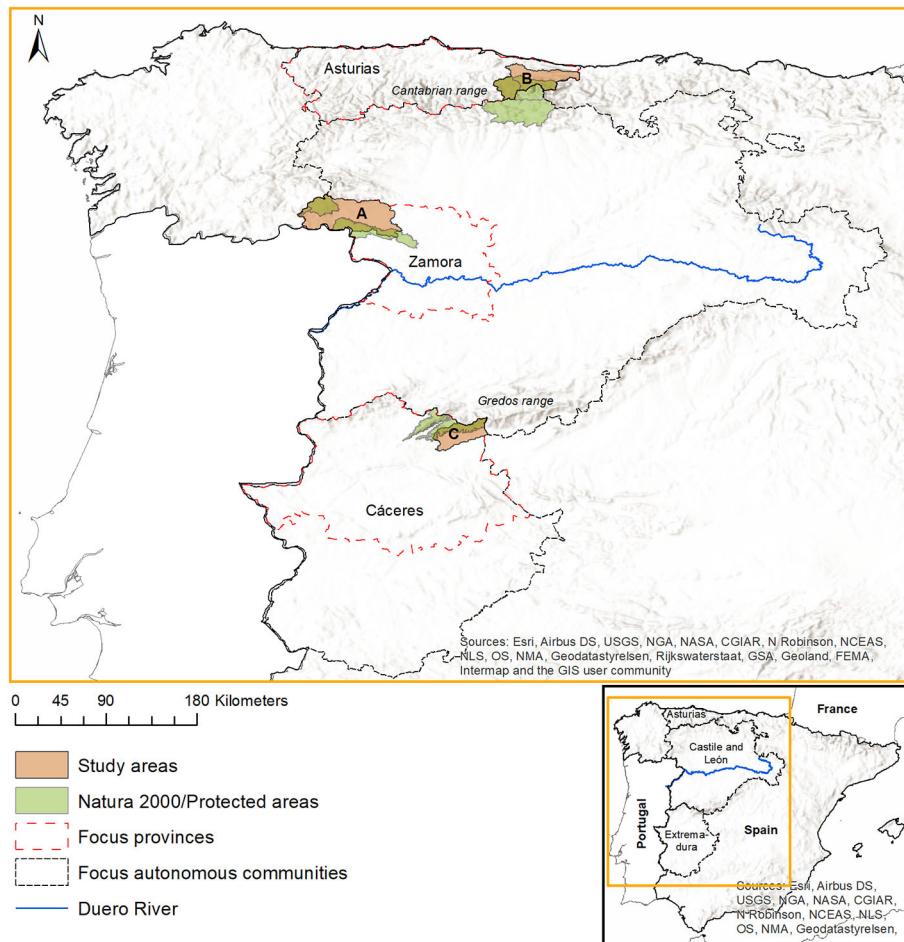


FIGURE 3 | Map of case study areas (orange), and relevant protected areas (green). *Location A:* Sanabria-La Carballeda, with Sanabria National park to the left and Sierra de la Culebra hunting reserve to the right. *Location B:* Oriente de Asturias district, with Ponga Natural Park to the left and Picos de Europa National Park to the right and center. *Location C:* La Vera, with the Sierra de Gredos y Valle de Jerte Natura 2000 area. Additional information about the characteristics of each location can be found in **Supplementary Table 1**.

In La Vera, Cáceres (**location C**, see **Figure 3**) the absence of wolves (extinct in the 1960s, Rico et al., 2000) enabled a similar trajectory of abandonment of protection measures as in location B. The area is characterized by the Gredos mountain range (400–2,400 MAMSL), with a forest and rangeland mosaic that has traditionally been grazed by goats. It is cataloged as Natura 2000 and high nature-value farmland (JuntaEx, 2014). In recent years the livestock sector has had significant issues with Bovine tuberculosis, which has a high prevalence in the region (Carrasco-García de León, 2015). The area has a prominent hunting sector and is a famous big game destination, particularly for ibex (*Capra pyrenaica*; Martín Delgado et al., 2019). In 2001, wolves recolonized the northern side of the Gredos range (Ávila province, Castile and León), which is just north of La Vera's border (see **Figure 2**), and in the same year the wolf was listed as critically endangered in Extremadura (Annex II and IV; JuntaEx, 2014; JCyl., 2016).

DATA COLLECTION AND ANALYSIS

Fieldwork took place from January–December 2020, with between 3 and 4 months spent in each location (approved by the Research Ethics Committee at the University of Leeds; AREA 19-018). Primary data sources consisted of observation and key informant interviews, purposively sampled to elicit the knowledge and lived reality of local communities and gain a deeper insight into local perceptions and experiences of coexistence (Smit and Wandel, 2006; Rust et al., 2017). Observation (participant and non-participant) was continuous and included accompanying farmers and wildlife managers during their daily tasks, attending local, and regional events, and informal conversations with local residents. For each location, a stakeholder network was produced through a snowball approach, from which we selected interviewees who were representative of a particular group, value orientation or

coexistence capacity (Berg and Lune, 2014). In total, 92 semi-structured interviews were conducted, 29–31 per site, in addition to three national-level carnivore or traditional landscape experts (see **Supplementary Tables 2A–D**). This sample enabled us to capture various perspectives within the different local groups, and triangulate them with those of civil servants at the regional level and national level experts. The interviews were either tape-recorded and subsequently transcribed or annotated during and after the interview. Questions were focused on rural dynamics, factors relating to wildlife interactions and aspirations for the future. Unless brought up by the informant, questions relating to wolves were asked at the end of the interview, in order to understand if and to what degree wolves were a main concern for local communities. Through this approach we could minimize potential rehearsed or polarized stances related to the wolf topic, encouraging communicative rather than a strategic rationality during the interview (von Essen and Hansen, 2015).

In order to contextualize and compare our findings, we supplemented primary data with an analysis of visual media (documentaries, short films, and promotional videos; see **Supplementary Table 3**) on the topics of human–wolf interactions and traditional farming, all produced in Spain during the last 5 years. We also surveyed local and regional newspapers and social media content during the fieldwork, to gain an overview of active debates and discourses about wolves and rural politics. Finally, we surveyed official documentation, such as management plans and information on wolf status, from Castile and León, Asturias, and Extremadura.

Following a grounded theory-type approach (Mabon et al., 2020), we continuously recorded and summarized observations and reflections during the fieldwork. This enabled us to identify recurring themes across the different coexistence states and to adapt the focus of the research accordingly (Rust et al., 2017). To gain a broad perspective on the entire dataset, the resulting notes, and interview and visual media transcripts were qualitatively analyzed and triangulated through thematic coding. The coexistence conditions of the framework were not used as separate elements of analysis, since they are interdependent and manifested in idiosyncratic ways in each location. Rather, the framework was used to provide an initial coding structure, established in NVivo software (QSR International UK Ltd.), which was then populated by the conditions, issues, trends, and aspirations as they emerged through the coding process. This iterative approach enabled the data codebook (see **Supplementary Table 4**) and the narrative structure of the findings to stem from what was deemed important by the informants, and on how they presented factors relevant to coexistence and their synergies within the system (Smit and Wandel, 2006). Key quotes from informants (coded with number and letter according to the study locations) represent perceptions of the most significant coding categories.

RESULTS

The following sections present the case study findings as seen through the framework, beginning with SES trends, and

issues that were shared across the study locations. Next, results from each location are presented, beginning with the current state of the wolf persistence condition (historic presence and absence, current population numbers, and protected status) before presenting themes relating to social aspects of HCR.

Common Trends Across the Coexistence States

Traditional, extensive livestock practices have persisted in the study locations, where they retain their significance for local livelihoods and cultures. In the last 50 years however, the number of farms have decreased drastically (Izquierdo and Barrena, 2006; MITECO JCyL., 2014). Despite the acknowledged quality of the products, the cultural values, and the advantages to animal health and biodiversity, shepherds have struggled to compete as local markets and infrastructure disappeared and the number of intermediaries in the supply chain increased (San Miguel et al., 2017). The limited economic viability of traditional farming has been exacerbated by inequities in agricultural policies, which despite recent greening efforts, are still biased toward farm size and efficiency over environmental and social indicators (Chemnitz et al., 2019). Informants expressed that they often struggled to meet subsidy allocation criteria, such as having enough animals per ha, producing enough per animal, or due to the extent of shrub/forest cover on their pastures. These trends contributed to changed animal husbandry practices, such as the drastic decline of goats and sheep in favor of cattle, which are less vulnerable to predation and less management intensive, with a more reliable consumer demand and higher agricultural subsidies:

“Six years ago my son decided to stay in the village [...]. As a mother, I couldn’t support him to stay with sheep. Because sheep is very “esclavo” [slave-like/work intensive] and here, in addition to the slave-like conditions, we have the wolf [...] and I didn’t want that life for my son. So I told him that I would support him if he wanted to stay here, perfect, but then we would have to go over to cattle farming, which gives you, within quotation marks, more free-time.” (Farmer and former shepherd, A16).

While the numbers of both shepherds (traditional managers of sheep and goats) and farmers (cattle owners) have declined in the villages, the sizes of the flocks have increased to keep up with rising costs. Some farmers have opted for a second profession to reach economic stability and improve living standards. This has resulted in larger numbers of unaccompanied livestock in the mountains, particularly cattle, and decreased the capacity for oversight and defense against predators. Informants described a homogenization of the landscape matrix, with increasing contrasts between easily accessible, intensively grazed lands and the more remote or marginal areas, which have become abandoned to nature-led processes. The trend has transformed the traditional landscape; infrastructure (trails, shepherd cottages and drinking stations) has fallen into disrepair and open areas have become recolonized by scrub, leading to the loss of flora and fauna associated with alpine grasslands and hay meadows, and increased prevalence of wildfires. This has increased management



FIGURE 4 | Case study locations (A–C, from top to bottom), exemplifying local farming systems (left), and village settings (right).

costs for remaining landowners, thus perpetuating the cycle, leading researchers and institutions to call for increased efforts to support and recover traditional farming practices (Izquierdo and Barrena, 2006; MITECO JCyl., 2014; Urivelarrea and Beaufoy, 2019).

Landscape homogenization has also reduced the buffer zones around some of the villages, which has contributed to a sense among informants that wildlife have become more numerous and bold, resulting in increased damage to crops and livestock, traffic accidents, and transmission of zoonotic diseases:

“The houses and the villages are nowadays small islands within this territory, and when wolves look for food they may pass by the four houses that are still inhabited. They come close because the food is close. Before the food was one or two kilometers away, now it is next to the houses. So when people abandon the villages, the vegetation “consumes” the territory that used to be cultivated [...] and the wild prey reclaim this territory. The more the landscape is depopulated, the more wildlife there will be and the more wolves there will be. [...]” (Biologist, A13).

In recent decades, there has also been a shift in how the landscapes of the study locations are valued by outsiders, from places of production to places of recreation. All three areas are experiencing increasing volumes of visitors, expanding from those arriving to visit resident family members or holiday homes to a diversity of tourist groups. Many are attracted by nature experiences, a trend that is projected to keep growing

(MAPAMA, 2017). This has caused friction over the purpose and use of nature and wildlife (GCG, 2018). Farmers and shepherds often felt misunderstood or judged by outsiders, for instance over their role in preserving the landscape:

“[...] this is a place a lot of tourist come to see. But why are there so many tourists here? Because people like to see the landscape, the look of it. [...] But without this [farming], it will disappear, the paths will disappear, the meadows will disappear. No one will “clean it” [from scrub].” (Shepherd and cheese maker, B5).

Another common theme concerned competition over land-use. This is particularly evident in the summer, when thousands of tourists cycle and hike through the traditional pastures. These trends are altering the space, habitat connectivity and resources available for wolves and people in each study site, with associated effects on local coexistence capacities, which is described with more detail in the following sections.

Location A: A Shift in the Coexistence State?

With regards to population persistence, the combination of regulated hunting and improved policies for nature protection have converted S-LC into a buffer zone for wolves. The area has one of the highest densities of wolves in Europe, which has remained stable around 16 packs since the late 1980s (Sáenz de Buruaga et al., 2015; JCyl., 2019b). It has also contributed to making the area famous as an exclusive hunting destination for wealthy outsiders, particularly for trophy hunting of red deer (*Cervus elaphus*) and wolf within the La Culebra reserve (Vicente et al., 2000; Martínez, 2019). Citing these factors, informants generally agreed that the conditions for long-term wolf persistence in S-LC were very favorable.

When the status of wolves changed to “game species” in 1970, the authority over wolf management was transferred from informal to formal institutions (Blanco and Cortés, 2009). This makes the regional government responsible for compensating damage to livestock within regional hunting reserves, such as La Culebra, while in the rest of northern Castile and León a specific insurance is required (JCyl., 2008, 2018). The regional government also manages the sale of hunting rights. Public auctions are organized and the funds redistributed to landowners on a yearly basis. These responsibilities have provided governing institutions with a clear management aim; to maintain stable wolf populations to enable and justify the continuous harvest of trophy specimens, which they have been effective in achieving since the 1980s (Blanco and Cortés, 2009; JCyl., 2018). According to local wolf experts, hunting has also been instrumental in retaining a sense among locals that wolves are being “controlled” and contributing to economic development, which has improved tolerance for their presence:

“Without hunting, the wolf wouldn’t be here. It would have been exterminated like in other sites. Thanks to the fact that it is a game species, and that it moves money they hate it less here. And there is no poaching. Because it generates money, anyone who wants to

poach a wolf here will be reported by their neighbors, because it deprives them of money [...] (Biologist, A13).

The pre-existing frameworks for monitoring and capitalizing on wolves have facilitated the emergence of tourism activities. There are now 12 wolf-watching businesses that completely or partly base their operations in the area, four of which have local offices (Lora Bavo and Villar Lama, 2020). In 2017, there was an estimated 3,100 visits, and almost half of the overnight stays in the La Culebra villages were attributed to wolves. To appeal to these tourists, various local businesses and producers have started using the wolf as a branding tool, visible as symbols, and names across the area. The burgeoning sector led some informants to perceive that wolf tourism had overtaken both agriculture and hunting in economic importance: “*So what is left to work with, as far as I can see as a mayor, and the government is supporting me in this, is tourism. They say [...] that not everyone can live off of tourism. But the tourism is helping us to not go under.*” (Mayor, A1).

Wolves were also widely believed to regulate the area’s ungulate populations, which were causing significant damage to agriculture: “*the wolf is needed to control all of the other fauna, the wild boar [Sus scrofa], they are invading us.*” (Mayor, A22). When local issues were discussed with informants, problems with ungulates were often mentioned before damage caused by wolves, which despite the high wolf density have remained comparatively low (JCyL., 2016). This has been possible because of local farmers’ and shepherds’ continued use of traditional protection measures (guardian dogs, shepherds and enclosures), which they described as the only way to avoid being ruined by depredation. Various shepherds and farmers emphasized that it is crucial to complement these measures with clearing scrub, not only to maintain pasture, but also to decrease hiding-places for predators (including wolves), and for guardian dogs to effectively survey livestock (see **Figure 4**). Although these measures are work and resource intensive, their effectiveness were widely acknowledged, since they have been validated and passed on from generation to generation. Farmers and shepherds often perceived them as an integral part of local animal husbandry, as expressed by an elderly shepherd: “*Here, it would never occur to anyone to let the sheep out alone*” (A23). A young farmer elaborated:

“7000 [euros] is what I have to spend on the dogs each year. For insurance and for food for the dogs [he had 21]. And if I wouldn’t have had to spend that on the dogs, that money would be for me, and I would live better. I could have done a lot with that money. So what happens? Well, if I notice that I can have a calmer life and calmer cows with some dogs, then I sacrifice myself.” (A15a)

Although opinions diverged over the acceptable size and impact of wolf populations, we encountered remarkably few expressions of fear or intolerance toward the presence of wolves among livestock owners or villagers. With the surge of pro-wolf agendas in Spain, this tolerance and the ability of S-LC’s farmers and shepherds to live alongside wolves is becoming increasingly admired and politicized (see **Supplementary Table 3**). One example is a young shepherd family who manage their flock with

18 guardian dogs, and who have launched their own “Grazing with Wolves” product brand (<http://www.pastandoconlobos.com/>). They are often featured in NGO campaigns or to demonstrate the viability of coexistence in newspapers and social media.

However, according to the area’s shepherds and farmers, their coexistence practices were not acknowledged in any practical sense and did not positively influence the value of their products. Conversely, local market initiatives, such as the wolf-brand, have struggled to gain local uptake and have been hampered by bureaucratic requirements for the agro-food industry, which largely fails to consider artisanal producers (Hinojosa et al., 2018). The narrow economic margins reported by informants meant that the relative costs of preventing and withstanding wolf damage were significant, yet support for preventative mechanisms is limited to the conflictive regions in the south of Castile and León, where the wolf is strictly protected (JCyL., 2018). In addition, the damage compensation scheme is slow (informants reported delays of up to 2 years), cumbersome and the amounts received are considered small, making it ineffective at reducing livelihood sensitivity to wolf predation. Similar issues were reported for the wolf insurance scheme: “*the cost of the insurance is more than the cost of those 5 or 6 sheep that you lose [per year].*” (Shepherd, A11). These problems lead to poor local uptake and often caused farmers to abstain from reporting damage, thus skewing the area’s damage statistics.

Nearly all informants expressed that they felt neglected or abandoned by the regional government, which was perceived as corrupt and disinterested in the concerns of small farms. There are few alternative livelihoods, and the resulting depopulation perpetuates the dismantling of social services and infrastructure in the region (MITECO JCyL., 2014). While tourism is increasing, it is concentrated on summers and holidays and for relatively few stakeholders, whose income is limited during the rest of the year. Informants therefore often had pessimistic views of the future, for their village in general, and the shepherd culture in particular: “*No no. This won’t continue. It won’t continue because there is very low profitability. And then it is quite a hard job. There are no weekends, no parties, no vacations.*” (Shepherd, A23).

“So the future, black. Because the people don’t have jobs. And the tourism, yes, but there needs to be incentives so that restaurants and hotels can survive with few people, because if there are no hotels and no restaurants, how will tourists generate money?” (Owner of a wolf-watching business, A4).

Location B: Lessons From 30 Years of Wolf-Related Disputes

In location B, informants described how the conservation and vigilance protocols for wolves, which were established in the eighties, had prevented the re-emergence of previous practices for “keeping wolves at bay.” These included hunting, traps, and poison, often conducted by specialist “vermin” hunters (Vielba Infante, 2018). The absence of these practices enabled wolves to recolonize the Asturian part of PENP, originating from

the southern slopes of the Cantabrian range (Cayuela, 2004; GPA., 2016). In 1992, 20 years after the first pack had become established, the population had expanded across the whole area of the park and into neighboring areas (Llaneza, 2017). With the current six family groups, local experts estimated that the population in PENP has reached ecological carrying capacity. The adjacent areas (Centro-oriental/PENP management zones) are also considered fully colonized. In 2019, the population was estimated at approximately 12 stable packs, including those within PENP (GPA., 2019).

Despite protests from conservation NGOs (Llaneza et al., 2016), the regional government has, since the eighties, implemented a program of wolf culling within delimited management zones where coexistence is deemed feasible, including within PENP (GPA., 2019). Even so, wolves have continued to expand toward the ocean and into areas that are considered unsuitable due to high densities of livestock and/or people. In these areas, culling is conducted whenever considered necessary, and in exceptional cases whole packs are removed (GPA., 2016). Civil servants deemed this approach necessary to address the accelerating levels of livestock damage and ensuing social upheaval since wolves returned: *“It is clear that if you have damages and you eliminate the wolf, the damages [to livestock] will decrease. We have a series of data that show that when you remove a significant amount of wolves, the damages decrease.”* (Civil servant, B2).

However, communities were not consulted about when and where controls were to take place. According to civil servants, restricted hunting methods and challenging conditions (see Figure 4) have also meant that established quotas were rarely fulfilled. This exasperated livestock owners, who overwhelmingly considered the regional government ineffective at realizing the promises of the wolf management plan and addressing the wolves that were causing damage. In addition to control, a damage compensation scheme has been operated since 1989 (García Hernández et al., 2019). In recent years some minor funds for guardian dogs and livestock fencing have also been provided (GPA., 2019), although evidence of the local efficacy of these methods is limited (Llaneza et al., 2016). Both schemes were generally perceived as ineffective by locals. Farmers and shepherds were unanimously dissatisfied with the bureaucratic and evidence burden of the compensation scheme, as well as how livestock was valued within them. The uptake of preventative methods was limited, since a variety of social and ecological factors were deemed to make them unfeasible:

“I don’t have any dogs. [...] The mastiffs are very defensive, and here there are a lot of tourists. And another factor is that this area is very steep, so there might be four goats over there and four over there. How many mastiffs can you have? Should you have 70 mastiffs in order to have one for each individual [goat]?!” (Shepherd and cheese maker, B5).

“With how mountainous and agrarian it is [in PENP], [...] the preventative methods will never be 100 % effective. [...] we have to keep in mind that they will not be a panacea.” (National wolf expert, B3).

Informants also reported that wolves had altered their hunting patterns, more frequently attacking during the day to access the “easy pickings” constituted by sheep and goats, thereby rendering night-time enclosure less viable as a solution. Increased attacks on cattle were also reported, particularly on young calves. Informants often attributed the continuing decline of free-range shepherd cultures and the increase of stabled animals in the valleys to the return of wolves, since people struggled to cope with the worry and trauma of finding one’s livestock injured and killed. The pastoral landscapes and artisanal cheese making are emblems of the area and crucial for local economies, identities and cultural heritage (Izquierdo and Barrena, 2006; González-Álvarez, 2015). Among locals, it represented the toil of previous generations, and preserving its beauty and function was considered vital. Damage to the livestock sector was therefore a major concern among informants across different groups. While conservationists and some civil servants emphasized the symbolic and ecological importance of harboring a flagship species such as the wolf in PENP, efforts to gain local support for wolf presence have generally been unsuccessful. Anti-wolf groups and discourses are still prevalent in the social and public media, and protests tend to reignite as soon as there is a surge in livestock damage (Llaneza et al., 2016). However, after over 30 years of entrenched disputes, informants described an emerging pragmatism, chiefly among locally based stakeholders:

“For the farmers, there have been years and years of pressure and threats [...]. And then they get tired. [...] They have noticed that society would not allow it, they would not accept zero wolves. That is a part of it. So now, when the farmers come here, you can talk to them without a problem. That before was very hard. [...] the conservationists too. And they notice, I think, [...] that they have been fighting for many years against the killing of wolves, especially when many have been killed, but they see that the wolves are still there, even increasing.” (Civil servant, B2).

“People nowadays are less fanatic. Both the conservation sector and the farmers [...] It would be very rare for you to find a farmer that will talk about extinguishing the wolf. Maybe they will say that in this particular area it is incompatible, but not about general extinction.” (Farmer and sector representative, B1).

Some initiatives are exploring new ways of improving local coexistence capacities, independent of public institutions. An interesting model is provided by a NGO for the preservation of the bearded vulture (*Gypaetus barbatus*; Fundación Quebrantahuesos., 2020). They are vulnerable to the use of poison and certain livestock medication (such as diclofenac), which they ingest when feeding on livestock carcasses. These properties link the vultures with the fate of both wolves and shepherds, leading the NGO to launch a “Pro-biodiversity” certification for producers of lamb. Improving coexistence with local fauna, including wolves, is one of the main criteria for inclusion, although it is not prescriptive about which methods should be used. The certification, which is free of charge, provides shepherds with a price premium for their products, in addition to publicized recognition of the environmental benefits of their labor. The project won the EU Natura 2000

award within the “socio-economic benefits” category in 2020 (European Comission., 2020), and after some initial apprehension there is now a waiting-list to join the scheme (Fundación Quebrantahuesos., 2020). A shepherd who was incorporated from the start was content with the needs-based approach of the project managers:

“They are the only foundation that has come here, gotten out of their car, and asked us what could be done. He did. And we are very satisfied. [...] And they pay us well. I mean, it is a reasonable price, not like before, and it is all on paper, signed. So then you can work in a different way. If you know that you have a goal that you need to fulfill, it is much easier to work. You know that someone will buy it, you know which day and how much you will get paid. You know it all.” (Shepherd, B26).

This project, in addition to the profitable artisanal cheese industry and the comparatively strong farming culture of the area, contributed to more optimistic views about the future of traditional farming than in location A and C. However, attacks on livestock and the associated trauma remain a challenge, notwithstanding the decreased economic severity on shepherds’ and cheese-makers’ livelihoods. Thus, when asked for their advice to areas where wolves may return, two civil servants who have worked throughout the process emphasized:

“The most important thing is to take those affected into account. Farmers, hunters, local councils. And with them achieve a “closer” [place-based] management. [...] They have to be part of the solution.” (B31).

“To sum up: I think that you have to protect the traditional activities that still remain, the few flocks that still remain, because they also have biodiversity function that is very important [...]. So we have to have a bit of everything, actions of mitigation, money [compensation], and, once in a while, some population controls of course.” (B2).

Location C: The Wolf, a Friend or a Foe for the Area’s Goat Sector?

Due to their critically endangered status, the regional government is required to facilitate the process of wolf recovery in Extremadura, with the aim of restoring self-sustaining populations (JuntaEx, 2014). Ecological conditions for wolves in La Vera were deemed favorable by local civil servants; human population density is relatively low (27 habitants/km² in 2017), there are abundant ungulate populations and increasing expanses of woodlands. Except for wolf mortality in the north of Gredos, due to culling and reprisal killings (JCyl., 2019a), no physical or legal barriers prevent wolves from recolonizing the area. Some informants claimed it had already occurred (there were rumors of wolves roaming the uplands), while others believed it could be delayed by up to 10 years.

According to a stakeholder within the regional government, plans for wolf return have been made, including programs for locally based community workers, vets, and field staff, as well as economic support for general farm improvements for those residing in wolf areas (ex-post payments). There were also plans

for ecological monitoring schemes before and after wolf return, in order to improve data on trophic impacts of wolves on local ungulate and mesopredator populations, and associated benefits to people (JuntaEx, 2014). The plans are partly modeled on reintroduction programs in which some of the project staff have been involved: the Iberian lynx reintroduction project in the south of the region (<http://www.iberlynx.eu/>), and the Iberá rewilding project in Argentina (Zamboni et al., 2017), both of which have had some success at decreasing local vulnerabilities and increasing support for species recovery (Jiménez et al., 2019; Petterson and de Carvalho, 2020).

However, the government has not communicated these intentions and has been critiqued for its failure to produce and publish a species recovery plan, which is a legal requirement for critically endangered species (Fernández Marugán, 2020). Local informants generally believed that preparation for wolf return was completely absent, and worried about the resulting proliferation of disinformation and social disputes:

“If we don’t start talking about the wolf now, there are going to be big killings [of livestock and wolves]. And problems between neighbors, problems between people. Because there are people who are against and people in favor. But there are also people who are afraid and who don’t know whether to be in favor or against.” (Local civil servant, C3).

In order to mitigate polarization, informants called for transparency and for local consultation with those susceptible to negative wolf impacts, mainly the local livestock sector. Informants within this group expressed the most apprehension toward imminent recolonization. Elderly shepherds who still remembered co-habitation agreed that the disappearance of wolves greatly facilitated livestock practices, and preferred maintaining this status quo: *“People could relax, it was marvelous! It was like they had imprisoned one of those who does a lot of robberies.”* (Retired shepherd, C6).

The absence of wolves did not prevent the demise of the farming sector, however. A major driver has been the regional government’s tuberculosis eradication program, which mandates killing or immobilization when cases are detected in herds (Majadas Andray, 2020). It drastically increased farmers’ vulnerability, and the uncertainty over its efficacy to curtail the disease caused widespread distrust in the regional government. It has also increased friction between farming and game managers, since game are vectors of the disease, while only livestock are subject to sanitary controls. This has led some stakeholders, including livestock owners, to ponder alternative solutions and the role of the wolf in regulating ungulate populations, notwithstanding the limited evidence of this relationship: *“[...] the only way is the wolf, that they come back. So that it [the boar population] goes down.”* (Shepherd, C26).

“But you know what, in Asturias and such they don’t have tuberculosis, but they have the wolf. And of course, it has removed all of the game. [...] So in the groups [of livestock owners], among us, we have talked about it. We said “what do we want, the wolf or tuberculosis?” Because for the wolf I have management approaches, but against tuberculosis...“ (Shepherd, C17).

The management approaches referred to were the use of guardian dogs and night-time enclosures, which several of the shepherds had maintained, albeit to a lesser extent, to protect flocks from mesopredators and to facilitate milking. Among farmers, whose cattle often roam in the mountains with minimal supervision throughout the summer (see Figure 4), these measures were generally not perceived as feasible.

Notwithstanding the uncertain benefits and the potentially adverse impacts of wolf return, none of the shepherds or farmers expressed strong views against the animal itself. It was generally agreed that they had to exist, although often with caveats such as “but not here,” “behind fences,” or “strictly controlled.” These views may be driven by changing values and a similar pragmatism as that of location B, as exemplified by a recent newspaper article: *“That’s the way it is, society is going this way [toward wolf tolerance], and you have to adapt [...] in my opinion it is best to be aware and follow where the tide is going because going against it is not going to be possible”* (Shepherd, interviewed by Arrebola, 2021). Their main concern was usually related to how the species would be governed. This stemmed from negative experiences of top-down conservation legislation over recent decades, which they felt had limited their autonomy and ability to address the problems they faced on a daily basis (such as regeneration of scrub). Reticence toward conservation projects and legislation was prevalent, since the government failed to provide effective alternative tools, and since local participation in related decision-making was limited.

However, since the livestock sector continues to decline, a common perception was that its resistance was less of an impediment to wolf recolonization and coexistence than that of the hunting sector, which has increased in political and economic influence with the increasing demand for big game (San Miguel et al., 2017). Game managers expressed worry at the prospect of wolf return, particularly with regards to ibex, which attracts wealthy hunters from across the country and the world. Prices for old males (which have larger horns) can exceed 10,000 euros at auctions, money that would be lost in the case of wolf attacks:

“economically, it will be us who are affected [...]. With the wolf, in the Ávila area 3 years ago, we noticed the expansion from north to south toward this area. And honestly, over there it has done a lot of damage. [...]. Because the wolf has killed the old animals, especially the old ones. And the problem with killing old animals is that they are the ones that are worth the most money.” (Manager of hunting association, C9).

Among village residents, trophy hunting often invoked negative emotions, and damage to the sector was not viewed with the same concern as those in the livestock sector. This is probably a legacy of deep-rooted connections to traditional landscapes and cultures, which in La Vera (as in the other study areas) form part of local identities (Urivelarrea and Beaufoy, 2019), whereas trophy hunting is attributed to foreign upper classes. However, shifting livelihoods are leading to a gradual decoupling of people’s lifestyles from the landscape: *“No matter how much they live in a village, they are increasingly urbanized”* (Village resident, C16). Many of those who own land in the mountains

live remotely, leasing to farmers or game managers, or leaving it in abeyance. These trends caused weaker cohesion among land managers and confusion over management responsibilities, e.g., who should clear shrub and where. Arson, which was driven by tensions between uses and the need to regenerate pastures, fed into this cycle and increased the prevalence of wildfires: *“So that abandonment, if we look at it in the short and medium term, is very worrying. Because quite immediately it is followed by fires. But are these fires because they are the natural dynamics of abandoned spaces or it is because tensions persist in that transition? I think it is more because of tensions.”* (Regional agro-ecology expert, C11).

Fire prevention constitutes a significant economic burden for the region, leading to calls for a recovery of traditional grazing practices among locals and organizations (Urivelarrea and Beaufoy, 2019; Majadas Andray, 2020). The calls cite a scheme which has proven effective in other parts of the country: the provision of commons and municipal infrastructure for shepherds, to use for minimum expense in return for environmental services (Lasanta et al., 2018; Sánchez-Mesa Martínez, 2019). One such initiative is currently being considered in one of the study municipalities, and could be instrumental in improving conditions for local shepherds. The success of this program (i.e., more goats in the mountains) could increase the risk of damage and disputes once wolves return.

DISCUSSION

Viewing our findings through the Resilient Coexistence Framework illustrates the complexity of local HCRs, and their contingency on wider SES processes. In the following section, we argue for proactive and participatory approaches to increase community capacity and willingness to coexist with large carnivores, and discuss the importance of reconciling the preservation of biological and cultural diversity.

A Systems Perspective of the Conditions of Human–Wolf Coexistence

Tracing the process of Iberian wolf expansion through our study sites, it was clear that they could adapt and flourish in habitats of varying human population density and resource availability, from the mountains of Asturias to the plains of Castile and León. Given their behavioral plasticity and dietary flexibility, wolves could probably recolonize most of rural Spain, as long as they are not hindered by people (Blanco and Cortés, 2009). This was exemplified by the increasing levels of human–wolf interactions and “bold” behavior in the vicinity of the study villages, due to decreasing buffer zones and intensity of human persecution. This phenomenon is supported by earlier findings from a nearby region of Asturias (García Hernández et al., 2019) and has been described for other large carnivores elsewhere (Ghosal et al., 2015). In conjunction with supporting conservation frameworks (Cretois et al., 2019), this points to a promising future for the persistence of self-sustaining wolf populations in Spain. As concluded by Mech (2017, p. 314), wolves *“could live almost anywhere. The real question society must face is where will people tolerate them?”*

With regards to people, the systems perspective adopted for this research revealed a more complex picture of coexistence. In our study locations, it was important to distinguish between the tolerance of wolf presence and the tolerance of wolf governance, which had different roles in driving positive or negative synergies between coexistence conditions. In location A, the continuous presence of wolves led people to think of them as an integrated part of the local system. This facilitated adaptation and an uninterrupted evolution of informal coexistence institutions, for instance visible in how livestock owners have continuously adjusted the number of guardian dogs, the relatively nuanced media coverage of wolves from the region (Delibes-mateos, 2020), and in the wolf-branding of local products to follow social trends (Martínez, 2019). The wolf was integrated, not only as a part of the economic, social and ecological system, but also in the story of S-LC (i.e., “lands of the wolf”), thus legitimizing coexistence as a way of life (Martínez, 2019). This could explain the relatively harmonious coexistence state over the last 20 years, despite its challenges and despite failing support from and for governing institutions. Similar findings were made by Dorresteijn et al. (2014) in Romania, where continuous coexistence with bears fostered the development of management tools and attitudes that effectively reduced conflicts.

Where these habits and institutions are absent, and where there are risks to carnivores and human interests, formal institutions have a crucial role to ensure that the process and outcomes of carnivore return are acceptable to local communities (Decker et al., 2016; Linnell and Cretois, 2018). Our findings from location B indicated that the failure to achieve procedural or outcome legitimacy for conservation agendas had been a major driver of wolf-related disputes in the area. Distrust in governing bodies was ubiquitous, and there were few opportunities for participation in decision-making processes. The regional government struggled to balance the preservation of natural and cultural elements of the area, also before wolves returned, which was illustrated by the continuing decline of traditional shepherd cultures within PENP (Izquierdo and Barrena, 2006; López and Pardo, 2018). This resulted in nature conservation and the survival of traditional cultures becoming framed as incompatible policy choices, by locals and in the media, and the wolf has come to embody the former. This contributed to the rejection of wolves and refusal to adapt, since the traditional land-use systems were important for local economies and identities (González-Álvarez, 2015). This fear of “losing the landscape,” and its links to large carnivores, has been observed elsewhere, for instance India, Sweden, and Norway (Ghosal et al., 2015; von Essen and Allen, 2018). A shared finding between these cases was the perception that traditional management is becoming impossible due to the increasingly hegemonic position of the wilderness ethos (promoting protection over production) within public opinion and policymaking. A contributing factor in location B may be the lack of tangible benefits of wolves for locals. In contrast to location A, the topography and controversial status of wolves have deterred wolf-watching businesses, ungulate overpopulation was not among the major local concerns, and there were no incomes from hunting wolves. If effective coexistence programs are not established by the regional government within the

near future, the same problems could emerge in location C, since many of the same risk elements are present: unprotected livestock, cultural importance of traditional land-use systems and distrust in governing institutions (Majadas Andray, 2020).

We contend that considerations of vulnerability and relationships to the land are imperative to understand how governance can be improved and coexistence capacity increased. Consulting locals about these factors could elucidate barriers or risks to coexistence, for instance economic precarity, and the synergies between wolves, local livelihoods, identities, and wider trends (Salvatori et al., 2021). Our findings indicate that this perspective has hitherto been missing or hampered by institutional silos in both location A and B’s conservation programs. Their approaches to maintain or increase coexistence have primarily centered on ex-post payment schemes, established under the assumption that they would decrease farmers’ sensitivity to and intolerance of carnivore depredation. As we have shown, and as found elsewhere (Ravenelle and Nyhus, 2017; Marino et al., 2018), these schemes have not been effective in either of these regards. Conversely, they have exacerbated distrust of the national and regional governments and official statistics, since validation and payments are slow, cumbersome and underfunded (GCG, 2018).

The other prominent approach was to decrease exposure between livestock and wolves. The focus had been lethal control of wolves and support for a predefined set of preventative mechanisms, which was also associated to resilience issues. Some form of lethal control was strongly supported among local livestock owners and civil servants. It has been acknowledged as a necessary element of European large carnivore management, to address bold individuals that evade preventative mechanisms (Linnell and Cretois, 2018). However, locals felt that current programs failed to target the right wolves at the right time. Furthermore, both hunting and lethal control is controversial among the wider public and increasingly generate backlash and legal procedures against the regional governments (Bruskotter et al., 2017), which has been recurrent in location A and B (Blanco, 2017; Camazón, 2020). Consistent with findings in other countries (e.g., Niedzialkowski et al., 2021), pressure to expand the protected status of carnivores across Spain has mounted over the last decade (Blanco, 2017). The national government recently tabled a proposal for a complete ban on wolf hunting (MITECO, 2020), which would alter coexistence conditions in the northwest of the country. While non-lethal mechanisms have proved effective in location A, wider application, research, and innovation (for instance technological solutions) are needed to illustrate their viability under conditions such as those in location B (Eklund et al., 2017; GCG, 2018). For instance, a study from the Alps, which have similar conditions (abrupt topography, small and scattered flocks, and high tourists numbers), showed that damage continued to increase despite widespread implementation of guardian dogs and enclosures, since wolves had adapted their hunting patterns (Meuret et al., 2021). There was also weak support for these measures among cattle farmers, such as those in location B and C, since they would imply drastic changes in husbandry regimes.

A major problem with both these approaches has been their narrow focus on livestock damage and their limited effectiveness at increasing adaptive capacities in our study locations, whether to prepare for or maintain coexistence. For instance, shepherding and guardian dogs come at a significant sacrifice of time and resources for shepherds and farmers in location A, which in addition to depopulation and market globalization, decrease their economic margins and exacerbate their sensitivity to shocks. The failure to incentivize coexistence practices, for instance by subsidizing dog food and insurance, has contributed to the present situation in which the most wolf-compatible farming cultures are increasingly pushed toward intensification or abandonment (Chemnitz et al., 2019). As shown by Madden and McQuinn (2014), the resulting threat to local identities risks antagonizing local communities and fuels the narrative of the wolf as incompatible with farming. In addition to the loss of cultural heritage, the disappearance of S-LC's shepherds could undermine both the outcome and pragmatic legitimacy for coexistence, in location A and elsewhere, since they have become emblematic for their successful coping mechanisms. Location A also illustrates that the mutual adaptation on which resilient coexistence depends extends beyond protecting wolves and livestock. As shown elsewhere (e.g., Petterson and de Carvalho, 2020; Rode et al., 2021), the whole range of these interconnections between wildlife, ecosystem dynamics, and human communities must be taken into account to gain, explain, and maintain legitimacy and coexistence capacity.

Place-Based Approaches to Prepare for Carnivore Comeback

Community adaptation to returning large carnivores should not be pursued in isolation, since it represents just one of many social, political, and ecological challenges for rural communities. Creating enabling environments for coexistence between humans and large carnivores should form part of a broader agenda to improve adaptive capacities and good governance in the light of these challenges (Darnhofer et al., 2010; Whitehouse, 2015). The associated imperative to create partnerships and bridge academic and governance silos could revitalize environmental governance, making it transformative rather than palliative (Redford and Sanjayan, 2003; Hartel et al., 2019).

Reconciling the preservation of carnivores and high nature-value farming systems, and being transparent about how and on which scale it is to be achieved (national or regional, within and/or outside protected areas), will be essential to mediate disputes and achieve just and sustainable conservation solutions (Pretty et al., 2010; Gavin et al., 2018). In our study locations, this approach could contribute to repairing the social license to operate of governing institutions (Jepson, 2005). If combined with effective communication efforts, it could also be an important element of people-people reconciliation, i.e., deliberative exchange and enhanced understanding between different social groups and worldviews (Treves et al., 2017; von Essen and Allen, 2019). Promising examples from our research include interpretation centers that jointly display the natural and cultural heritage of the region, such as that of the Iberian

wolf center in Sanabria (<https://centrodellollobo.es/>), shepherds welcoming visitors into the traditional cottages and caves to learn about local cultures and products (i.e., <https://quesosdecabral.es/>), and a participatory multi-stakeholder think-tank where wolf-policy recommendations are debated and promoted (GCG, 2018). Such initiatives can contribute to decreased polarization over wolves in traditional landscapes, and prevent behaviors that increase the risk of wolf attacks (Penteriani et al., 2016) or cause friction between locals and visitors.

Other projects lead the way to more proactive coexistence approaches through their work with rural problems. The Pro-biodiversity certification in location B illustrates that when the drivers of local vulnerability (e.g., low product yield and profitability) are understood and addressed, it can enable institutions to transform disadvantages into coexistence preconditions (i.e., exclusive, environmentally beneficial products with associated recognition, and economic return for producers) (Mathie and Cunningham, 2003). Similarly in location C, plans for ex-ante payments within wolf areas, and the provision of municipal shepherd infrastructure, have the potential to reverse negative trends within the traditional sector, addressing its inherent issues with dignity, security, and profitability (Lasanta et al., 2018). Rather than being prescriptive and retrograde, "custody of the territory" and ex-ante schemes enable stakeholders to seek inspiration from traditional knowledge and practices, while retaining flexibility to adapt to current societal, technological, and land-use trajectories (Fuentes et al., 2011; Persson et al., 2015). When realized under the banner of coexistence, the projects could render large carnivores a positive force for change in traditional landscapes, where the loss of biological and cultural diversity often share drivers, e.g., wildfires or ungulate overpopulation (Henle et al., 2008; Pretty et al., 2010; Varga, 2020). Gaining local legitimacy for compensation performance schemes would benefit greatly from the presence of positive demonstration places and projects, which illustrate that functioning HCR's are possible. It is therefore imperative to ensure livelihood resilience and acknowledge existing coexistence areas such as location A, so that they can remain a source of hope and inspiration for recolonization areas (Bennett et al., 2015; Pound, 2015).

Addressing conflicting needs and value framings with limited space and funding will remain a continuous challenge. This could become evident in location C, where programs to improve coexistence between shepherds and wolves may be unpopular with the hunting sector. Similarly, within certification schemes, the inclusion of some usually implies the exclusion of others, and since they are based on exclusivity, they cannot exceed certain quantities of output without reducing prices. These issues may never be fully resolved, and compromises will require an active dialogue about societal priorities, in addition to transparent decision-making, to ensure procedural as well as distributional justice of large carnivore governance (Bennett et al., 2019; Salvatori et al., 2021). As emphasized by Redpath et al. (2013), the co-occurrence of conservation and livelihood preservation depends to a large extent on the willingness of parties to acknowledge and discuss shared problems, stresses and uncertainties, and address them collaboratively.

Reflections on the Coexistence Approach and Future Research Directions

Elucidating conditions that permit large carnivores to survive and reclaim territory, and that enable people to adapt, is vital to aid decision-makers in ensuring resilient coexistence in the face of global change (Carter and Linnell, 2016; Pooley et al., 2020). The combination of a coexistence lens with the proposed theoretical framework proved useful in expanding knowledge of how we can explain and support adaptive capacities. By focusing on coexistence and its underlying drivers, rather than conflict, and using the framework to explore relevant interconnections, we could illuminate positive factors and drivers that otherwise risk being overlooked, since harmonious relationships generate less attention and resources than dysfunctional ones (Fernández-Gil et al., 2016; Pooley et al., 2017). The framework also enabled us to understand past issues and failures within their wider social-ecological context, and to identify trends that may alter current HCR for better or worse. It is thereby useful as a heuristic tool for descriptive analysis of both states and pathways to coexistence. This knowledge can be used to generate future scenarios based on local conditions, and help articulate the transformations needed to progress toward them (Bennett et al., 2015).

However, thinking of HCR as a complex adaptive system means that the approach requires and yields intricate and large quantities of data. It is important that the user(s) have good connections to the location under analysis, in order to select and correctly interpret the factors that are most relevant to local coexistence capacity. We therefore encourage the use of the framework by inter- and trans-disciplinary working groups (see Hartel et al., 2019), or to apply it in iterative processes with community groups to co-produce knowledge and ensure the validity of the research outcomes. For instance, it could be useful to support focus groups and scenario workshops within participatory action research (see Milich et al., 2020).

More empirical studies of the social and ecological impacts of large carnivore (re)colonization, the local viability of different preventative mechanisms, and of the various functioning institutions that are already in place (including novel and traditional, participatory or top down) are needed. Building this evidence-base is essential to corroborate and validate the increasingly contested theory and rationale of large carnivore restoration and reintroduction (Treves et al., 2017; van Eeden et al., 2018). This knowledge is also needed to expand large carnivore discourse and policy beyond its current focus on the past (both practices and states of nature), to more flexible and inclusive models for the future. Lastly, continued research on how to achieve equitable representation and knowledge co-production in participatory processes are needed to ensure legitimate outcomes. For instance, on who and how to represent the rights of wildlife, and how to avoid “tyranny of the majority” while adhering to the legitimate concerns of non-local people regarding the intrinsic values of nature and the use public goods (Lockwood, 2010; López-bao et al., 2017).

CONCLUSIONS

In a time where environmental agendas are being advanced to address the climate change and biodiversity crisis, it is crucial to establish just and effective methods of working with rural communities (Salvatori et al., 2021). We contend that facilitating coexistence with large carnivores in traditional pastoral landscapes can be symbolic of a wider pursuit to achieve sustainable and legitimate conservation governance and rural development programs. Given the continued expansion of large carnivores across Europe (Chapron et al., 2014; Cimatti et al., 2021), more inclusive and innovative approaches are needed to manage these species across human-induced borders, learn about local barriers and opportunities to coexistence, and how to (re)distribute resources to ensure that co-adaptation is possible. Existing knowledge, institutions, and projects that could shorten the transition period for coexistence abound, but more effective methods to identify, learn from, and support them are needed (Bennett et al., 2015; Hovardas et al., 2017). This requires reconfigured relationships and knowledge exchange between urban and rural stakeholders (including policy-makers, scientists, locals, and NGOs) to achieve productive dialogues and reconcile the many needs and priorities for the countryside in the future. Ultimately, the aim of conservation policy is not limited to saving contested species, but about fostering harmonious relationships between humans and the other species that inhabit this planet (Adams, 2015).

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available. In order to protect the anonymity of study participants according to the terms of our ethics approval, we cannot share the raw data, which may contain identifiable information. Requests to access the datasets should be directed to Hanna L. Petterson, eehlp@leeds.ac.uk.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Research Ethics Committee at the University of Leeds AREA 19-018. The patients/participants provided their written or oral informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

HP was responsible for conception, study design, data collection, data analysis, drafting of manuscript, and visualization. JL-B contributed wolf expansion data and input on relevant study sites. All authors assisted in review and editing of the manuscript and approved of the final version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fcosc.2021.710218/full#supplementary-material>

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Coexistence and Culture: Understanding Human Diversity and Tolerance in Human-Elephant Interactions

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There is a growing recognition of the importance of conservation beyond protected areas, in spaces of human-wildlife coexistence. Negative human-wildlife interactions are a key challenge, but a better understanding of the forms of tolerance and mutual accommodation would be useful for coadaptation toward coexistence. To date, however, studies of human-wildlife often have been limited by a largely quantified positivist epistemology, which elides the diverse cultural and ecological contexts which enable tolerance and coexistence between humans and wildlife to develop and adhere. In Gudalur, a plantation landscape in South India, about 150 elephants share space with a quarter of a million people. Using a quantified survey coupled with ethnographic fieldwork, we aim to better understand human diversity and tolerance of elephants that allows for coexistence. We find a marked difference between communities, with ethnicity being a better predictor of tolerance than the more tangible socio-economic or geographic variables such as income, education, land holding or cropping patterns. Using qualitative data, we identify three socio-cultural variables that are relevant to tolerance—a shared history of living with elephants, mode of subsistence and type of agricultural crops, and most importantly, ontology or the fundamental understanding of “what is an elephant?” Hunter-gatherer conceptualisations of elephants as “other-than-human persons” prove to be the ontological stance best suited to coexistence, as it allows for elephant individuality and interpersonal negotiations of shared space, which is limited in other world-views, including the worshiping of elephants as Ganesha, the elephant headed deity in the Hindu Pantheon. Having identified some important differences among ethnic communities in human-elephant interactions, we consider the implications of the research for improving the management and practice of human-wildlife coexistence not only in the Nilgiri region but within the broader context of conservation and development.

Keywords: human-elephant interactions, Asian elephant, *Elephas maximus*, tolerance, indigenous worldviews, human-elephant conflict, human-wildlife conflict, Nilgiri Biosphere Reserve

INTRODUCTION

Protected areas (PAs) have formed the backbone of nature conservation, but there is a growing move to look beyond the PAs, taking larger landscape level approaches that incorporate multiple land use types and integrate the needs of wildlife and people (e.g., Jonas et al., 2014; Moola and Roth, 2019). This is particularly relevant for large mammals whose home ranges do not correspond with or are often larger than the designated reserves (Douglas-Hamilton et al., 2005). In a country like India, home to two-thirds of the world's Asian elephants (*Elephas maximus* L.) and tigers (*Panthera tigris* L.), sharing space with 1.4 billion people at a relatively high density of over 400 people/km² (Mathur and Sinha, 2008), coexistence with wildlife is vital. The major challenge with people and large wild animals sharing space is potential human-wildlife conflict (HWC) since they purportedly all competed for space and resources (Pimm et al., 1995). There has been a deluge of literature on the subject, particularly since 2003 when it was formally defined at the Fifth IUCN World Parks Congress in Durban, South Africa. HWC in this early definition was primarily about the negative impact people and wildlife had on each other since there was an inherent competition for space and resources, but the term has since been criticized as these negative impacts do not constitute "conflict" in the dictionary sense of the term with people and wildlife as conscious antagonists (Peterson et al., 2010). The majority of studies tagged with HWC refer to conflict between different groups of people with differing opinions about conservation, termed "conservation conflict" (Redpath et al., 2015). Despite this problematic framing of HWC, the literature continues to grow; there are over 59,000 journal articles with "human-wildlife conflict" as a key phrase as of 2021, growing at about five papers a week¹. This burgeoning literature is largely comprised of case studies from different parts of the world, documenting instances of HWC and the negative impacts on either wildlife or people, often attempting to quantify the economic, ecological and sometimes the social damage caused by these negative interactions.

Discussions around coexistence are relatively recent, described as "a sustainable though dynamic state, where humans and wildlife co-adapt to sharing landscapes and human interactions with wildlife are effectively governed to ensure wildlife populations persist in socially legitimate ways that ensure tolerable risk levels" (Pooley et al., 2021). What consists of "tolerable risk levels," is one of the more significant themes to emerge in the current literature; the variety of attitudes and orientations that people hold toward wildlife—which can be measured and quantified to better understand their perceptions of conflict, and to better understand tolerance to wildlife in their environs or livelihood space (Lute et al., 2016; Wilbur et al., 2018). Some of the most cited articles suggest that the likelihood of retaliatory killing is not related to the economic and financial loss the wild animals caused, but more to other social beliefs and peer group norms (Dickman, 2010; Treves and Bruskotter, 2014; Gangaas et al., 2015), including such things as spiritual beliefs

and religious group affiliation (Hazzah et al., 2009). How tolerant people are to HWC, findings suggest, depends more on their cultural constructions of coexistence with specific animals than their calculus of the economic costs or benefits of coexistence (Kansky and Knight, 2014) and people's beliefs about wildlife population trends, behavior and ecology takes priority over their real interactions with the animals and the damage they cause (Inskip et al., 2016).

The human dimension of HWC (e.g., Manfredo and Dayer, 2004; Dickman, 2010; Young et al., 2010; Redpath et al., 2013) is a significant part of the literature, and the focus is on better understanding the range of variables that correlate with tolerance as a basis for the development of human-wildlife coexistence. If the capacity for tolerance and mutual accommodation is lacking, the requisite conditions for coexistence, including coadaptation, often fail to develop or adhere. Tolerance itself is not instinctual, but rather a learned behavior in both human and wildlife populations, and thus rife with historical and of-the-moment contingencies, perceptions, and options for engagement. Understanding the complexity that informs tolerance and its relationship to HWC and coexistence thus necessitates a better understanding of the complex sociocultural and ecological contexts that inform human-wildlife interactions.

What is often missing from the present HWC narratives and debates, however, is precisely this deeper engagement with diverse cultures and ecologies from other disciplinary perspectives, particularly the critical social sciences. Anthropologists, for example, have been critical of the discourse on HWC being dominated by the natural sciences (Nelson, 1995; Knight, 2000). The existing literature on HWC or tolerance seldom adopts an ethnographic or non-Western cultural perspective and fails to delve deeper into human-wildlife interactions beyond a set of quantified variables. Yet, focused ethnographic studies on HWC provide deeper insights on what it means to coexist and 'live with' animals from indigenous cultural perspectives and lifeways, typically evolved *in situ* and *in vivo* with said animals over centuries if not millennia (Nelson, 1995). This is particularly relevant for the coexistence of humans and elephants, where elephants are often thought of as other-than-human persons (Ingold, 2000), especially so in South Asia with a long history of human-elephant entanglement (Locke, 2013, 2017).

It is this ethnographic gap in the literature and methodology of HWC studies that we seek to address here, to understand tolerance of elephants that allows for coexistence. We pose the question—*How are people differently tolerant to elephants around them, and what are the underlying cultural factors that affect this tolerance and facilitate coexistence?* To answer this question, we use a mix of quantitative and qualitative methods. First we conduct a broad scale assessment of the level of tolerance to elephants and how this varies between different ethnic communities, using a detailed questionnaire survey. Second, we deploy an ethnographic approach of participant observation and conflict tracking to delve deeper into the idea of tolerance and what allows some communities to avoid HWC and coexist more peacefully with elephants than others. In particular we focus on diverse cultural beliefs about elephants and how these inform

¹Based on a search in the database Scopus in March 2021.

TABLE 1 | Summary of ethnic communities.

Ethnic/stakeholder groups	Indigenous	Scheduled tribe	Subsistence mode/occupation	Legal land owners	Interaction with elephants	Approx. population
Forest department/conservation NGOs	No	No	Government employment/salaried and temporary residence or non-resident in the Nilgiris	n/a	High	n/a
Kattunayakan	Yes	Yes	Traditionally Hunter-Gatherer (HG) and now occupied in wage labor, but still most forest dependent of all the tribes.	No	High	<1%
Bettakurumba	Yes	Yes	Traditionally HG, now also occupied in wage labor, with a number of them working for the forest department, particularly as <i>mahouts</i> .	No	High	1%
Paniya	Yes	Yes	Also traditionally HG, but now mostly occupied in wage labor	No	Moderate	6%
Mullukurumba	Yes	Yes	Settled agriculturalists (SA), with a significant number of them currently employed in Government jobs.	Yes	Low	<1%
Chettys	Yes	No	SA, now also involved in small local businesses	Yes	Moderate	10%
Early Planters	No, 1900's onwards	No	Tea/Coffee plantation owners and workers, again with younger generation mostly in other parts of the country/world.	Yes	High	30%
Malayalis	No, arrived 1940's onwards	No	Agriculturalists, though mostly growing cash crops, with the educated younger generation moving to urban centers.	No	Low	17%
Sri Lankan Tamils	No, 1980's onwards	No	Wage laborers and small-scale cash crop farmers	No	Moderate	35%

communities' responses to elephants. This approach helps us to identify cultural drivers of human-elephant coexistence.

METHODOLOGY

Study Region and Its People

The quantitative surveys were carried out in a small study site of about 10 km², immediately south of Mudumalai Tiger Reserve (MTR) in Tamilnadu, India, to (a) ensure as much uniformity as possible in terms of the nature of human-elephant interactions, and (b) minimize unidentified confounding variable that may affect tolerance. The villages within 500 m of the southern edge of MTR were chosen using a GIS software (QGIS v2.0), from 76.530°E, 11.533°N to 76.465°E, 11.577°N. Out of a total of nine communities who reside in the region (Table 1), the smaller subset of study area we sampled included communities from five different ethnic backgrounds and histories. A total of 20 semi-structured interviews were conducted with key informants—members of the communities who were considered elders or leaders—to understand the background and context. These interviews provided insights into the frequency and nature of human-elephant interactions as well as some overarching perceptions around the seriousness of the problem. These preliminary results were used to formulate a questionnaire, described below.

The qualitative work was carried out in the wider region including the entire Gudalur Forest Division south of the Mudumalai Tiger Reserve (MTR), and adjacent human-modified areas covering about 580 km². Gudalur is surrounded by a

network of protected areas comprising parts of the 5,500 km² Nilgiri Biosphere Reserve (NBR), declared by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in 1986. The biosphere forms part of the Western Ghats-Sri Lanka biodiversity hotspot, the 8th hottest hotspot in the world (Myers et al., 2000) and home to numerous endemic and endangered species, leading to its recognition as a UNESCO World Heritage Site in 2012. This landscape holds the largest Asian Elephant (*Elephas maximus*) and tiger (*Panthera tigris*) populations in the world (Johnsingh et al., 2008).

The people inhabiting the region have also been the subject of numerous anthropological studies, with Hockings (2008, p. 2) claiming that it "would be no exaggeration to assert that the Nilgiris district has been more closely and thoroughly studied by more anthropologists, throughout the entire history of their discipline, than has any other district in Southern Asia, or perhaps anywhere." In addition to the Indigenous people in the region (who now constitute a minority) there have been waves of immigration over the last two centuries, resulting in a very heterogeneous population, with varying cultures, histories, tenure over land, and modes of subsistence, summarized in Table 1. The region is also experiencing rapid changes in land use, expanding tourism and urbanization, alongside growing populations of large mammals (Puyravaud and Davidar, 2013), putting animals and people into much greater contact. From a traditional conservation biology perspective, the region is a human-wildlife conflict hotspot since a large number of people and wild animals share space (Baskaran et al., 2012).

The five ethno-linguistic communities² living immediately south of MTR in the quantitative study site were—Kattunayakans, Bettakurumbas, Paniyas, Chettys and Malayalis. The remaining four communities (or in some cases “stakeholder groups,” which we discuss further in the qualitative results) occupying the wider region were Sri Lankan Tamils, Early Planters, Mullukurumbas and Forest Department/Conservation NGOs (**Table 1**). The Forest Department (supported by Conservation NGOs and wildlife conservationists), and the early planters are also key stakeholder groups, even if not an ethnic community and their perceptions of elephants were also recorded.

Methods

The quantitative work was centered around a questionnaire to measure tolerance. To this end, first various statements about purportedly negative human-wildlife interactions were formulated based on the qualitative semi-structured interviews that explored what tolerance means in the local context or cultural perspective (or model, cf. Kempton et al., 1996; Thornton et al., 2020) of HWC. These statements were formulated around the ideas that (1) human and wildlife spaces should be separated, given that space was shared with animals it was inevitable that there will be (2) disruption to daily life (3) some degree of property and crop damage (4) some livestock depredation (5) Some human injury or even death, and (6) rising crop damage is because of changing crop patterns and (7) human injury or death was often on account of negligence. In the questionnaire pilot, the respondents found it difficult to answer questions on a “fine-grained” 5-point Likert scale popular in studies of this kind (Grenier, 1998). Therefore, a 3-point scale was chosen. The responses to these seven questions were noted as “disagree,” “can’t say,” or “agree,” ranked−1, 0 or +1 depending on how tolerant the response was.

A range of other explanatory variables were also collected: gender, occupation, education level, income level, ethnic community, land area, types of crops and how attractive they were for wild animals, how much they used the forests, which animals were perceived as problems and frequency of interaction and conflict with these animals, and the wildlife friendliness of their mitigations measures. While the focus was on elephants, problems with other animals were also noted. Questionnaires were administered orally by the first author and two research assistants (youth who worked at local charity and had prior experience in administering questionnaire surveys) to 250 respondents spread across all the villages in the study area, with 50 respondents sampled from each of the five ethnic communities (with an attempt to alternate between male and

²The question of indigeneity is much debated in India, and the Government does not acknowledge that any particular groups are indigenous, and instead recognizes some people as “Scheduled Tribes” under the constitution. This is more of an administrative and political construct than an anthropological classification (Singh, 1986). India’s refusal to recognize indigenous people, a status denoting internationally recognized rights to natural resources and more importantly to self-determination is arguably based on a fear that in doing so it will encourage ethnic separatist tendencies jeopardizing the state’s territorial integrity (Karlsson, 2003). The more widely used term in India by the indigenous communities themselves is “Adivasi” or original inhabitant.

female respondents). The approximate village-wise distribution of households was obtained from a local NGO and the local government office. The villages in the region merged into each other resulting in an uneven spread of houses through the region. Therefore, Google Earth imagery of the region was also examined to establish the correspondence between the spatial distribution of households and the household records held by the local NGO and the government office. For the tribal communities (who live in relatively more dispersed houses) approximately every third household was sampled, while for the non-tribal communities (who live in relatively more dense settlements) approximately every 5th household was sampled. Responses then were coded into a spread sheet (Open Office version 3.2) and later analyzed using statistical software PASW (version 18, formerly called SPSS) and R (both statistical analysis software programmes). These variables are described in **Table 2**.

Four levels of analysis were undertaken.

- Consistency of Tolerances Score: Cronbach’s α test was used to measure the internal consistency of the seven questions to measure tolerance (score of ≥ 0.8 indicates “good reliability,” (Cronbach, 1951). Given the limitations of this test for uni-dimensionality (Green et al., 1977), factor analysis was also carried out using principal components method of analysis (Costello and Osborne, 2005).
- Difference Between Communities: The Kruskal Wallis H test was then carried out with the ethnic community as the grouping variable, returning ranks for each of the communities. The two tests were then carried out to determine if the difference between the communities was significant. Kruskal Wallis *post hoc* Multiple comparison test in R and a Mann-Whitney U test (Mann and Whitney, 1947).
- Building a Multivariate Model—Predictors of Tolerance: Since most of the variables that could contribute to tolerance were nominal/ordinal, they were coded in a way that would be meaningful in a quantifiable model, as described in **Table 2**. All variables were then correlated against each other, so that similar variables could be removed.
- Multivariate Regression: The model was set up with tolerance as the dependent variable, and gender, land area and occupation, income, education level, conflict proneness of crops, frequency of interaction with elephants and frequency of interaction with boars³ as independent variables. Given that all the variables were non-parametric, the categorical regression function in PASW 18 was used.

For the more extensive qualitative body of work, additional ethnographic methods were employed across the wider study region, the Gudalur forest division, including all the 9 communities or stakeholder groups (**Table 1**). These involved, “*the researcher participating... in people’s daily lives for an*

³Wild boar emerged as another species that caused significant damage in the questionnaire survey, and so frequency of interaction with boar was also noted and included in the quantitative analysis. However, there was little or no discussion around wild boar in the ethnographic fieldwork, with the problem being localized to the edge of the tiger reserve, and it was not further examined in this study.

TABLE 2 | Coding of socio-ecological and HWC variables for correlation.

No.	Variable	Coding
1	Gender	Binary; 0/1
2	Occupation	Nominal; 1-4; 1—agricultural laborer, 2-Both agriculturalists and laborer, 3—self-employed agriculturalists, 4—non-agriculture
3	Education level	Ordinal; Ranked 1-4; 1-No formal education, 2-Basic literacy, 3-High School, 4-University
4	Income	Ordinal; Ranked 1-4; (all in INR/month, closest) 1-2500, 2-4000, 3-6000, 4-10000, or more
5	Area of land holdings	Ordinal; Ranked 0-4; 0—None, 1-<1 acre, 2-1-5 acres, 3-5-10 acres, 4-More than 10 acres
6	How wildlife-conflict prone the crops were	Ordinal; Ranked 1-4; 1-no land, 2-tea/coffee/pepper, 3-tapioca/ginger/tubers, 4-paddy/bananas
7	Use of forests	Ordinal; Ranked 1-4; 1 for none, 2 for firewood, 3 for forest produce for own consumption, 4 for forest produce for sale
8	Perceived frequency of interaction	Ordinal; Ranked 1-4; Unequally spaced classes with Elephants and Wild Boar
9	Perceived frequency of conflict	Ordinal; Ranked 1-4; Unequally spaced classes with Elephants and Wild Boar
10	Ethnic community	Ordinal; Ordered according to Kruskal Wallis ranks for tolerance

TABLE 3 | Summary of quantitative analysis.

Analysis	Result
The different responses to the questions on tolerance were examined for uni-dimensionality and internal consistency; based on which they were aggregated into a single score for each individual.	The seven questions on tolerance did measure the same thing and could be grouped together to create a tolerance index.
Tolerance scores were then grouped according to community to see if a marked difference existed between communities, and a check was performed to determine whether the differences were statistically significant.	There was a marked difference between different community's levels of tolerance to wildlife. With Kattnayakans representing the most tolerant end of the scale and Malayalis representing the least tolerant.
All variables that could contribute to tolerance were then entered in to a multivariate model to determine how significant ethnicity was in comparison with the other variables.	Among all the variables ethnic community was the most significant in predicting tolerance.
The wildlife friendliness of mitigation measures was then examined, and effectiveness of using tolerance to predict this was tested.	Tolerance to wildlife was not a good predictor of the wildlife friendliness of mitigation strategies.

extended period of time, watching what happens, listening to what is said, and/or asking questions through informal and formal interviews" (Hammersley and Atkinson, 2007, p. 3), or participant observation. A large number of free flowing discussions occurred while informants were involved in everyday

activities, such as harvesting tea, and often involved stopping work to watch elephants.

The majority of this fieldwork was carried out by the first author, drawing from his experience in the region over the last decade across the 360 or so hamlets and various Indigenous communities in the study region, with in-depth ethnographic fieldwork undertaken in 2015 and 2016. The participant observations were founded on an already established trusting relationship between the first author and the participants through a close interaction over a decade preceding the study.

Finally, HWC incidents were tracked through a crowd sourced elephant monitoring and reporting system (Babu and Thekaekara, 2013) to establish correspondence between the incidents and their ethnographic narratives. Discussions were in multiple languages—Tamil, Malayalam or English. As there were no formal interviews, discussions were not recorded. Local people were also suspicious of conservationists, wildlife researchers and government officials, who often claimed they had encroached onto forest land and should be evicted; recording conversations risked further enhancing their suspicions⁴. At the end of each day, notes were made in English, translating key statements from the discussions relating to human-elephant interactions. Statements relating to interactions and belief with elephants were extracted and grouped together in analysis, and used to describe the varying views across different ethnic communities.

The ethnographic literature was also used, with caution, to describe communities. Despite the large body of anthropological literature from the Nilgiris, much of the early work by non-professionals has proven unreliable (Hockings, 2008). Even the basic classification of the people living in the Gudalur region is unclear, such that contemporary studies of ethnobiology in the Nilgiris (Rajan et al., 2002) or those claiming to provide an anthropological perspective to community-based conservation (Anderson, 2001) confuse different ethnic communities. We therefore relied on our fieldwork to ground truth each of the communities' specific territory, knowledge, beliefs, and practices informing interactions with elephants, and how this linked to modes of tolerance and coexistence.

RESULTS

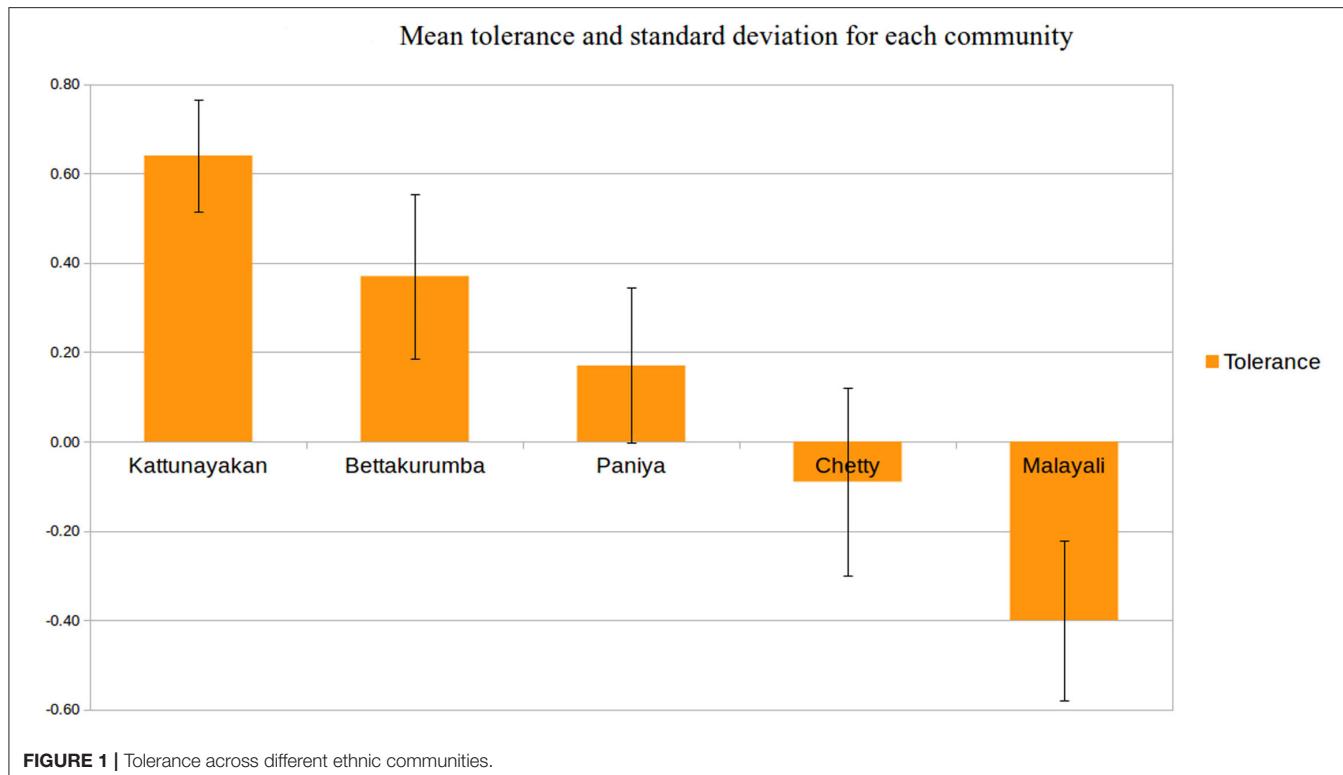
Quantitative Analysis and Results

Tolerance was the key variable being probed and the following statistical analyses were undertaken (Table 3).

Consistency of Tolerance Score

The seven questions to measure tolerance passed Cronbach's α test for internal consistency with a score of 0.829, indicating that all the questions were well-correlated with each other. Factor analysis showed that all seven questions loaded significantly onto one component, the only one with an eigenvalue greater than one, indicating that all seven questions could be simplified

⁴For further insights into the high levels of conflict between the state and local people see the popular article: <https://www.thehindu.com/features/magazine/a-fragile-coexistence/article6989721.ece>.



into one factor. Mean “tolerance” score was then computed for each individual.

Difference Between Communities

The null hypothesis of the Kruskal Wallis H test (that there was no difference in tolerance between the different communities) was rejected, pointing to differences between the communities and returned ranks for each of the communities. The mean tolerance and standard deviation for each community was computed (Figure 1). Kruskal Wallis *post hoc* Multiple comparison test in R showed the critical difference in ranks was 40.597 for a *p*-value of 0.05, and so communities 1&2 (Malayalis and Chetty), 2&3 (Chetty and Paniyas) and 3&4 (Paniyas and Bettakurumbas) were not significantly different from each other. The Mann-Whitney U test (Mann and Whitney, 1947) between adjacent communities (1&2; 2&3; 3&4; 4&5) returned a *p* < 0.05 in all cases, indicating that all the communities were significantly different from each other in terms of their tolerance to wildlife.

Multivariate Model–Predictors of Tolerance

Frequency of interaction and frequency of conflict showed the highest correlation (0.898 for elephant and 0.856 for boar). This is likely the case because interactions tend to be best remembered when there is an anomaly or problem, so only interactions with elephant/boar were used in the model. Ethnic Community and use of forest was correlated (0.746) which was perhaps expected to some degree. Despite rapid changes in the regions and diversification in livelihoods, forest use patterns were broadly linked to ethnic identity and historical relationships

with the forests; hence we removed “use of forests.” Occupation and Land Area were also correlated with each other (0.676), because as land area increases people tend to work less as agricultural laborers and more as self-employed agriculturalists. Factor analysis showed they both loaded significantly on one factor, which was highly correlated (0.997) with the mean of the two, and so these two variables were combined.

Multivariate Regression

For *p* < 0.05, “interaction with elephants,” “interaction with boars,” and “ethnic community” came out as being the only significant predictors of an individual’s level of tolerance, but with ethnic community being the most relevant, with a β -value of 0.744.

In summary, the quantitative analysis found that (1) the seven questions probed the same underlying value of tolerance, (2) The 5 ethnic communities were all significantly different from each other in their tolerance levels, and (3) of all the variables, ethnic community was the most significant predictor of tolerance.

This was a useful starting point. However, from the perspective of investigating elements contributing to more peaceful coexistence with wildlife, it was important to understand the diversity in tolerance among peoples in the study region, and what made some more tolerant of elephants than others. This deeper engagement with the underlying values, beliefs, and practices that led to people being more tolerant was beyond the scope of a questionnaire survey, and in the next Section analyze the relationships that various communities have with

elephants (and more broadly nature) in more depth based on the ethnographic methods deployed.

Qualitative Results—The Intricacies of Tolerance Across Communities

Forest Department and Conservation NGOs

Beyond resident communities, the most influential stakeholder group is the Forest Department staff, supported by a range of NGOs and wildlife activists. This is a very diverse group of actors who are not entirely similar in their views and perceptions of elephants, but there remain some broad similarities, where they supposedly represent the voice of the elephants. While comparatively small in number, they set the conservation narrative and policy agenda around elephants. This stakeholder group overlaps with some of the other local communities, where a few individuals are employed as temporary field staff. However, for most local staff, their perceptions of elephants tend to align more with their ethnic identity. Our descriptions of this stakeholder group's beliefs around elephants therefore, does not include the few local inhabitant's views on elephants, and is more representative of the permanent forest department staff, who are periodically transferred to different divisions, and are invariably not long-term local residents.

The Nilgiris has a very large number of registered trusts and societies, the majority of them relating to wildlife and environmental conservation. Yet these NGOs and wildlife activists have little or no real interaction with elephants on the ground. The Nilgiri Wildlife and Environmental Association (NWEA) is an interesting example, being the oldest conservation organization in India. It was established as the Nilgiri Game Association in 1877 by elite Colonial hunters who pushed for the enactment of the Nilgiri Game and Fish Preservation Act in 1879, arguably the first conservation legislation in the country, aimed at controlled hunting. Today the NWEA consists of about 900 members with the highest-ranking government officials all enrolled as ex-officio members. They are able to exert significant pressure in the policy space. Almost every local or national news article on "Human-Elephant Conflict" (HEC) quotes one of the local conservation groups as the expert opinion.

This stakeholder group also engages in judicial activism with significant repercussions on the human-elephant shared space. They have pushed through the establishment of an elephant corridor, which could potentially displace thousands of people, even those with title to their land (Shaji, 2021). They succeeded in banning all night traffic on highways coming through wildlife reserves in the region (triggering significant backlash from local people) (Krishnakumar, 2018), prevented the establishment of an international scientific observatory (Jayaraman, 2009), and stopped the construction of a railway line through the forests. Their overall goals, while not entirely uniform, converge on some basic issues concerning the "saving" of elephants, which resonate with more global conservation narratives of elephants as endemic, flagship, keystone and umbrella species in the ecosystem. In contrast, they consider most people in the region as encroachers who have taken over forest lands for agriculture and reduced elephant habitat. They see this conversion of forest land

into agriculture as the root cause of HEC. In regular encounters between people and elephants, even in cases of people getting accidentally killed, they believe it is the people's behavior toward elephants that is the problem (see Taghioff and Menon, 2010; Thekaekara, 2010 for more discussion on the local politics of conservation). While biologists often focus on the survival of the species as a whole and are not averse to the culling "problem" individuals in a particular locale, for this group the rights of individual elephants throughout the region are also important, and thus they invariably oppose the capturing or killing of any elephants.

Kattunayakans

Kattunayakans are the most forest dependent of all the communities, as is described by their name: Kattu (forest) Nayakans (rulers). The majority are landless and engage in wage labor with local land owners and the forest department to supplement their hunting and gathering of wild foods and forest produce for consumption and sale.

Kattunayakans (Nayaka) have been the focus of ethnographies by Bird-David (1990, 1992, 1996, 1999, 2006), detailing anthropological perspectives on their unique world view, especially their ontological understanding of elephants as "other-than-human persons" (cf. Hallowell, 1960).

"Nayaka described some elephants as 'devaru'⁵. They did not apply this word to all the elephants...because of their assumed, shared, inert 'elephantness'. Rather, Nayaka used the word for specific elephants, in particular situations...characterized by immediacy not just in the physical sense of close distance, but in a social-phenomenological one" (Naveh and Bird-David, 2014, p. 60).

This ontology is further elaborated with examples; an elephant that carefully walks between houses without damaging them and being respectful toward people, or one which walks past a person and "looked straight into his eyes" and "communicate with him non-verbally" is *aana-devaru* (elephant-person), but an elephant that damages houses, behaves unpredictably, or where there is no mutual engagement, is just an ordinary *aana* (elephant) (Bird-David and Naveh, 2008, p. 60). Such classifications reveal variations in tolerance and divergent dispositions toward coadaptation and coexistence within elephant populations.

Kattunayakans often talk to elephants, particularly the "devaru" elephants that they relate to, as other-than-human persons. As Bird-David and Naveh (2008, p. 63) relate:

"One October night in 2003, elephants entered KK [the village]; they trampled one of the huts, walked through the wetland paddies, and started to eat banana plants. While doing so, they also emitted loud bellows that were heard all over the village. One man went to about eight meters from where the elephants were standing, a distance that, should the need have arisen, would still have enabled him to run away. From there he approached the

⁵While literally translating to 'god', the phrase is more nuanced in the Kattunayakan context, relating to their animistic relationship with elephants and other 'other-than-human persons', rather than the better known Hindu Ganesha the elephant deity.

elephants boldly. In a typical blaming tone he said:

“Seri [in this sense ‘ok’], if you want to eat, you silently eat and go. We have children here!”

The elephants, then, stopped bellowing, and a few minutes later went away, out of the village.”

“When a Nayaka finds himself in front of an elephant, he prefers to stand still and, as calmly as possible, to address the elephant in a persuasive tone of voice (characterized both by the tone and by the substance):

“I am not coming to disturb you, or to do any harm to you.”

The most frequently used rhetoric in such cases stresses what is common to both sides of the encounter:

You are living in the forest, I am also living in the forest; you come to eat here, I am coming to take roots (fruits, fire wood, etc.)... I am not coming to do any harm to you” (2008, p. 63–64).

One village is particularly well-known in the region for having very low conflict with elephants, as explained by a resident:

“We have no problem with these elephants. We know them, and they know us. Every year we do *pooja*⁶ for *Aane devaru* and ask them not to disturb our village. They listen to us. They don’t come and trouble us here even though there are lots of jack fruit trees, but all the other people in this whole area have lot of problems with elephants” (Therakolly, October, 2011)⁷.

Agriculture is now wide-spread, and some of the Kattunayakans who are in possession of land also grow crops, in part to prove their occupation of the land. In terms of crop choices, they have all chosen tea or coffee rather than bananas, which are much more lucrative. When questioned about this choice, the immediate answer was “*because elephants will eat them [bananas] of course*” (Therakolly, July, August, 2010). Coexistence with elephants thus remains a priority for Kattunayakans despite changes in their mode of subsistence.

Bettakurumbas

There is almost no contemporary literature on the Bettakurumbas, where older literature suggests that they represent remnant populations from the Pallava Dynasty, after its fall during the 7th and 8th century CE. Their relationship with nature stems from their long isolation in the hills (Thurston and Rangachari, 1909).

In their own oral history however, they identify as forest people. Narratives of capturing and taming wild elephants are vibrant in their stories, and they claim that Maharajas depended on them for *keddah*⁸ operations, with British and Indian forest

⁶For this hunter-gatherer community a *pooja* is a ritual to connect and communicate with animistic spirits and other-than-human persons, where at times gifts of fruits or even alcohol are offered. This is distinct yet increasingly more influenced by the mainstream *pooja* in Hinduism, which is a worship ritual performed to offer devotional homage and prayer to deities.

⁷All quotes in this paper are from key informant discussions, with the place and date mentioned at each instance.

⁸A method of capturing elephants where an entire herd is driven into a specially constructed stockade or ‘*keddah*’, followed by *mahouts* entering the *keddah* on tame elephants and lassoing and separating out the elephants for individual training.

departments continuing this tradition. This is referenced in the early Western literature:

“The Betta Kurumbas are, I am told, excellent elephant *mahouts* (handlers), and very useful at *keddah* (elephant-catching) operations” (Thurston and Rangachari, 1909, p. 162).

“I have heard of a clever Kurumba, who caught an elephant by growing pumpkins and vegetable marrow, for which elephants have a partiality, over a pit on the outskirts of his field” (1909:163).

Even today, one of the main occupations in the community is looking after the captive elephants as *mahouts* (elephant handlers), and working for the forest department in the neighboring PA. An excerpt from discussions with some *mahouts* brings out a version of elephant capture rather different from the *keddah* operations:

“In the old days there was no fuss like there is now to capture elephants; hundreds of people and shooting the elephants with sleeping medicine and all that.

On the correct day, the elders in the village will do all the required *poojas* for the spirit. Then some selected men will go into the forests, to a particular area that the spirits tell us where to find the elephants. When they see the herd they go up to them and ask some elephants to come and join us to work for the Kings. Some particular elephants would separate out from the herd and give themselves up to be caught. On their own they would come out and enter the kraal for training (Thepakadu, September, 2009).

They pride themselves in not using the *ankush* or bull hook to control elephants, and talk about the mutual relationship between them and elephants, highlighted by story of Bhama, who chased away a leopard that attacked her *mahout*, and carried him back 3 km to the camp and saved his life, as he was critically injured and unconscious⁹.

Bettakurumbas’ abilities to communicate with and gain cooperation from wild elephants finds mention in the 1908 Gazetteer of the Nilgiris: “*Stories are told of how they can summon wild elephants at will*” (Francis, 1908, p. 156). This reflects their animistic ideas about elephants as coexistent other-than-human persons capable of mutual respect and cooperation.

Paniyas

The Paniyas are the largest tribe in the region. The name translates into “worker” (Paniyan) in Malayalam, and records from as early as the 8th century CE suggest that the Paniyas were an enslaved community (Aiyappan, 1992). The traditional slavery evolved into a system of indentured labor under the Chettys, which appears to have persisted until 1976 (Kulirani, 2003).

Given this long history of subjugation and marginalization, there is confusion around their basic hunter-gatherer vs. settled-agriculture mode of subsistence, but the early literature records that “*women and children may be seen digging up jungle roots, or gathering pot-herbs for food*” (Thurston and Rangachari, 1909 Vol. 6:59). Their engagement with the modern cash economy remains similar to the traditional immediate returns (Woodburn,

⁹News article: <http://www.thehindu.com/2000/01/23/stories/13231087.htm>.

1982) of the food gathering economy, where they see agricultural labor as a form of wage gathering which allows them to purchase food for their families in the immediate term rather than be banked individually (Kulirani, 2003).

Given this background, there are limited interactions with elephants compared to the Kattunayakans and Bettakurumbas, but within these interactions there is some degree of tolerance of elephants, as the following examples illustrate.

An old Paniya man had been killed by an elephant, while on the way back from a tea estate where he worked. In a discussion with his daughter:

“What can be done? Nothing can be done. He has gone. What can we say about the elephant? It was going one way on the road and he was coming the other way. He got killed. It did not come after him to kill him. Such things happen. If they give compensation good, otherwise what can be done? Nothing” (Gudalur, December, 2007).

This attitude—an acceptance coexistence with occasional conflict, particularly through accidental encounters with elephants—was relatively widespread among many of the communities. While this could be on account of an element of powerlessness in terms of the laws that prohibit killing elephants, there is no oral or written history of these indigenous communities killing elephants.

Many years later, in discussion with the same person about elephants in the region:

“Elephants are coming back everywhere! Growing up as a child we used to happily play around the village till late night. Even my grandparents don’t remember a time when there were elephants in our village. Now no one steps out after dark, almost every day there are elephants around. Even the dogs have to be kept inside the houses. Everyone is scared, it’s not like before...

Nothing can be done. They said they will put a fence around the village, but it will break and elephants will come. We have to be careful now, that’s all” (Gudalur, March, 2016).

Mullukurumbas

Unlike the other three communities, the Mullukurumbas are settled agriculturalists and the only tribal community in the region to have title for their land, granted in colonial times. They also consider themselves superior to some of the other tribal communities; “*Among the natives of the village, the Mullukurumbas are next to the Chettys socially and ritually, while the Urali Kurumbas [Bettakurumbas], Kattu Naickens and Paniyans follow in the descending order*” (Misra, 1971, p. 31). They are more integrated into mainstream society, and Misra notes that in 1971 it was already three or four decades since the forests around them had been changed to plantations, affording very limited interactions with wildlife (elephants). Still, we include them in this discussion, since elephant ranges are expanding, and more Mullukurumba villages are beginning to interact with elephants regularly. Also, a large number of the temporary field staff of the forest department, employed to chase elephants are from this tribe. One interesting interaction that highlights Mullukurumba’s beliefs about elephants:

“...On the way back we decided to come through Ayankolly road... When we reached Amko factory, there was Makana [wild, tuskless male elephant] standing. And two staff were there... they were talking to the Ganesan elephant telling him to go into the forests quietly and not to stand in the middle of town, otherwise lots of people will come and it will be a big problem for him. Subramani ettan told me that this animal can understand whatever we speak to him” (Cherambadi, 10th May, 2016).

This practice reflects the notion of appealing to the elephant as a manifestation of the Hindu god Ganesh in order to maintain peaceful coexistence.

Chettys

“Chettys” (also spelt Chettis) are a well-known merchant community across South India, but the Chettys of the Nilgiris are not connected to this larger community, and very little has been written about them in colonial literature. Bird-David says they “*probably gradually emigrated from surrounding areas throughout preceding centuries and encroached on land in the Nilgiri-Wynaad*” (1994:341), but for most local people, the Chettys are considered indigenous, with no marked point of immigration into the region. They have long been settled-agriculturalists, traditionally growing a range of millets and grains, but now focused on paddy cultivation in low lying areas (Krishnan, 2009) and a range of cash crop vegetables. Although they have lived and continue to live in close proximity to the forests, they do not have a history of dependence on forest produce.

An emblematic response to how they see the future with elephants in the region is as follows:

“Growing paddy is very difficult. We have always had problems with elephants. In the old days there was no other choice, we needed the rice to eat. We had various bell systems to warn us when elephants came. Then we would all get together and beat drums and chase them away. Now people can’t take that much trouble. If the elephants come and start eating the paddy no one comes to help. Children will not want this hard lifestyle. Once they go to school and college they will not come back to this. They will get good jobs and move to other places.”

“In the long term we will have to do something about elephants. Once my son grows up he may want to buy a motorbike. Then we will need a road here and that won’t be good for the animals. And it’s dangerous as well, people on bikes get killed by elephants quite often we hear” (Muduguli, June, 2009).

Of the 1000 or so Chetty families currently in the region, over 600 families live within what is now the Mudumalai Tiger Reserve, and have been fighting to be relocated out of the forests since the 1980’s, even getting the High Court to instruct the Government to relocate them. From the quote above, it is evident that they do not see a future linked to agriculture, particularly when it is further strained by wild animals feeding on their crops. Coexistence in their case may mean adapting to other modes of subsistence and conflict avoidance. With their long shared history of living with elephants they are not particularly antagonistic toward elephants and believe negative interactions are inevitable, but at the same time do not appear to have significant animistic

beliefs or interactions with individual elephants as other-than-human persons that may have especially facilitated tolerance and coexistence in the past.

Early Planters

The five ethnic communities described above now form less than about 20% of the population, with various waves of migration over the years. The first migration of early planters began in the mid-1800's, and carried on till the mid-1900's. This stakeholder group does not constitute a single ethno-linguistic group, with their only common factor being the fact that they were the first immigrants into the region, and are further divided by class—small estate owners or local elites and estate workers. The local elites form a peer group in the Nilgiris and interact regularly through social clubs, where English is the common language of communication.

Despite wielding significant power locally, the unstable nature of global commodities like tea and coffee has produced for them a fragile and ambiguous financial status. The majority of the younger generation is moving out of the region to urban centers in India and other parts of the world, with their family estates turning largely into holiday homes. Given that elephants do not eat tea or coffee, there is no immediate threat posed by elephants to this group and their livelihood. Their relative affluence rarely puts them into direct and life-threatening contact with elephants, making them more tolerant to the animals on their land:

"I keep our gate locked during the day to keep unwanted people out. But I leave it open at night, to allow the elephants to move in and out, without having to knock the gate down!. The herd comes right up to the veranda. Last week, there were seven of them, they ate up all the flowers, but didn't do any other damage. They are actually very peaceful animals if you don't trouble them" - (a small estate owner, January 2011).

"We do have considerable damage from elephants on the whole, but actually we are quite proud of it. Whenever relatives and friends come over, we walk them through our estate and show them all the signs of where the elephants have been and what they have done. It's all part of this estate life" - (another small estate owner, January 2011).

While they do not appear to hold animistic beliefs about elephants, there is some idea of individuality and an attempt to rationalize bad behavior by particular elephants:

"It was horrible... They just completely destroyed everything. ... Really rowdy elephants, we have never seen anything like this in the last 30 years. We are convinced they came from Kerala. Just the same as all these young rowdy tourist boys now come on motorcycles you know" (Silver Springs Estate, February 2016).

In this first wave of migration into the region, there are also workers on these same estates. Our interactions with these groups of people are somewhat limited, since the majority of them live in labor lines¹⁰, situated inside privately owned estates without public access. They are clearly much more exposed and thus

¹⁰Terraced dwellings constructed for plantations workers.

vulnerable to being in dangerous situations with elephants. Yet, overall, their attitude and perception of elephants is similar.

...elephants have always been here, but now both the elephants and the people are increasing. Before we used to not see them much, they used to come and go in the night once in a way, but now we see elephants almost every other day. But what to do? We can't chase them anywhere. This is also the elephant's home. Neither us nor them can go back to our native places. This is our home now" (Kapikadu Village, February 2016).

There is a sense that elephant numbers and range are increasing and there is likely to be more conflict in years to come. But there is also a sense of inevitability and tolerance—neither the elephants nor the people can be displaced from the region, and there is no option but to try and coexist peacefully.

Malayalis

The Malayali settlers from the neighboring state of Kerala are perhaps now socially and politically the most vociferous community in the region, occupying most of the elected positions in the local self-government. There has historically been significant conflict between the Malayalis and the indigenous communities, primarily over land; *"The Christian immigrants here are keen to possess land in and around the village. Hence they liberally lend money to the native population if the latter mortgages their land"* (Misra, 1971, p. 32). An NGO in the region also highlights this: *"ACCORD (Action for Community Organization, Rehabilitation and Development) was born in November 1985 out of the realization that the Adivasis of the Gudalur Valley were being cheated and exploited... We started with the central belief that Adivasis had to retrieve the ancestral lands taken away from them by force and deceit"*¹¹.

Having little traditional experience with forests or wildlife, or a tradition of sharing space with elephants, they find it hard to deal with elephants:

"We urgently need better protection from the elephants. The forest department is not doing anything to help us. A poor family invests all their savings, taking loans against their gold to plant a few acres of bananas, and in just one night their whole life is destroyed by elephants. We don't even get compensation from the Government since we don't have patta¹² for the land. We have had many protests demanding that proper trenches and electric fences are built to keep the elephants inside the forests, but no one is listening."

"Elephant are routinely coming into all the areas in our panchayat (local self-government), even near the town. We have sent petitions to the Collector, Mudumalai Field Director and all officials. Still no action is taken. So last month we organized a protest outside our panchayat office, with full participation from all the local people..." (Local Government Meetings, Gudalur, June 2013).

¹¹<http://adivasi.net/history.php>.

¹²Patta refers to a legal title deed for the land. Many of the immigrants do not have this, with contested land rights being a key part of the problem.

Overall, this community has the most trouble living with elephants, and they are perhaps the only ethnic community which, on the whole, does not see sharing space with elephants as a viable option now or in the future.

Sri Lankan Tamils

The Sri Lankan Tamil repatriates are the final migrant community to enter the region, and were subjected to the largest organized yet turbulent migrations in the 20th century. The Colonial era companies took a large number of Tamilian laborers from India to Northern Sri Lanka in the late 19th and early 20th centuries to work on tea plantations, but at the time of Sri Lankan independence these communities, then at about 500 thousand people, were denied citizenship. After numerous diplomatic discussions they were allowed to come back, and about 250,000 people were moved to India between 1967 and 1987 (Bass, 2013)¹³. The majority of the repatriates who stayed in India were settled in the Nilgiris, where the Government converted large tracts of forests into tea plantations to employ them, with a number of them subsequently squatting on government land.

Given that historically they had little or no interaction with elephants, Sri Lankan Tamils find it particularly hard to cope, and also get no compensation from the state for losses in elephant encounters, as they do not possess title for their land. As one pleaded:

“You have to help us somehow. We live in constant fear. Elephants never used to be here before, but in the last few years they are always here. They come at night and break down houses. We can’t go out to the toilet in the morning without fearing for our lives. We can’t come back to our houses from the bus stand if it gets later than six in the evening. More and more people are getting killed every year. Either the government should give us land somewhere else or they should chase all these elephants back to Mudumalai”- (O’Valley region, October 2013).

While this fear of elephant was the dominant sentiment, a most positive sentiment also was articulated: “...I have been here for over 30 years—more than most of the other people. Things have changed a lot and the problems have increased. The number of people has increased a lot, and the elephants are not afraid as much now, and boldly walk on roads, drink water from the panchyat tanks etc... Elephants have always been here, and they will always be here. People will learn to adjust. This chasing them into Mudumalai is foolish, everyone knows it cannot be done” (O’Valley region, October 2013).

The majority of this Tamil community is also Hindu, worshiping Ganesha, the elephant headed deity, and as one informant noted, damage by elephants is understood in terms of divine retribution:

“The people must have done something wrong in their lives and God is punishing them. There is no other explanation” (Deivamalai Village, January 2016).

¹³The conflict peaked around 1980, with a brutal anti Tamil pogroms in Sri Lanka where thousands of Tamils were killed, leading to a war that lasted decades with about 70,000 people killed over the years - http://news.bbc.co.uk/1/hi/world/south_asia/7521197.stm.

DISCUSSION: CATEGORIZING THE HUMAN DIVERSITY

The quantitative analysis points to the cultural variable of ethnic community as the key predictor of tolerance. While generalizing about an entire community’s interactions with elephants is arguably problematic, from a policy or management perspective, some generalization or grouping is inevitable, and we argue that ethnic community is the most meaningful way of doing this. From the qualitative methods, we have outlined each ethnic community’s history in relation to the landscape, their current occupations and modes of subsistence, and finally to elephants themselves in terms of knowledge, beliefs, and practices.

From this analysis, there are three main cultural-ecological variables that correlate with enabling tolerance and the sharing of space with elephants for a more peaceful coexistence: (1) Elephant ontologies, or what each community thinks an elephant is within their collective lifeworld, (2) a community’s specific modes of subsistence and agricultural crops, and (3) the shared ethnic history of living with elephants. The diversity that arises amongst these three dimensions in combination is more difficult to classify or cluster neatly, and any simplistic grouping of peoples is fraught with generalization, essentialization, and subjectivity. Nevertheless the correlations are significant, and our analysis below suggests these underlying cultural-ecological factors coalesce in a tolerance that enables people and elephants to coexist more peacefully. Therefore, it may be a useful heuristic approach to understanding the unity and diversity of human-elephant interactions in the region, if not more widely (Thekaekara and Thornton, 2016). It is important to note that these results represent a temporal snapshot of beliefs and perceptions, and attitudes toward coexistence with elephants may change with on-going interactions and demographic conditions among and between different ethnic communities or stakeholder groups and elephants over time. Some individuals may also oscillate between positive and negative perceptions about elephants (Thekaekara, 2018).

Ontology—What Is an Elephant

First, concerning the characterization of elephants, or the varied elephant ontologies - how are they conceived and their interactions with people explained? There appear to be four broad conceptualizations that emerge, where people understand elephants as (1) Other-than-human persons, (2) Gods, (3) Victims, and (4) Wild/unpredictable animals, which we briefly describe below.

First is the indigenous idea of other-than-human persons, where some individual elephants are accorded some form of person-hood, capable of mutual respect, communication and even relationships with humans, that was prevalent among the Kattunayakans, Bettakurumbas and to a lesser extent the Paniyas. This conceptualization of elephants allows for accepting varying behavior in elephants based on individuality, personality and agency. Elephants are expected to behave in accordance with human values and morality, and elephants that have been wronged are expected to be angry or sad and behave unpredictably (where even killing of a person is not seen

as unusual), but aberrant individuals who behave badly with no (perceived) provocation are liable for punishment. This understanding of elephants is perhaps the most conducive to sharing of space for a more peaceful coexistence.

Second is the idea of elephants as Ganesha or Ganapati, one of the best known and most worshiped deities of the Hindu pantheon, which is prevalent among all the communities except the hunter-gatherers, Christian or Muslim Malayalis, and Forest Department/Wildlife NGOs. Attributing divine status to elephants almost automatically implies certain reverence and tolerance. Negative encounters between people and elephants are rationalized in terms of divine retribution, and there is a certain acceptance of that moral ecology. While this appears to be ideal for tolerance and a sharing of space, we rank it below the other-than-human idea of elephants, as this divine reverence does not allow for individuality in elephants. Even with continuous exposure to violence from elephants, there is no room to adjudicate these negative interactions, and assign responsibility to both humans and elephants, since the latter is considered divine. This can lead to a complete breakdown in the human-elephant relationship, and elephants can then quickly become demons. While we did not encounter direct references to this in our fieldwork, we did find a deep antagonism toward elephants in some people, particularly the Sri Lankan Tamils, despite their worship of elephants. This duality exists in Hindu mythology; Gajasura is the elephant demon, and Gajasurasamhara, an avatar of Shiva, is the “slayer of the elephant demon,” who appears in Pallava and Chola art and iconography from over a thousand years ago, portrayed dancing on an elephant’s head (Peterson, 1991).

The third is the idea of elephants being victims. This is very prevalent among the Wildlife People group in particular—i.e., the notion that humans are expanding into and destroying elephant habitat, and forcing them into contact with people. The Kattunayakans also share this view to a lesser degree, where they see both themselves and elephants losing out on account of the large migration of people into the region. With this approach there is again limited scope to accommodate individuality, personality or agency in elephants. The underlying assumption is that elephants are passive victims not in control of their circumstances, who interact with people only because they have been forced to do so. This idea is arguably the basis of the global narrative around conservation, but, ironically, it is not shared by most of the communities living with elephants. In fact, while there has been a significant reduction of natural cover over the last century, with immigration and growing human population into the region, elephants also have been expanding their range over the last few decades (MoEFCC, 2017).

And finally, is the idea of elephants as wild and unpredictable animals. This stems from an anthropocentric view of the world, arguably rooted in the Judeo-Christian ideology where man was created in the image of God, to “rule over the fish in the sea and the birds in the sky, over the livestock and all the wild animals, and over all the creatures that move along the ground” (Genesis, 1975 1:26). White (1967) argued that this ideology of dominion was a root cause of the current ecological crisis. This could also be rooted in a more secular utilitarian or materialist

worldview, where much of the natural world is seen as a resource base. This orientation does not allow for elephants (or any species) and humans to be ontological equals, and typically (St. Francis notwithstanding) there is no moral obligation to behave well or coexist tolerantly with animals, and killing elephants is acceptable. A version of this also exists in biology, where “unruly” animal behavior is explained more in terms of instinct and stimulus from their immediate environment rather than more contingent, complex processes of culturally-mediated experience and cognition (Masson and McCarthy, 1996).

How these views manifest across different communities is shown in **Table 4**. It is evident that many of the communities ascribe to multiple conceptualizations of the elephant. While all of these different ideas around “what is an elephant?” are important, from the perspective of sharing space with elephants the most relevant is the hunter-gatherer’s other-than-human ontology of elephants, which allows for significant mutual accommodation and variation in the behavior of both elephants (as non-human persons) and people. This worldview makes them the most tolerant, both from the quantitative regression model and from the qualitative analysis of interactions with elephants.

Modes of Subsistence or Agricultural Crop Types

Another important factor that mediates human-elephant interaction and coexistence is the type of land use and this is very relevant in shared spaces where the people are hunter-gatherers, small scale agriculturalists, agricultural laborers, plantation owners, to traders or small business owners, with agriculture also varying between food crops like rice, bananas or vegetables which elephants eat, and plantations crops like tea and coffee which elephants do not eat. From the “competition over space and resources” (Pimm et al., 1995) understanding of HEC, it would appear that conflict could be grouped into three distinct categories with decreasing intensity of conflict with elephants – (1) No crops, (2) inedible (for elephants) crops, and (3) edible crops. Not interacting with elephants at all would imply no conflict at all, but all the communities in the region do interact with elephants in some ways.

No crops - the Wildlife People, most of the Sri Lankan Tamils, laborers from the early planters, the Paniyas and some of the Kattunayakans and Bettakurumbas, all do not own significant areas of land or grow any crops themselves. This may minimize their negative interactions with elephants and engender less negative attitudes about sharing space.

Inedible crops - the early planter who grew tea and coffee, which elephants do not consume and may therefore not facilitate significant negative interactions between elephants and people. Some of the Kattunayakans, Bettakurumbas, and Mullukurumbas who have land have taken to planting tea and coffee over the last decade, partly as a means of proving their possession over the land they occupied. While the Mullukurumbas have traditionally planted rice and bananas, since they do not significantly overlap with elephants, the Kattunayakans and Bettakurumbas almost never planted bananas, even though they are more remunerative than tea or

TABLE 4 | Varied beliefs about elephants.

Ethnic/stakeholder groups	Other-than-human Persons	Gods	Victims	Wild animals
Forest Department/Conservation NGOs				
Kattunayakans				
Bettakurumbas				
Paniyas				
Mullukurumbas				
Chettys				
Early Planters				
Malayalis				
Sri Lankan Tamils				

Shaded area indicated "yes" and unshaded area indicates "no".

coffee. When queried about why they did not grow bananas, the answer from a Kattunayakan was "*because elephants will eat it of course.*" And as described above, a Bettakurumba elder also voices his concern about some of the other communities planting bananas and the increased risk it poses in attracting elephants to the human settlements.

Edible crops - the Mullukurumbas and Chettys have traditionally always planted rice, and the Malayalis often grow bananas – the crops that elephant do eat, and arguably pose a significant challenge from the perspective of sharing space.

Although we have been critical of the ecological competition within human-elephant modes of subsistence being the sole framework for understanding conflict between elephants and people, it cannot be entirely ignored as an ultimate parameter to sharing space. Different communities' subsistence adaptations is shown in Table 5.

Again there is significant diversity, with multiple communities engaged in more than one mode of subsistence. But the most relevant aspect is that on the whole only significant high conflict crops are planted by the Malayalis, since the Mullukurumbas do not significantly overlap with elephants and the Chettys are very small in number and also increasingly less disposed toward agriculture for the livelihood.

Shared History

Finally, the shared history between elephants and people is an important factor in understanding tolerance. Living with elephants inevitably poses some challenges, and a shared history is a key element in allowing a culture of mutual accommodation to evolve. Communities like the Chettys, for example, who grow paddy and have a long history of guarding their crops from elephants, are less antagonistic toward elephants than the Malayali immigrants. Categorizing this shared history is challenging, since even among the indigenous communities there is some debate about when they first moved into the region. For this thesis, the most appropriate classification is (1) indigenous communities who have been in the region for at least a few 100 years and are the best adapted to elephants, namely the Kattunayakans, Bettakurumbas, Paniyas, Mullukurumbas and Chettys, (2) communities who have been in the region for close to a century – the early planters who came into the region in the first

wave of immigrations in the late 1800's and early 1900's and have now forged a relationship with elephants, and (3) communities who moved in about 50 years ago or less, specifically the Malayalis in the 1960's and the Sri Lankan Tamils in the 1970's and 80's, who have had significantly less time to adapt to elephants.

These different conceptual and explanatory frames vary significantly among the different communities inhabiting the Nilgiris, as summarized in Table 6.

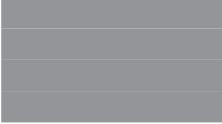
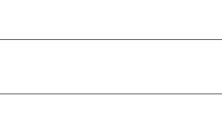
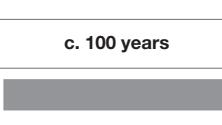
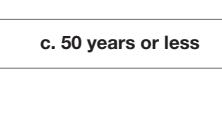
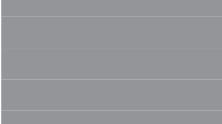
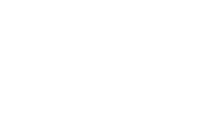
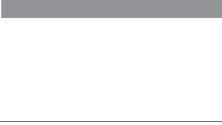
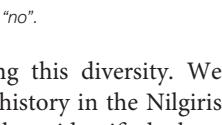
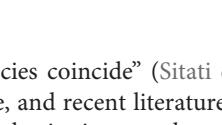
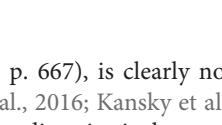
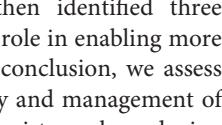
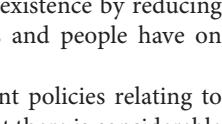
Being able to share space for a more peaceful coexistence with elephants clearly hinges on the shared history, and how long the people have lived with elephants is important for evolving cultural and geographic conflict mitigation techniques, including interspecific communication and mutual accommodation and coadaptation for coexistence. This varies significantly among the different communities in the region. Significantly, even the most recent immigrant communities have been in place for over 30 years and, with new generations growing up on the land, are showing signs of adaptive coexistence with elephants (as in the case of some Sri Lankan Tamils or Early Planters).

In summary, these three underlying cultural-ecological factors seem to provide an enabling environment for tolerance of elephants and the ability to coexist peacefully. While all of these factors vary significantly between the different communities, tolerance does not vary linearly with each of them. That is, communities who plant elephant-conflicting crops are sometimes more tolerant than others who do not engage in agriculture, and communities who have had a longer exposure to elephants are sometimes less tolerant than those with a shorter exposure to elephants. But from a management perspective some generalizations are required, and given the monolithic understanding of the human in HWC policy around HEC, these three factors are arguably a reasonable way of heuristically understanding and accounting for the varying propensity of people to coexist peacefully space with elephants.

CONCLUSIONS

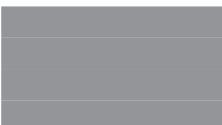
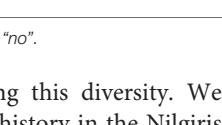
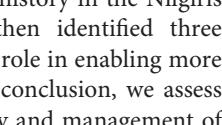
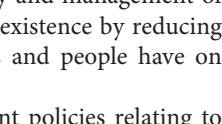
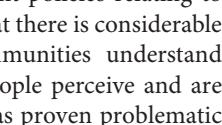
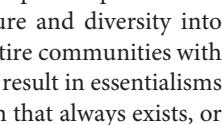
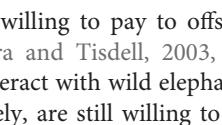
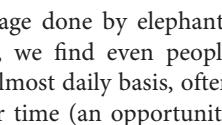
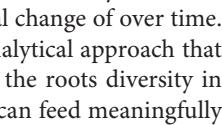
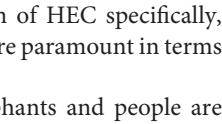
We have shown in response to the question "*How are people differently tolerant to elephants around them, and what are the underlying cultural factors that affect this tolerance and facilitate coexistence?*" that ethnic community is the most critical

TABLE 5 | Varying agricultural practices.

Ethnic/stakeholder groups	No agriculture	Inedible crops	Edible crops
Forest Department/Conservation NGOs			
Kattunayakans			
Bettakurumbas			
Paniyas			
Mullukurumbas			
Chettys			
Early Planters			
Malayalis			
Sri Lankan Tamils			

Shaded area indicated "yes" and unshaded area indicates "no".

TABLE 6 | Varying history of living with elephants.

Ethnic/stakeholder groups	Indigenous	c. 100 years	c. 50 years or less
Forest Department/Conservation NGOs			
Kattunayakans			
Bettakurumbas			
Paniyas			
Mullukurumbas			
Chettys			
Early Planters			
Malayalis			
Sri Lankan Tamils			

Shaded area indicated "yes" and unshaded area indicates "no".

variable for predicting and understanding this diversity. We analyzed each ethnic community's varied history in the Nilgiris and interactions with elephants, and then identified three underlying factors that seem to play a key role in enabling more peaceful human-elephant coexistence. In conclusion, we assess the implications of this diversity for policy and management of the shared space to promote successful coexistence by reducing HEC and the negative impacts elephants and people have on each other.

Unfortunately, currently no government policies relating to human-elephant interactions recognize that there is considerable variation in how different human communities understand elephants, and the assumption that all people perceive and are impacted by elephants in the same way has proven problematic to promoting coexistence. Factoring culture and diversity into policy is a significant challenge; labeling entire communities with certain tags of tolerance or intolerance can result in essentialisms – failing to account for individual variation that always exists, or for temporality and contingency of cultural change of over time. Nevertheless, we have demonstrated an analytical approach that yields practical insights for apprehending the roots diversity in human-elephant relations which, in turn, can feed meaningfully into policy formulation and the reduction of HEC specifically, and HWC more generally. Three insights are paramount in terms of their implications for policy.

First, not all interactions between elephants and people are negative. The traditional idea that conflict "occurs wherever these

two species coincide" (Sitati et al., 2003, p. 667), is clearly not accurate, and recent literature (Inskip et al., 2016; Kansky et al., 2016) is beginning to take account of the diversity in human-animal relations. Still, the cultural nuances informing human-elephant interactions are not captured in the frameworks of the natural sciences. Positive interactions between elephants and people are ignored, and there is a fascination with elephants that draws people to them even in cases of conflict which is not accounted for in the literature. In some cases, there is the entertainment and "fun" in people having a night out chasing the elephants together, but in other cases they are also just content to watch the elephants for extended periods of time. For tourists seeking wildlife experiences this is of course understandable and expected and there are even attempts to look at how much they will be willing to pay to offset the damage done by elephants (Bandara and Tisdell, 2003, 2004). Yet, we find even people who interact with wild elephants on an almost daily basis, often negatively, are still willing to invest their time (an opportunity cost) in fascinatingly watching elephants so as to learn more about them, if not as a demonstrable act of tolerance and coexistence. Tea estate workers and supervisors stop working for a while and invariably call their managers to come and join them. What to do about the elephants is almost secondary, the first reaction is usually to simply stop and watch them. We routinely come across people who complain bitterly about elephants and the damage they cause, who could be classified as highly intolerant. Yet, they are more than willing to spend an hour or two watching

elephants with us, constantly discussing the elephants' activities, individual proclivities (including tolerance), and the specific interactions each has had with local people in this human-dominated landscape. The positive experiences and knowledge people gain from elephants is almost never quantified or even recognized in studies on HEC. Yet such engagements form the basis of continuous learning, coadaptation, and the negotiation of peaceful coexistence.

Second, indigenous communities, and hunter-gatherers in particular, often have a very different perspective on non-human species, and their relationship with particular other-than-human elephants is very useful in allowing them to coexist with elephants more peacefully. And given the "*remarkable consistency of animism across the world*" among hunter-gatherer communities (Praet, 2013, p. 341) and wide attestations regarding the non-human personhood status (Nelson, 1995) of animals among forest-based people who share space with them, it may be a widespread cognitive adaptation to consider them not as incompatible with human existence, but rather part of the community of beings. This idea of personhood extends to the individual too. The Kattunayakans understanding of "idiosyncratic personalities" that Naveh and Bird-David (2014) describe is very similar to what modern ethologists have discovered through careful elephant behavioral studies (Lee and Moss, 2012; Srinivasaiah et al., 2012). Perhaps linked to this is the fact that people who have been living with elephants for some time also seem to have more nuanced ideas of personality and culture in elephants, where they distinguish between good and friendly elephants and bad or rowdy elephants. This is compatible with hunter-gatherers' other-than-human persons perspective, but accepting that in a community of beings some individuals may behave badly and must therefore be punished or excluded in order to maintain peaceful coexistence between the human and elephant communities. This view has important conservation implications, and the idea of elephants as non-human persons has had impacts on conservation policies in other regions (Derham and Mathews, 2020), where the behavior of individual elephants is assessed beyond the wider conservation goal of saving the species (Wallach et al., 2020).

Third, the dominant view on HWC may not always be the majority one. In Gudalur, most of the *panchayat* positions are occupied by Malayalis, who have the most trouble in sharing space with elephants. As a consequence, the dominant narrative in local policy circles assumes that the high level of conflict and antagonism between people and elephants is common to all the inhabitants of the region, but this is clearly not the case. Yet, if this is taken as a given, any superficial investigation into the question of HEC will inevitably play out as a self-fulfilling prophecy. It is only through a deeper ethnographic engagement and comparative analysis of constituent communities that a more nuanced picture emerges of the significant differences in how people interact with elephants.

A key implication of these findings is that conflict mitigation strategies must seriously consider this diversity in how humans interact with elephants before they are implemented

universally across communities. Strategies informed by best-practice examples of tolerance will be key to promoting peaceful coexistence between people and elephants. Simplistic barriers aimed at separating out spaces or implementing singular deterrents may in fact have negative consequences in the long term, making people less willing to share space. Broad overly simplistic assumptions about tolerance by reducing it merely to ideas of ethnicity or indigeneity will be problematic since it is unable to capture changes in attitudes over time and difference in individuals' behaviors toward elephants. Understanding cultural differences and variability over time is vital in order to come up with nuanced community and place-based solutions that work to promote peaceful coexistence between people and elephants. Redesigning the way policy is formulated, moving it away from the top-down, expert driven approach, to more bottom-up and community-driven strategies will be essential. If every village is encouraged and allowed to make their own plans for sharing space with elephants, with access to the range of available solutions, it will provide impetus for more community-based, culturally-relevant and resilient human-wildlife coexistence.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Open University Human Research Ethics Committee. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

Study design was by TThe, SB, and TTho as a part of the first author's PhD thesis. Fieldwork, data collection, and analysis were performed by TThe. The manuscript was written by TThe, SB, and TTho. All authors read and approved the final manuscript.

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Understanding Human–Canid Conflict and Coexistence: Socioeconomic Correlates Underlying Local Attitude and Support Toward the Endangered Dhole (*Cuon alpinus*) in Bhutan

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Understanding human–canid conflict and coexistence must focus on documenting human–canid interactions and identifying the underlying drivers of reciprocal human attitude which enables appropriate strategies to minimize conflict and forge coexistence. The dhole (*Cuon alpinus*), Asia's most widely distributed wild canid, is highly threatened by human persecution and anthropogenic activities. Despite its “endangered” status, its ecological role as an apex predator, negative interactions with humans, and dhole-specific attitude studies are limited, thus hindering the development of a comprehensive dhole-conservation strategy. Here, we investigate the influence of socioeconomic factors of age, gender, income, residency inside/outside a protected area (PA), and other variables (cultural beliefs, livestock loss, and quantity of livestock loss) on the attitudes of local people and support for dhole conservation in the Himalayan Kingdom of Bhutan. We conducted a semi-structured questionnaire survey of 1,444 households located within the PA and non-PA from four representative regions in the country. Using R programming, we ran Pearson's chi-square test of independence to test the overall difference in the attitude and support for dhole conservation, followed by recursive partitioning through a conditional inference regression tree to identify its significant covariates with the highest explanatory power. Majority (79.1%) of respondents ($\chi^2 = 488.6$; $df = 1$; $p < 0.001$) disliked the dhole over those who liked it. More than half (57.7%) ($\chi^2 = 412.7$; $df = 2$; $p < 0.001$) opposed dhole conservation over those who either supported or remained neutral. Experience of livestock loss to dholes was the primary ($p < 0.001$) factor influencing the negative attitude and opposition to dhole conservation, despite an acknowledgment of the ecological role of the dhole in controlling agricultural crop predators. Our study,

which is the first-ever survey in Bhutan, solely focused on investigating human attitudes and perceptions toward the dhole, indicating that livestock loss to dholes transcends all positive attitudes to the species and drives a predominant dislike and opposition to its conservation. To improve the attitude and support toward the dhole and to foster dhole–human coexistence, livestock predation by dholes needs alleviation by improving the existing animal husbandry, in conjunction with promoting conservation awareness on this species.

Keywords: attitude toward wildlife, dhole conservation, endangered canid, human-canid conflict, livestock predation, socioeconomic correlates, human-wildlife coexistence

INTRODUCTION

Canids are globally widespread and face management and conservation challenges (Lamb et al., 2020) from large geographic ranges interspersed with human-modified landscapes (Srivaths et al., 2019). Livestock predation is the main source of conflict between humans and canids (Srivaths et al., 2020), resulting in persecution (Torres et al., 2018), population reduction (Boitani et al., 2004), and even eradication (Karanth et al., 2014; Ugarte et al., 2019) of canids. Notable examples include extermination of the Mexican wolf (*Canis lupus baileyi*) from its natural range (Brown, 1983), extirpation of the African wild dog (*Lycaon pictus*) from 64% of the countries where it historically occurred (Woodroffe et al., 1997), eradication of gray wolves (*Canis lupus*) from most of the United States and Europe (Mech, 1995), and extinction of the Falkland wolf (*Dusicyon australis*; Sillero-Zubiri, 2015).

Ten canid species are from Asia (Din et al., 2013), of which, the Asiatic wild dog or dhole *Cuon alpinus* (Pallas, 1811) is the most widely distributed. This hypercarnivorous (Van Valkenburgh, 1991) pack-hunting apex predator primarily inhabits South and Southeast Asian forests in India, Nepal, Bhutan, China, Myanmar, Thailand, Cambodia, Laos, Malaysia, and Indonesia (Kamler et al., 2015). To aid their movement and dispersal, dholes also use unprotected secondary forests, multi-use forest fragments, and agro-forests adjoining the protected forest reserves (Gangadharan et al., 2016). Although deemed shy and elusive with infrequent interactions with humans (Srivaths et al., 2020), this species has disappeared from ~82% of their former range (Wolf and Ripple, 2017) through habitat loss and human persecution (Karanth et al., 2010). For example, dholes in India were deemed vermin and hunted to near extinction (Cohen, 1978), while in Nepal, dholes were poisoned and shot as pests (Khatiwada et al., 2011). Similarly, dholes in Bhutan were considered pests and subjected to mass poisoning in the 1970s and 1980s (Wang and Macdonald, 2006; Thinley et al., 2011). Recently, dholes in Vietnam have been deemed close to local extinction from hunting, prey decline, and habitat destruction (Hoffmann et al., 2019). The International Union for Conservation of Nature (IUCN) currently lists the dhole as “endangered” based on a population estimate of 4,500–10,500 individuals, of which, only 949–2,215 are mature individuals persisting in small, isolated metapopulations (Kamler et al., 2015).

Dholes in Bhutan have recovered from near extermination (Wang and Macdonald, 2009; Thinley et al., 2018). They have now become widely distributed in the country, with distribution spanning across all districts, PAs, and biological corridors (Thinley et al., 2021). Despite its globally endangered status and ecosystem role as an apex predator (Thinley et al., 2018, 2021), the dhole is not listed in Schedule I of the Forest and Nature Conservation Act of Bhutan which affords maximum legal protection (Namgyal and Thinley, 2017). Conversely, livestock predation by dholes continues to be a contemporary issue with some local persecution of this species (Tshering and Thinley, 2017). Given the endangered status of the dhole, preventing localized extinctions of dholes and promoting dhole–human coexistence requires a better understanding of human–dhole conflict.

However, recent literature on human–predator conflict argues that relevant conflict studies should really be framed as a conflict between humans over wildlife issues (Pooley et al., 2017). Furthermore, assessing the influence of socioeconomic factors on the occurrence and intensification of human–canid conflict substantially contributes to species conservation by providing conflict mitigating decision-making information (Torres et al., 2018). Therefore, understanding this conflict must focus on documenting canid interactions with humans, and identifying the underlying drivers behind reciprocal human attitude (Li et al., 2015; Thinley et al., 2019; Sangay et al., 2020). Identifying these drivers further enables appropriate strategies to minimize conflict (Manfredo, 2008; Mir et al., 2015) and forge coexistence (Bencin et al., 2016). Notable drivers of human attitude toward canids in Asia include socioeconomic correlates of gender (Kusi et al., 2020), occupation (Khan et al., 2019), education (Din et al., 2017), income (Din et al., 2017; Khan et al., 2019), and livestock loss (Srivaths et al., 2020). Additional drivers include perceived cultural significance (Li et al., 2015) and residence relative to protected area landscapes (Kusi et al., 2020).

Regional attitude studies on large canids in the Indian subcontinent (Din et al., 2017; Khan et al., 2019) tend to focus on the gray wolf, which is of least concern to IUCN. Despite being endangered, the dhole has received less conservation attention (Widodo et al., 2020), including discerning socioeconomic correlates driving attitude toward the dhole. Although Srivaths et al. (2019) examined human–dhole interactions in Central India, their study concurrently included other sympatric canids with an overall emphasis on socioeconomic impacts

from livestock loss, without addressing human attitudes and perceptions. Similarly, Katel et al. (2015), Wang and Macdonald (2006), and Tshering and Thinley (2017) investigated dhole-induced livestock predation in Central Bhutan and interviewed local pastoralists to discern socioeconomic correlates from livestock loss. However, their studies also encompassed sympatric carnivores and did not report local perceptions and attitudes specifically toward the dhole. Such attitude studies should also be solely focused on dholes because perceptions of people can be influenced by the presence of sympatric carnivores (Srivaths et al., 2020). This enables a better understanding of driving factors underlying the human–dhole conflict to avoid a reoccurrence of historic mass persecutions previously documented in the Indian sub-continent (Cohen, 1978; Wang and Macdonald, 2006; Khatiwada et al., 2011; Thinley et al., 2011).

The objectives of our study were to document the attitude and support of people toward the dhole in Bhutan, including identifying the underlying socioeconomic driving factors, given the involvement of the species in livestock predation and consequential persecution by locals (Sangay and Vernes, 2008; Thinley et al., 2011; Rajaratnam et al., 2016). We additionally investigated the roles of livestock predation, gender, protected area (PA) residency, and cultural belief in influencing the attitude and support of people toward the dhole. We predicted negative influences from livestock predation and feminine gender on driving the attitude and support for dhole conservation because livestock loss fuels negative attitude toward canid conservation (Wang et al., 2006b; Dressel et al., 2015) and more men exhibited positive attitudes toward large carnivores as in the case of Nepal (Kusi et al., 2020). Protected area residency can positively influence the attitude of people toward wildlife from increased conservation awareness (Thinley et al., 2019). We predicted a positive impact from PA residency similar to more PA residents liking the endangered golden langur (*Trachypithecus geei*) in Bhutan because of their exposure to more conservation awareness programs (Thinley et al., 2019). In addition, PA residents are often more familiar with wildlife conservation efforts because benefits from natural resources provide authorities with an incentive to promote conservation education (Karanth and Nepal, 2012). Cultural and religious beliefs can influence the attitude of people toward wildlife (Dickman, 2010). We predicted a positive influence of cultural beliefs associated with the dhole, based on the premise that dholes would be associated with some local cultural figures that foster positive attitude, such as in the case of the locals in western Nepal positively viewing the tiger (*Pantheratigris*) that is believed as the vehicle of Hindu goddess Durga (Bhattarai and Fischer, 2014).

MATERIALS AND METHODS

Study Area

Bhutan covers a small geographical area of $\sim 38,394 \text{ km}^2$ in the eastern Himalayas and in the Indian subcontinent (Figure 1) with extensive forests encompassing 71% of the country [Forest Resources Management Division (FRMD), 2016]. It is a stronghold for dhole conservation based on its extensive distribution (Thinley et al., 2021). Its forests support rich biodiversity comprising 11,248 species, which include 5,369

and 129 plant and mammal species, respectively [National Biodiversity Centre (NBC), 2017]. The mammalian carnivore community includes four wild canid species: Tibetan wolf (*Canis lupus chanco*), golden jackal (*Canis aureus*), and red fox (*Vulpes vulpes*) (Wangchuk et al., 2004). Prominent livestock predating carnivores include the tiger (*Panthera tigris*), snow leopard (*Panthera uncia*), common leopard (*Panthera pardus*), dhole, Tibetan wolf, Himalayan black bear (*Ursus thibetanus*), clouded leopard (*Neofelis nebulosa*), marbled cat (*Pardofelis marmorata*), golden cat (*Catopuma temmincki*), leopard cat (*Prionailurus bengalensis*), and yellow-throated marten (*Martes flavigula*) (Wangchuk et al., 2004).

Bhutan is divided into 20 *Dzongkhags* (administrative districts; Figure 1) and 205 *Geogs* (sub-districts) with $\sim 51\%$ of the country protected through a network of PAs and biological corridors (Dorji et al., 2019). People live inside PAs based on the traditional land rights where PA governance is shared: local governments administrate people while PA management oversees natural resources. The majority of Bhutanese are Buddhists (80%) with the remaining comprising Hindus, Christians, and other faiths (Thinley et al., 2019). The general topography of the country is steep and rugged (Tshering et al., 2020), resulting in scattered rural settlements housing the majority (62.2 %) of 735,553 people [National Statistics Bureau (NSB), 2017] in the country. Agro-pastoralists subsisting on agricultural farming and livestock rearing (Tshering and Thinley, 2017) occupy areas below 3,500 m. Pastoralists raising yak occupy areas above 3,500 m (Thinley et al., 2017). We conducted our study in four representative regions collectively encompassing 13 dzongkhags, 53 geogs, and four PAs of Bumdeling Wildlife Sanctuary (BWS), Jigme Dorji National Park (JDNP), Royal Manas National Park (RMNP), and Wangchuck Centennial National Park (WCNP; Figure 1).

Survey Design and Data Collection

We designed semi-structured questionnaires (Supplementary File) to elicit unambiguous responses (Vodouh   et al., 2010) and gather information on the perception, attitude, and support toward the dhole. The questions were drafted in English which trained survey enumerators verbally translated into local dialects wherever appropriate. Responses were translated back into English. Questionnaires were initially field-tested in a non-study area, prior to application (Thinley et al., 2019). Field testing enabled identification and reframing of key questions to improve efficiency. Questionnaires were divided into two parts. The socioeconomic profile of a respondent was initially recorded in terms of age, gender, locality (village, geog, dzongkhag, and PA residency), education level (tertiary, secondary, primary; monastic, and none), and annual income in US dollars [low ($<\$1,400$), medium ($\$1,400\text{--}\$13,000$), and high ($>\$13,000$)]. Next, the following information was then discerned:

1. Encounter with dholes (seen/not seen);
2. Attitude (like/dislike) toward dholes and reasons;
3. Cultural beliefs associated with dholes (yes/no) and specifics;
4. Livestock loss to dholes in the last three years (yes/no);
5. Quantity of livestock lost to dholes (if “yes” to 4);

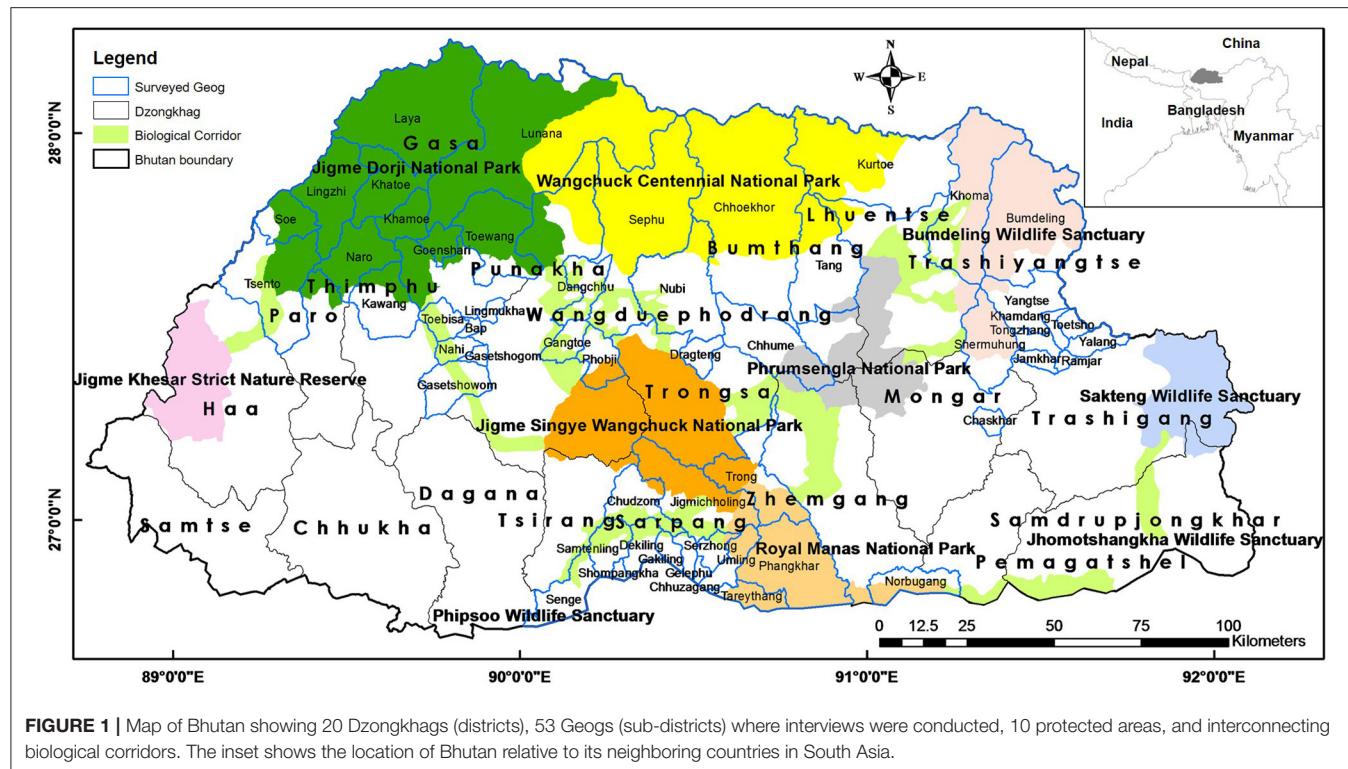


FIGURE 1 | Map of Bhutan showing 20 Dzongkhags (districts), 53 Geogs (sub-districts) where interviews were conducted, 10 protected areas, and interconnecting biological corridors. The inset shows the location of Bhutan relative to its neighboring countries in South Asia.

6. Nomination of the top livestock predator species; and
7. Support increase (yes/no) of dhole populations and reasons.

The perception and attitude of people toward wildlife are influenced by social values and motivational factors, such as economic benefits and innate human tendencies (Kellert, 1993). Therefore, elicited reasons for Question 1 were segregated by physical appearance (cute/ugly/fearful), conservation benefits (beneficial/destructive), aesthetics (does/does not beautify surroundings), rarity (rare/abundant), economics (high/low economic value), religion (has/no religious value), compassion, and peer influence (others like/dislike dholes). We deemed respondents to: (a) “support” dhole conservation if they responded “yes” to population increase (in 7 above); (b) “oppose” dhole conservation if they responded “no” to population increase; and (c) remain “neutral” if no opinion was forthcoming.

To obtain representative samples, the country was stratified into four geographic regions comprising one PA and non-PA per region: JDNP and Wangdue Forest Division in the west; WCNP and Bumthang Forest Division in the center; BWS and Trashigang Forest Division in the east; and RMNP and Sarpang Forest Division in the south (Figure 1). Trained enumerators opportunistically conducted face-to-face interviews on the available households in each region from September to November 2019. Following Thinley et al. (2019), household heads were primarily interviewed, and if unavailable, the next eldest member was interviewed.

Data Analysis

Data were analyzed in program R version 4.0 (R Core Team, 2020). We first performed a Pearson’s chi-square test of independence with Yates’ continuity correction using the R package “MASS” version 7.3–15.5 (Venables and Ripley, 2002) and function “chisq.test,” to test the overall differences in the attitude toward dholes and support for their conservation. We subsequently conducted binary recursive partitioning based on conditional inference trees (Tighe et al., 2012) using the R package “party” version 1.3–4 and the “ctree” function (Hothorn et al., 2006). These regression trees iteratively compare response variables with each explanatory variable, and identify significant covariates with the highest explanatory power through adjusted Bonferroni tests at $p < 0.05$ (Hothorn et al., 2006; Tighe et al., 2012). We chose this method because it provides a more intuitive tool to identify the hierarchical importance of explanatory variables in explaining variations in the dichotomous categorical response variables (Tighe et al., 2012), as recently demonstrated by Thinley et al. (2019) and Sangay et al. (2020). We initially tested “attitude toward dholes” (response variable) against explanatory variables of “age,” “gender,” “annual income,” “education level,” “PA residency,” “dhole encounter,” “local belief on dholes,” “experience of livestock loss to dholes,” and “quantity of livestock lost to dholes.” Next, we reran the analysis to test “support for dhole conservation” (response variable) against the same set of explanatory variables but with “attitude” as an additional explanatory variable.

TABLE 1 | Socioeconomic variables of 1,444 respondents in rural Bhutan with respect to attitude and support toward the dhole (*Cuon alpinus*), based on a questionnaire survey from September to November 2019.

Socioeconomic variables	Levels	Attitude toward dholes		Support toward dhole conservation		
		Like	Dislike	Support	No support	Neutral
Gender	Male	(15.1) 218	(47.2) 681	(23.2) 335	(32.8) 474	(6.2) 90
	Female	(5.8) 84	(31.9) 461	(13.1) 189	(20.7) 299	(3.9) 57
Age	18–19 (teen)	(0.1) 1	(0.4) 6	(0.1) 2	(0.2) 3	(0.1) 2
	20–29 (twenties)	(2.4) 34	(10.7) 154	(4.1) 59	(7.5) 109	(1.4) 20
	30–39 (thirties)	(4.5) 65	(17.9) 258	(8.4) 121	(12.3) 178	(1.7) 24
	40–49 (forties)	(5.5) 80	(20.4) 294	(9.2) 133	(13.8) 199	(2.9) 42
	50–59 (fifties)	(4.4) 64	(13.5) 195	(7.1) 102	(9.1) 132	(1.7) 25
	60–69 (sixties)	(3.0) 43	(12.0) 173	(5.7) 82	(7.5) 109	(1.7) 25
	70–79 (seventies)	(1.0) 15	(3.7) 53	(1.7) 24	(2.6) 37	(0.5) 7
Education	80–89 (eighties)	(0.0) 0	(0.6) 9	(0.1) 1	(0.4) 6	(0.1) 2
	College	(0.3) 4	(0.6) 8	(0.5) 7	(0.2) 3	(0.1) 2
	High school	(1.5) 22	(4.0) 58	(1.5) 22	(3.5) 50	(0.6) 8
	Primary school	(2.6) 38	(8.9) 128	(4.7) 68	(5.3) 76	(1.5) 22
	Non-formal	(4.6) 67	(17.7) 256	(7.5) 108	(12.3) 177	(2.6) 38
Income	None	(11.8) 171	(47.9) 692	(22.1) 319	(32.3) 467	(5.3) 77
	Low (<1,400/year)	(11.7) 169	(45.2) 652	(21.3) 307	(30.1) 434	(5.5) 80
	Medium (1,400–13,000/year)	(9.0) 130	(33.7) 486	(14.8) 214	(23.3) 336	(4.6) 66
Location of residence (with respect to a protected area)	High (>13,000/year)	(0.2) 3	(0.3) 4	(0.2) 3	(0.2) 3	(0.2) 3
	Inside	(11.8) 171	(39.5) 570	(15.4) 223	(29.9) 432	(6.0) 86
	Outside	(9.1) 131	(39.6) 572	(20.8) 301	(23.6) 341	(4.2) 61
Encounter (seen a dhole)	Yes	(14.4) 208	(54.6) 788	(22.5) 325	(41.2) 595	(5.3) 76
	No	(6.5) 94	(24.5) 354	(13.8) 199	(12.3) 178	(4.9) 71
Local belief on dhole	Yes	(3.9) 57	(10.1) 146	(5.5) 80	(7.7) 111	(0.8) 12
	No	(17.0) 245	(69.0) 996	(30.7) 444	(45.8) 662	(9.3) 135
Experienced livestock loss to dholes	Yes	(7.3) 105	(38.5) 556	(11.9) 172	(33.9) 489	(0.0) 0
	No	(13.6) 197	(40.6) 586	(24.4) 352	(19.7) 284	(10.2) 147

Values are shown as (percentage of respondents) and number of respondents. Annual income is in U.S. dollars.

RESULTS

Socio-Demography

We interviewed respondents from 1,444 households, of which, 62.3% were men and 37.7% were women, with similar proportions residing inside (51.3%) and outside (48.7%) PAs (Table 1). Ages ranged from 18 to 84 with most belonging in the age class 40–49 years (25.9%), followed by 30–39 years (22.4%), 50–59 years (17.9%), and 18–19 years (0.5%). More than half (59.8%) had no education while the rest were educated formally (17.9%) and informally (22.4%) (Table 1). Most households (56.9%) earned less than US \$1,400 per year while 42.7% earned between US \$1,400 and US \$13,000 per year (Table 1). Only 0.5% earned more than US \$13,000 per year. More respondents had encountered a dhole (69%) than those who had not (31%) (Table 1).

Local Beliefs Associated With Dholes

Only 14% ($n = 203$) of respondents held local beliefs associated with dholes (Table 1). The majority (90.1%) of beliefs were associated with deities. These portrayed dholes as hunter dogs of local (60.1%) and national deities (21.7%);

manifestation of local deities (3%); and retribution from unappeased deities (5.4%). Some believed dholes to indicate good luck (0.5%), good harvest (2%), and misfortune (2%). A few revered dholes as guard dogs of Hindu Lord Rama (1.5%), equated their red coat to monks (2%) and perceived them as farm protectors (0.5%).

Livestock Depredation by Wild Carnivores

Less than half (45.8%; $n = 661$) of households experienced livestock loss to dholes in the last 3 years (2017–2019). Among those who lost livestock to dholes, some lost more than one livestock type such that 80.6% lost 1,433 cattle; 18.5% lost 255 horses; 12.4% lost 312 yaks; 3.8% lost 59 others (poultry and pets); 1.8% lost 49 sheep; and 1.5% lost 15 goats. On average, a household lost 3.2 livestock heads to dholes. Dholes were identified as the top livestock depredator by 41.1% of the total respondents, followed by common leopards (22%), tigers (11.6%), snow leopards (8.1%), small felids (marbled cat, golden cat, and leopard cat) as a collective group (5.5%), Himalayan black bears (5.3%), yellow-throated martens (4.8%), Tibetan wolves (1.4%), and clouded leopards (0.2%).

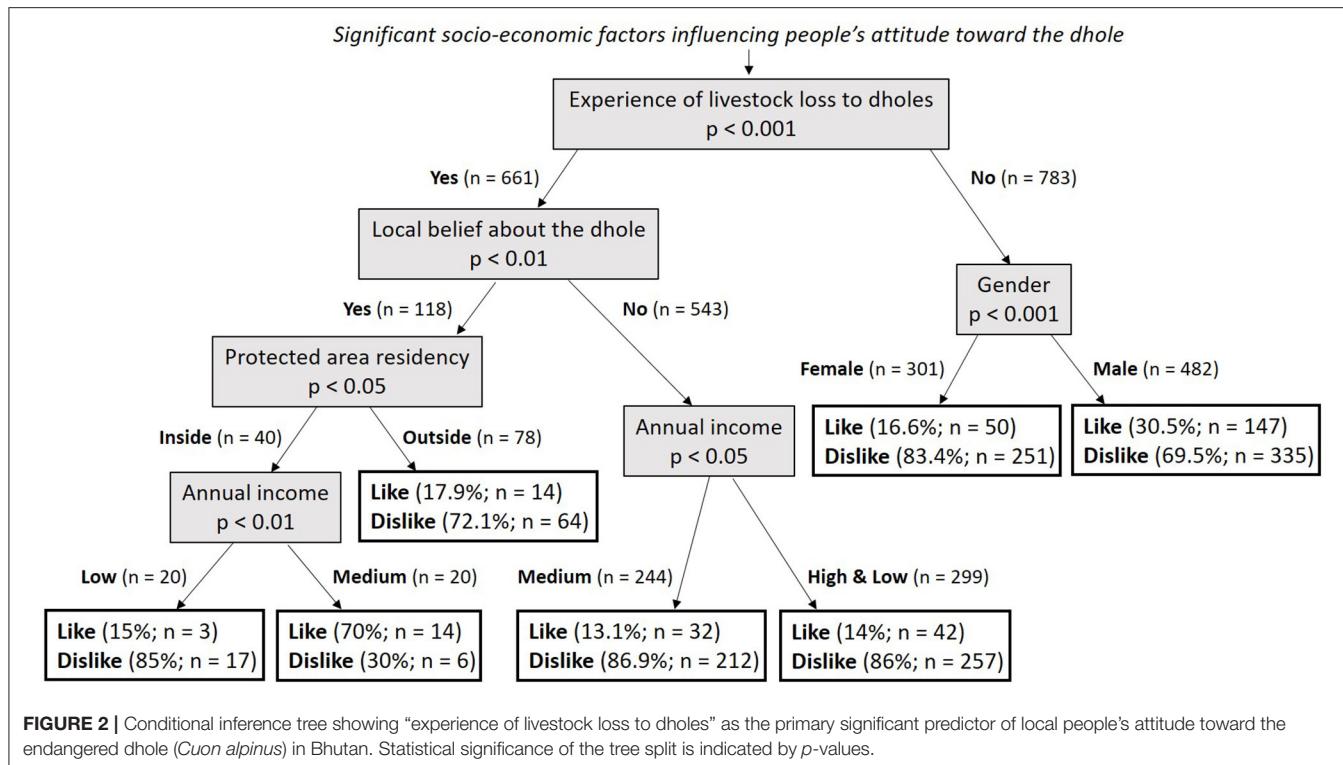


FIGURE 2 | Conditional inference tree showing “experience of livestock loss to dholes” as the primary significant predictor of local people's attitude toward the endangered dhole (*Cuon alpinus*) in Bhutan. Statistical significance of the tree split is indicated by *p*-values.

Drivers of Attitude Toward Dholes

The majority of respondents (79.1%; $n = 1,142$) significantly disliked dholes ($\chi^2 = 488.6$; $df = 1$; $p < 0.001$) over those who liked them (20.9%; $n = 302$). The primary reasons were livestock predation (79.9%) followed by non-religious significance (8.8%). Secondary reasons included its fearful appearance (6.4%) and a plain dislike (2.8%). Lack of aesthetic (0.9%), abundant in nature (0.3%), and economic values (0.3%) were other minor reasons. Reasons encompassing legal restrictions and the stigma of a bad omen constituted 0.8% dislike for dholes. Conversely, respondents primarily liked dholes for their ecological role (51%). Other major reasons for liking dholes were the perceptions that dholes had a cute and cuddly appearance (10.3%), are rare (7.3%), have aesthetic value (6.3), and have religious significance (6%), and due to innate fondness for the species (5.6%). Compassion (2.3%) and economic value (2%) were minor reasons for liking dholes. Additional collective reasons included inquisitiveness about dholes and their non-harm to both crops and humans (9.3%).

“Experience of livestock loss to dholes” was the primary significant ($p < 0.001$) determinant of the attitude toward dholes (like/dislike; **Figure 2**). Among those who experienced livestock loss (45.8%; $n = 661$), with or without “local beliefs on dholes” (17.9%; $n = 118$) significantly ($p < 0.01$) further drove attitude. However, for the majority without holding any beliefs (82.1%; $n = 543$), “annual household” income significantly ($p < 0.05$) influenced attitude, whereby, the majority of all income groups (86.4%; $n = 469$) disliked the species (**Figure 2**). Among those holding local beliefs, “PA residency,” significantly ($p < 0.05$)

influenced attitude (**Figure 2**). For PA residents (33.9%; $n = 40$), “annual income” further determined attitude ($p < 0.01$). Majority (85%; $n = 17$) of low-income households disliked dholes while the majority (70%; $n = 14$) of medium income households liked dholes. Similarly, the majority (72.1%; $n = 64$) of non-PA residents with holding local beliefs disliked dholes. Among respondents who did not experience livestock loss to dholes (54.2%; $n = 783$), “gender” significantly ($p < 0.001$) influenced attitude. Both sexes disliked dholes with women (83.4%; $n = 251$) professing more dislike than men (69.5%; $n = 335$; **Figure 2**).

Drivers of Support for Dhole Conservation

Majority (57.7%; $n = 834$) of respondents significantly opposed dhole conservation ($\chi^2 = 412.7$; $df = 2$; $p < 0.001$) over those who supported it (35.7%; $n = 515$) and remained neutral (6.6%; $n = 95$). Fear of increased livestock predation by dholes (88.6%) primarily drove opposition to dhole conservation (**Figure 3**). Lack of government compensation for dhole-induced livestock loss (6.5%) contributed to a much lesser extent. A small proportion of respondents also listed the lack of economic value of the dhole (1.4%), its increased threat to humans (1.7%), and its fearful appearance (1.4%) as additional factors (**Figure 3**). Other collective minor reasons for opposing dhole conservation included an inherent dislike and reference to an established high population of dholes (0.4%; **Figure 3**). Less crop damage from wild herbivores (82.1%) was the main reason for supporting dhole conservation (**Figure 3**).

“Experience of livestock loss to dholes” was again the primary significant ($p < 0.001$) predictor of support for dhole

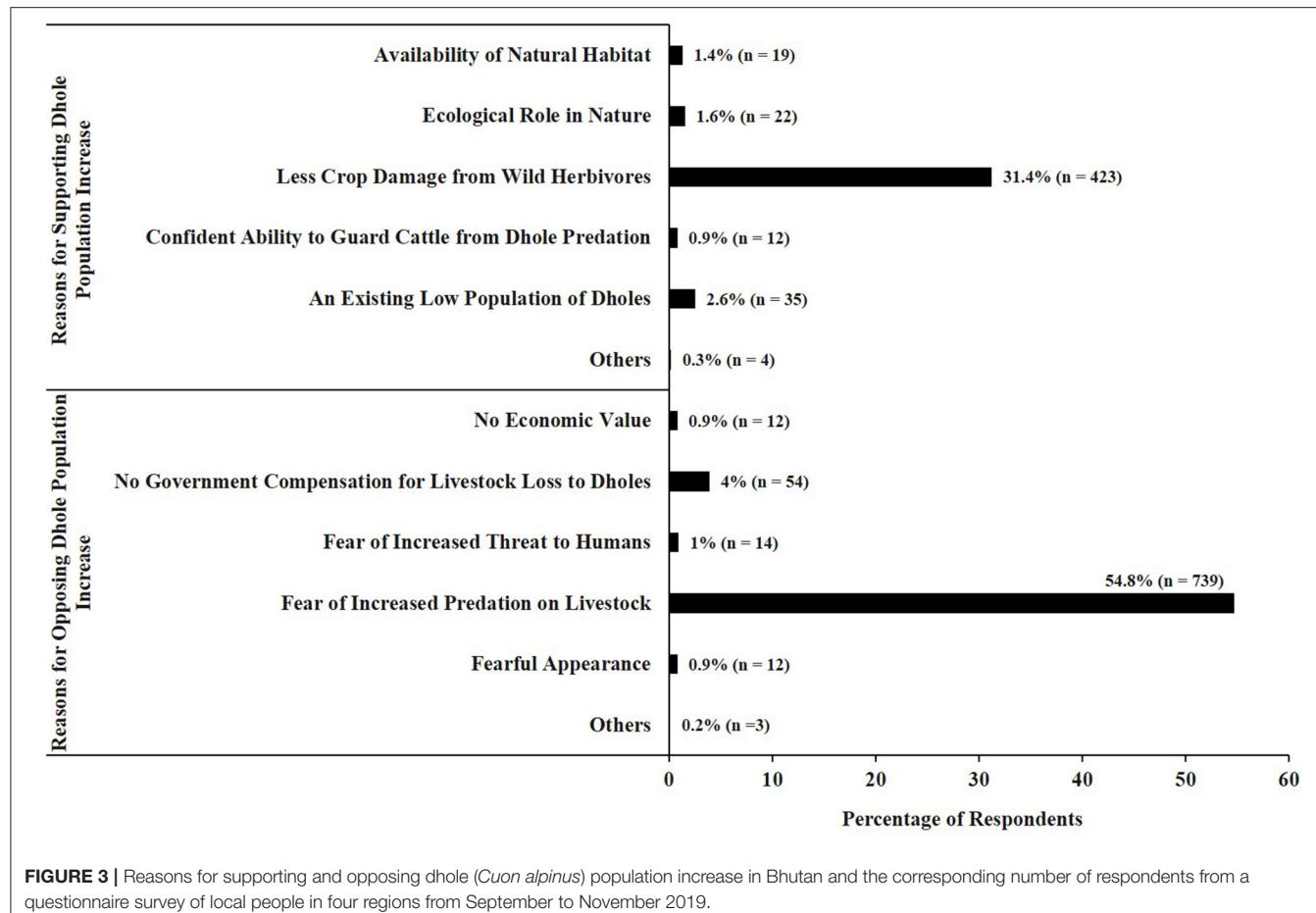


FIGURE 3 | Reasons for supporting and opposing dhole (*Cuon alpinus*) population increase in Bhutan and the corresponding number of respondents from a questionnaire survey of local people in four regions from September to November 2019.

conservation (Figure 4). Among those who experienced livestock loss, “PA residency” significantly ($p < 0.001$) impacted local support particularly among non-PA residents (50.4%; $n = 333$) in terms of “quantity of livestock lost to dholes” (Figure 4). Those who lost >1 livestock (58.3%; $n = 194$) were significantly ($p < 0.001$) further influenced by their attitude, whereby, majority (80.6%; $n = 133$) of those disliking dholes ($n = 165$) opposed dhole conservation. Of the remaining 15% ($n = 29$) who liked dholes, 41.4% ($n = 12$) still opposed dhole conservation (Figure 4). Similarly, almost half (46.8%; $n = 65$) of non-PA residents who lost ≤ 1 livestock to dholes opposed dhole conservation. Opposition to dhole conservation was also substantial among PA residents who experienced livestock loss to dholes (49.6%; $n = 328$) with an overwhelming majority (85.1%; $n = 279$) opposing dhole conservation (Figure 4). Support for dhole conservation among respondents not experiencing livestock loss to dholes (54.2%; $n = 783$) was significantly ($p < 0.001$) influenced by “attitude” (Figure 4). The majority (74.8%, $n = 586$) disliked dholes, of which, 42.7% ($n = 250$) opposed dhole conservation; 37.9% ($n = 222$) supported dhole conservation; and 16.8% ($n = 114$) remained neutral. Of the minority (25.2%, $n = 197$) who liked dholes, 66% ($n = 130$) supported dhole conservation; 17.2% ($n = 34$) opposed dhole conservation; and 16.8% ($n = 33$) remained neutral (Figure 4).

DISCUSSION

Attitude and Support Toward the Dhole

We conducted the first-ever survey in Bhutan solely focused on investigating human attitudes and perceptions toward dholes, by interviewing 1,444 rural residents across protected and non-protected landscapes. To date, only Jenks et al. (2014) had conducted a similar attitude survey on dholes in south eastern Thailand involving 791 rural people residing outside PAs. In their study, negative local attitude to dholes was largely influenced by fear of personal attack. We also discerned a negative attitude among the majority of respondents (79.1%; $n = 1,142$), which contrastingly, was primarily driven by livestock predation as anticipated. Respondents listed dholes as the top livestock predator as observed in western Bhutan (Katel et al., 2015) and the neighboring Indian state of Arunachal Pradesh (Lyngdoh et al., 2014). In our study, 661 households lost 2,123 livestock to dholes from 2017–2019, constituting an average loss of 3.2 livestock per household. Previous studies in Bhutan (Norbu, 2014; Dorji, 2017; Tshering and Thinley, 2017) also documented high levels of dhole-related livestock predation over comparable timeframes, ranging from 35 to 82% loss in livestock comprising cattle, yak, and horses. This livestock loss resulted in a substantial negative

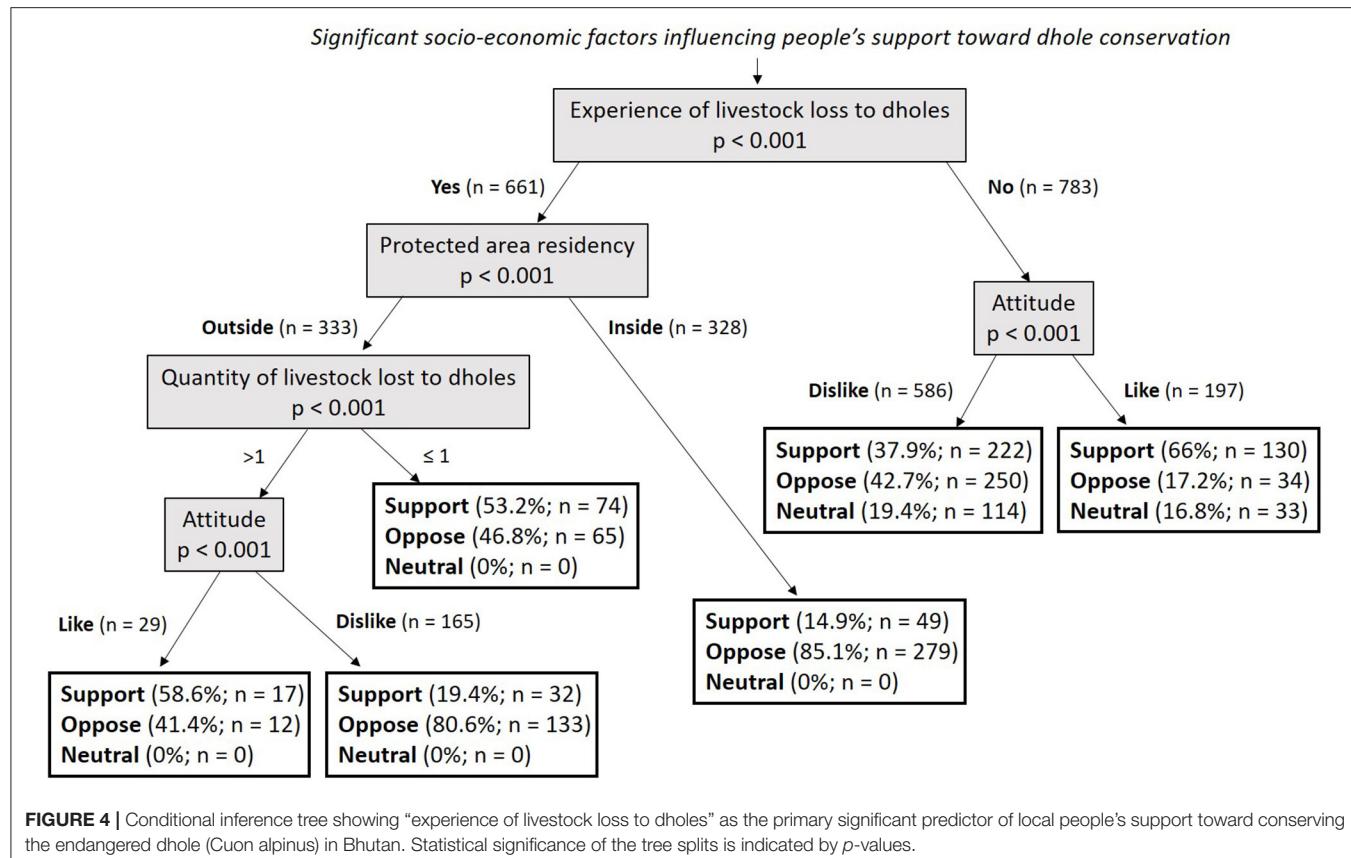


FIGURE 4 | Conditional inference tree showing “experience of livestock loss to dholes” as the primary significant predictor of local people's support toward conserving the endangered dhole (*Cuon alpinus*) in Bhutan. Statistical significance of the tree splits is indicated by *p*-values.

attitude to dholes (Wang and Macdonald, 2006; Katel et al., 2015).

A similar negative attitude toward dholes stemming from livestock loss also exists across their distributional range in a current review by Srivaths et al. (2020) which linked dhole diet with livestock consumption and human–dhole interaction. It supports the premise of Bickley et al. (2019) which stated that people who experienced livestock predation by wild canids were more likely to dislike them due to economic loss (Lindsey et al., 2005). Our study showcases this dislike because livestock loss presents a significant socioeconomic setback to rural farmers in the predominantly agrarian society of Bhutan (Sangay and Vernes, 2008; Rajaratnam et al., 2016). Yak loss results in sizable income loss to upland pastoralists, while cattle loss compromises agricultural production and nutrition for lowland agro-pastoralists.

Ahmad et al. (2016) noted that pastoral communities experiencing human–carnivore conflict tend to have low income with low tolerance to carnivores and their conservation, as observed in our study. Consequentially, a prevalent negative attitude driven by livestock predation precluded local support for dhole conservation as we postulated. Approximately 53.5% ($n = 773$) of our respondents opposed conserving dholes because of socioeconomic impacts from livestock predation. Katel et al. (2015) also noted hostility to conservation by farmers in western Bhutan who experienced severe (82%) livestock loss to dholes.

Similarly, locals in the neighboring Indian Arunachal Pradesh supported reducing dholes because of livestock loss (Lyngdoh et al., 2014). As observed in our study, human intolerance and opposition to canid conservation due to socioeconomic loss from livestock predation has been established elsewhere: the Indian gray wolf in the Hindu Kush region (Din et al., 2013; Khan et al., 2019) and Pamir Mountains (Din et al., 2017) of Pakistan; Himalayan wolf in Nepal (Kusi et al., 2020); endangered Ethiopian wolf (*Canis simensis*) in south Wollo, Ethiopia (Eshete et al., 2018); gray wolf in the Carpathian Mountains, Slovakia (Rigg et al., 2011); African wolf (*Canis lupaster*) in Guassa Highlands, Ethiopia (Atickem et al., 2017); African wild dog in Kenya (Woodroffe et al., 2005); and chilla (*Lycalopex griseus*) in Chile (Silva-Rodriguez et al., 2009).

Effect of PA Residency on Attitude and Support

Contrary to our expectation, PA residency was inconsequential in driving the positive attitude to dholes and supporting dhole conservation. Dislike for dholes and their conservation was evident across the majority of the respondents, but more so among PA residents. Substantial intolerance by PA residents is because grazing in PAs increases the risk of livestock loss (Li et al., 2017) as alternate prey to predators (Karanth et al., 2013). For example, residents in Kanha, India, experienced substantive livestock predation through grazing activities in

PA (Karanth et al., 2012). Recently, Letro and Fischer (2020) found that biological corridor residents in Bhutan deemed tiger conservation unimportant due to livestock predation, while the majority of residents in Musk Deer National Park, Pakistan wanted to eliminate carnivores from the park due to socioeconomic loss from livestock predation (Ahmad et al., 2016). Non-PA residents experience livestock predation because dispersing wildlife from PA (Woodroffe et al., 2005) create conflict outside reserve boundaries (Karanth et al., 2013). This creates animosity as exemplified by the majority of residents near Tarangire National Park in Tanzania desiring a reduction in carnivore populations to reduce threats to livestock and humans (Mkonyi et al., 2017).

Contrastingly, residents in the Kanchenjunga Conservation Area of Nepal had higher tolerance to carnivores than non-residents despite suffering livestock predation, largely due to a community-owned conservation approach (Kusi et al., 2020). Residents outside Kalakkad-Mundanthurai Tiger Reserve in India regularly experienced livestock predation by leopards but exhibited a positive attitude from heightened conservation awareness (Krishnakumar and Nagarajan, 2020). Estifanos et al. (2020) also noted PA agro-pastoralists wanting to conserve and increase endangered Ethiopian wolf populations in the Bale Mountains National Park of Ethiopia, due to financial incentives from wolf-related tourism. However, a large proportion of non-park residents observed in the study by Estifanos et al. (2020) did not support wolf conservation due to a perceived notion of not accessing rewards from wolf-based tourism.

Influence of Gender on Attitude and Support

Although most male and female respondents disliked dholes and opposed their conservation (Table 1), our premise that more women than men will dislike dholes and oppose their conservation was upheld. Indeed, our data revealed more men liked dholes (15.1%; $n = 218$) and supported dhole conservation (23.2%; $n = 335$) than women (like: 5.8%, $n = 84$; support: 13.1%, $n = 189$). Kusi et al. (2020) stipulated that fewer men favored large predators in Nepal because men were seasonally migrating to cities for work and were not experiencing livestock depredation by wild predators as much as women were. In our study, both men and women were residents all year and were engaged in outdoor activities, such as crop cultivation and collection of fuelwood and non-timber forest products (Thinley et al., 2019), and were thus considered to be equally exposed to livestock predation. It is likely that the prevalent negative attitude of women to dholes reflects a greater fear of carnivores (Mir et al., 2015) and dislike of fearsome species (Schlegel and Rupf, 2010). Such profound negativity can also be attributed to the lack of aesthetic appeal of dholes compared to other predators (Khatiwada et al., 2011).

Role of Cultural Belief on Attitude

In our study, only 14.1% ($n = 203$) of respondents held beliefs associated with dholes. A majority believed dholes as hunter dogs for local and national deities amidst an entrenched Buddhist reverence for deities (Allison, 2019), whereby, regular

rituals are undertaken in pursuit of good health, bountiful crops, and livestock protection. For those culturally aware, livestock predation by dholes was viewed as retribution by unappeased deities. In a previous study, Katel et al. (2015) noted religious tolerance by Bhutanese farmers amidst strong prejudice toward dholes because of their predisposition to disemboweling and feeding on alive prey (Wangchuk, 2004). While we anticipated some acceptance (Srivaths et al., 2019) through this legacy of cultural reverence (Karanth et al., 2013), but a strong negative attitude still prevailed. This contrasts Buddhist pastoral communities in the Qinghai-Tibetan Plateau being highly tolerant of livestock predating carnivores (Suryawanshi et al., 2014) by the virtue of sacred mountains around Buddhist monasteries being safe havens for snow leopards and wolves (Li et al., 2015). Similarly, local residents in the South-Western Ghats of India viewed leopards positively and refrained from religiously forbidden lethal retaliation (Krishnakumar and Nagarajan, 2020). Bagchi and Mishra (2006) noted that despite resentment to large carnivores in Nepali pastures, people did not actively persecute them because of cultural and religious reasons. Contrastingly, residents of Musk Deer National Park in Pakistan bitterly detested Indian gray wolves, which was further exacerbated by a cultural perception of wolf tyranny, cowardice, and cruelty (Ahmad et al., 2016). In this study, we can only surmise that pervasive socioeconomic effects from livestock loss overshadowed any cultural and/or religious beliefs on dholes. This was especially evident in the severe dislike of dholes by culturally aware low-income PA residents, and strong opposition to their conservation by those who lost more than one livestock to dholes.

Role of Age and Education Level

The age of respondents in our study did not influence attitude to dholes, despite older generations elsewhere negatively viewing carnivores (Lindsey et al., 2005) from bad interactions (Bencin et al., 2016). For example, Røskaft et al. (2007) found that older, poorer Norwegian men exhibited more negative attitudes toward European wolves. Zimmermann et al. (2005) also noted older cattle ranchers in Brazilian Pantanal exhibiting entrenched negativity to jaguars (*Panthera onca*). We also did not determine any influence from education level on the attitude to dholes and their conservation, although education has driven positive attitudes on the notable livestock-depredating large canids like the European wolf (Røskaft et al., 2007), Ethiopian wolf (Eshete et al., 2018), and Indian gray wolf (Din et al., 2017; Khan et al., 2019). Instead, negative attitudes to dholes expressed by educated respondents in our study were primarily driven by livestock loss.

Importance of Knowledge on the Ecological Role of Dhole

Some respondents experienced livestock loss to dholes but still liked the species (7.3%; $n = 105$) and supported its conservation (11.9%; $n = 172$). They acknowledged the ecological role of the dhole in controlling crop raiders like wild pigs (*Sus scrofa*), sambar (*Rusa unicolor*), and muntjac (*Muntiacus muntjac*). The wild pig is the principal crop raider across Bhutan (Wang et al., 2006a) and studies (Wangchuk, 2004; Thinley et al., 2018)

show dholes effectively predating on wild pigs as pack hunters against this gregarious and prolific breeder. It is believed that wild pig populations surged with subsequent increased crop loss several years after a mass poisoning campaign that almost extirpated the dholes in the 1970s and 1980s (Wangchuk, 2004; Thinley et al., 2011). Dholes in concert with common leopards are known to predate on crop raiding ungulates at village cropland peripheries when tigers are present in the environs (Thinley et al., 2017, 2018). A recent study by Bickley et al. (2019) also demonstrated support by local residents for conserving Cerrado canids, such as hoary fox (*Lycalopex vetulus*), crab-eating fox (*Cerdocyon thous*), and maned wolf (*Chrysocyon brachyurus*), ecologically controlling rodent and insect pests in the central Brazilian ranches. Indeed, the dhole is deemed as the top keystone carnivore in Bhutan and elsewhere in its range (Thinley et al., 2021).

Conservation Implications

Our study indicates that livestock loss to dholes transcends all positive attitudes to dholes and drives a predominant dislike and opposition to their conservation, as noted by Srivaths et al. (2020) in parts of the distributional range of the dhole. Lax herding primarily contributes to livestock predation throughout protected and non-protected Bhutanese landscapes (Wang and Macdonald, 2006; Rajaratnam et al., 2016; Tshering and Thinley, 2017). In the wet season, when grass is abundant, farmers, particularly the agro-pastoralists, freely graze their untended cattle and horses in forests during the day whilst tending to crops and retrieve them in the evening. Livestock is thus prone to successful predation (Tshering and Thinley, 2017) because they are easy to catch (Palmeira et al., 2008) when dholes are most active, as evidenced by Woodroffe et al. (2005) for African wild dogs. Livestock predation rarely occurred in the dry season when livestock was tethered near homesteads and fed with crop residue (Thinley et al., 2011). Untended livestock grazing has also been noted as a key factor behind livestock predation by Indian gray wolves in Hindu Kush, Pakistan (Khan et al., 2019), common leopards in Maharashtra, India (Donikar et al., 2011), and snow leopards in Mongolia (Johansson et al., 2015).

To improve the human attitude, support for conserving dholes, and foster dhole–human coexistence in Bhutan, it is imperative to minimize livestock predation by addressing prevailing lax herding practices among rural agro-pastoralists. It is so because improvements in livestock husbandry can minimize livestock loss to predators and mitigate human–carnivore conflicts (Ogada et al., 2003; Gusset et al., 2009). Katel et al. (2015) recommend stall-feeding and cooperative herding of livestock in the forests during the day. Customized livestock corrals (Loveridge et al., 2017) and non-grazing of livestock in depredation-prone areas (Sangay and Vernes, 2008) are other plausible solutions. These measures are feasible based on the willingness of some of the respondents to modify traditional herding practices. Compensation and insurance schemes can also offer some economic offsets to livestock loss, but have inherent issues in the misuse and/or equitable market value of livestock (Torres et al.,

2018; Kusi et al., 2020). The ecological role of the dhole in controlling crop predators also needs wider promotion to rural agro-pastoralists to improve attitude, harness greater support for dhole conservation, and ensure harmonious co-existence.

An expanding human footprint poses increasing challenges to ensure the persistence of carnivores in human-dominated landscapes (Lamb et al., 2020), and this especially resonates for global canids. Our study indicates that dholes in Bhutan may be at the crossroads between persistence and increasing adversity from humans. Given the higher propensity of studies on human–felid interactions over those on human–canid interactions (Srivaths et al., 2020), we advocate more dedicated attitude studies on dholes throughout their range to ensure the survival of this globally endangered canid. This approach is equally applicable in discerning conservation measures for other globally endangered canids in human-dominated landscapes.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Department of Forest and Park Services, Bhutan. The interview respondents provided their verbal informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

PT: conceptualization, study design, data curation, formal analysis, and writing the original draft. RR: conceptualization, validation, writing, review, and editing. LN, LD, JT, CN, CY, TW, SW, TD, and ST: data collection and data entry. CW: data curation, formal analysis, writing, and review. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fcosc.2021.691507/full#supplementary-material>

Supplementary File | Study Questionnaire.

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From Conflict to Conviviality? Transforming Human–Bear Relations in Bulgaria

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The question of how to transform human–wildlife relations from conflict to coexistence, rather than merely mitigating conflicts, has become a central focus of research and practice. In this article, we address this important question by exploring the factors that may contribute to promoting successful coexistence between humans and brown bears within Europe and elsewhere. We do this through comparative analysis of two cases in rural Bulgaria evidencing different degrees of conflict and coexistence between members of the two species. Through this comparison, we highlight the main factors that lead to conflict in our problem case as well as those that might help to instead foster coexistence. We situate this analysis within growing discussion of convivial conservation as a novel approach intended to transform conservation policy and practice throughout the world that emphasizes the importance of attending to the overarching social and political-economic processes encompassing human–wildlife interaction in order to influence the latter. In this way, we contribute to research and discussion concerning how to transform human–wildlife conflict (HWC) into convivial coexistence more broadly by demonstrating how attention to the immediate circumstances of human–wildlife encounter in such efforts should be complemented by promotion of more inclusive, democratic forms of decision-making, and egalitarian distribution of economic resources.

Keywords: human–wildlife conflict, coexistence, convivial conservation, brown bear, Bulgaria

INTRODUCTION

Current discussions concerning nature conservation address both the shortcomings of historical attempts to preserve biodiversity and potential ways to redress such issues in pursuit of more successful and just preservation of non-human nature moving forward (e.g., Marrs, 2011; Wuerthner et al., 2015; Büscher and Fletcher, 2020). Within such discussions, many agree that we need better relations with non-human nature transcending the strict borders and dichotomies characterizing conventional conservation approaches focused on creation and enforcement of protected areas (PAs). Consequently, the concepts of coexistence, cohabitation, and conviviality are becoming central to research and discussion (Hinchliffe and Whatmore, 2006; Boonman-Berson et al., 2016; Frank and Glikman, 2019; Büscher and Fletcher, 2020). This growing currency is accompanied by calls to replace the “negativity” implied in the term human–wildlife *conflicts* (HWC) with a more positive focus on encouraging coexistence (Frank and Glikman, 2019), as well as to reform the problematic concept of wildlife *management* considered overly instrumental and anthropocentric (Boonman-Berson et al., 2016).

The question of how to transform human–wildlife relations from conflict to coexistence, rather than merely mitigating conflicts, has thus become a central focus of attention (e.g., Frank and Glikman, 2019; Büscher and Fletcher, 2020; Hodgson et al., 2020). A focus on nurturing coexistence is essential in particular to the novel “convivial conservation” approach grounded in the idea that humans and animals can and should live together within shared landscapes (Büscher and Fletcher, 2020), but which goes beyond this narrow focus on the immediate circumstances of human–wildlife interaction to also emphasize the importance of attending to the overarching social and political-economic processes within which such interaction occurs.

Fostering coexistence is considered particularly challenging in the case of large carnivores such as the brown bear (*Ursus arctos*), the focus of the present article. Like other large carnivores, the brown bear is considered a keystone species, attributed with controlling ungulate population density and thus preserving vegetation structure and plant diversity within the ecosystem it inhabits (Van Valkenburgh and Wayne, 2010). It is also particularly sensitive to human influence (Woodroffe and Ginsberg, 1998) which increases its vulnerability to anthropogenic change and extinction through impacts such as habitat loss and degradation, depletion of prey, persecution, hunting, and exploitation (Karanth and Chellam, 2009). In many cases, the overlapping presence of brown bears and humans in multi-use landscapes increases the likelihood of conflict and reduces local human populations’ tolerance of the animals’ presence (Treves and Karanth, 2003; Temple and Terry, 2007).

In this article, we address this important issue by exploring the factors that may contribute to promoting successful coexistence between humans and brown bears within Europe and elsewhere. We do this through comparative analysis of two cases in Bulgaria evidencing different degrees of conflict and coexistence between members of the two species. In previous articles, we focused on a case in Bulgaria’s Rodopi mountains in which people and bears have learned to cohabit in relative harmony (see Toncheva and Fletcher, 2021; Toncheva et al., in press). As this case is rather exceptional, we complicate our analysis here by introducing a different case in the same region wherein humans and bears face a number of obstacles inhibiting this same sort of peaceful cohabitation. In this article, we focus on developing a detailed description of this second case, while due to space constraints we introduce the first case via reference to our previously analyses published elsewhere (see Toncheva and Fletcher, 2021; Toncheva et al., in press). Through comparison of the two cases, we aim to highlight the main factors that led to conflict in this case as well as those that might help to instead foster coexistence. In this way, we contribute to growing discussions concerning how to transform HWC into coexistence more generally by drawing on the convivial conservation approach to demonstrating how promotion of coexistence in human–wildlife relations can be complemented by promotion of more inclusive, democratic forms of conservation decision-making, and egalitarian distribution of economic resources.

We begin by situating our study within overarching discussions concerning HWC and coexistence. We then move to the specific cases, outlining our methodology emphasizing a

multispecies research approach. Following this, we outline the results of our study, explaining the various factors that seem to have contributed to exacerbating human–bear conflict in this area. We then compare this case with results of our previous research in a different case exhibiting relatively successful coexistence in order to illuminate the characteristics accounting for this difference. We conclude by highlighting the implications of our analysis for the broader discussion regarding how to transform HWC into coexistence in relation to the convivial conservation proposal.

FROM CONFLICT TO COEXISTENCE

Until recently, human–wildlife interactions were predominantly studied by a broad interdisciplinary field in their negative connotation as HWC (see Margulies and Karanth, 2018; Frank and Glikman, 2019). From this perspective, HWC is addressed predominantly in terms of its negative economic and ecological impacts on local communities and wildlife populations (Barua et al., 2013; Margulies and Karanth, 2018). Conflicts are believed to arise especially when activities of humans and wildlife intersect (Treves et al., 2006; Boonman-Berson et al., 2019), leading to unwanted results for both wildlife and local communities who pay the costs for living with wild animals. From the humans’ perspective, this is commonly interpreted as the animals’ exceeding a threshold of social carrying capacity or cultural tolerance (e.g., Carpenter et al., 2000; Brenner and Metcalf, 2020). Particularly in the case of large carnivores, there has historically been widespread belief among both conservationists and policy-makers that such animals cannot coexist with humans (Treves et al., 2006).

A growing body of research demonstrates, however, that coexistence is indeed possible in certain cases, for instance in human–tiger relations in Nepal (Carter et al., 2012) and human–brown bear relations in Bulgaria (Toncheva and Fletcher, 2021; Toncheva et al., in press). Therefore, researchers increasingly assert that “[t]here is a need to consider conflict and coexistence as they relate to each other” (Frank and Glikman, 2019, p. 11). Promotion of coexistence is based on the presumption that humans and animals are able to inhabit a common, or at least overlapping, landscape in relative harmony (Hinchliffe, 2007). According to Frank, “coexistence takes place when the interests of humans and wildlife are both satisfied, or when a compromise is negotiated to allow the existence of both humans and wildlife together” (Frank, 2016, p. 739). There is no agreement, however, regarding how to precisely define the term while there exist diverging understandings which ranges from mere mutual tolerance (Woodroffe et al., 2005), to peaceful cohabitation (Hinchliffe, 2007) to active co-adaptation (Boonman-Berson et al., 2016; Carter and Linnell, 2016), and conflict negotiation (Yurco et al., 2017). To accommodate such diversity, Frank (2016) proposes the idea of a *coexistence continuum* ranging from simple tolerance at one end to active co-creation of shared space at the other.

Whatever one’s preferred definition, the central challenge faced in such discussions is “how to catalyse a paradigm

shift from HWC discourse to human–wildlife interactions and coexistence dialogue for a more positive and inclusive relation with wildlife and nature” (Frank and Glikman, 2019, p. 13). This would then require exploring strategies to “embrace the differences” between species in learning to “live together” in shared landscapes (Boonman-Berson et al., 2016; Büscher and Fletcher, 2020), as well as “how conflicts can be reduced to the point where people start to accept wildlife in their proximity” and in this way “begin to shift toward mechanisms that enhance coexistence and tolerance toward wildlife” (Frank and Glikman, 2019, p. 12).

Our article responds to such calls by exploring different cases of human–bear interaction in Bulgaria’s Rodopi mountains displaying dramatically differing degrees of conflict and coexistence (Toncheva and Fletcher, 2021). In particular, our research contributes to furthering exploring the human dimensions of human–wildlife interaction (see e.g., Manfredo et al., 2009; Dickman et al., 2013) as well as to the study of human–bear conflict and coexistence specifically (Wilder et al., 2007; Howe et al., 2010; Can et al., 2014). As Frank and Glikman (2019) point out, this growing line of inquiry has rendered the picture of HWC “even more complex” than previously by bringing into focus the intricate relationships obtaining among the multiple actors comprising a given situation, the particular power dynamics informing such relationships (Margulies and Karanth, 2018), and the way animals are often ascribed significant symbolism (of power, of oppression, etc.) by local community members that influence human–wildlife interactions beyond simple economic interests. This complexity is compounded by mounting assertions of the need to also account for the animals’ perspectives and interests in such interactions in addition to the various humans’ (Margulies and Karanth, 2018; de Silva and Srinivasan, 2019).

Such assertions bring into focus the challenges that research dealing with human–wildlife interaction faces as a form of multispecies encounter (Hodgetts and Lorimer, 2015; Margulies, 2019). Traditionally, the majority of projects to manage HWC have been “directed or designed by ecologists without social science input” (Treves et al., 2006, p. 392). Yet natural science studies of this sort are critiqued for not acknowledging the importance of social factors that are often major factors in human–wildlife relations (Dickman, 2010; Dickman et al., 2013). Despite recent innovations in the field including increased integration of natural and social science methods, researchers still face a number of challenges related to adequate methodology, expertise, or available data sources to do justice to the social dimensions of human–wildlife interaction in the depth and rigor demanded by social scientists (Madden, 2014; Margulies, 2019).

On the other hand, the anthropocentrism present in much of the social science research concerning conservation has been criticized for failing to adequately include perspectives of the non-humans involved in human–wildlife interactions (Hodgetts and Lorimer, 2015; Srinivasan and Kasturirangan, 2016). To transform conflict into coexistence, critics assert, we must take seriously the role of animals in the “coproduction of entangled environments” (Margulies and Karanth, 2018, p. 155). Ethnographic study of multi-species encounter that

acknowledges the formative role of animals in shaping human–non-human interaction (Haraway, 2008; Margulies, 2019) is therefore appropriate to overcome the limitations of study from the perspective of either social or natural science considered independently, and thus to do justice to complexities of and the diverse actors involved in human–wildlife relations, as we explain further in the following section.

Striking an appropriate balance between human and non-human perspectives and interests in conservation decision-making is particularly relevant to the approach termed “convivial conservation,” in which promotion of human–wildlife coexistence stands central but which is also grounded in a concern to foreground social justice and equity in such decision-making (Büscher and Fletcher, 2019, 2020). In this respect, convivial conservation aims to also balance a focus on the immediate context of conservation programming with attention to the overarching political-economic structures in which such contexts are embedded and that shape the sorts of interventions that can be realized within them.

Pursuit of convivial conservation thus emphasizes the need to restructure conservation around three central principles, both globally and locally: (1) conservation spaces that integrate rather than separate humans and other species; (2) direct democratic governance arrangements that challenge elite technocratic management; and (3) novel finance arrangements that seek not to commodify conserved resources but instead redistribute existing wealth and resources. Pursuit of these three principles in concert can thus ground pursuit of *coexistence* within a broader concern to facilitate human–wildlife *conviviality* by addressing the important social and political factors shaping interaction between humans and other species in many spaces (Pooley et al., 2017).

In this discussion, we therefore employ the convivial conservation proposal as a guiding framework through which to evaluate to what extent our different cases exhibit aspects of conviviality in conservation policy and human–wildlife relations. Through comparison of the two cases, one of which is explored in detail below and the other discussed through reference to previous publications (Toncheva and Fletcher, 2021; Toncheva et al., in press)—and which for readability’s sake are referred to as case #1 and case #2, respectively—from this perspective we ask what lessons can be learned from this comparison in terms of prospects and mechanisms to transform conflicts into convivial relations, both within our cases and more broadly.

STUDY AREA AND METHODS

Empirical research for our focal case (#1) was conducted over 3 months in the fall of 2019 within three rural communities in Bulgaria’s Southern Rodopi mountains, an area right at the border with Greece. While formal ethical review and clearance is not a legal requirement at either institution where the two authors are based, the research was performed in accordance with best practice standards for ethnographers, through adherence to conventional ethical guidelines for ethnographic field research

via obtaining informed consent and avoiding asking potentially “harmful” questions of at-risk populations¹.

The region where the research was performed lacks formal PAs and human–bear conflicts have become a serious issue there during recent years. The area has experienced increased reports of bear-induced damage events (doubling in 2019 from the previously registered 50–60 incidents per year in the region), the reasons for which remain unclear to conservation experts (see below). The situation is partly a result of the protected status of the brown bear in Bulgaria in accordance with European legislation, which requires that bear habitats are included under the protection of Natura 2000. However, many of the territories inhabited by bears remain outside the boundaries of existing PAs. Such is the case in the Rodopi mountains where, due to various economic interests, no national parks have been established (and only small fragmented areas designated as nature reserves). Together with the increasing bear population in recent years this makes this area the region with the most intense human–bear interactions in the country (ДУЦОВ, 2012).

As evidenced by our research, the situation is compounded by various factors including a lack of accurate information regarding the bear population, unclear compensation procedures in the case of damage caused by bears to human livelihoods and little coordination among different governing institutions. The increase in economic damage and minor success of existing compensation schemes have also contributed to the increase of human–bear conflicts in the area. Overall, we face a situation of predominantly negative attitudes toward the bears and illegal activities such as bear poaching in the context of feelings of despair among the local populations concerning the potential to receive adequate assistance from authorities and conservation experts.

The study area falls within the administrative boundaries of the Smolyan unit and is managed by Smolyan region’s environmental division and Smilyan Forestry. The settlements investigated in this study are the villages of Arda, Mogilitsa, and Gorna Arda (Figure 1). The three villages include dispersed hamlets, with a total area population of <600. The low population density and population decline in the post-socialist period have been accompanied by an increase in the bear population, resulting in a higher encounter rate and establishment of particular relationships and attitudes toward the brown bears. The economic profile of the area is characterized with a broad shift from traditional livelihoods such as animal breeding and agriculture toward development of rural and ecotourism. However, the population has also maintained small agriculture plots, animal herds, and other land-based livelihood activities predominantly for individual and family needs. Bear damage to these, together with the general underdevelopment of the area is, therefore, perceived as a serious violation that exceeds the actual economic loss.

The ethnographic research conducted for this study among the local human population based on an inductive approach

(Bernard, 2011), applied to generate insights on human–bear conflicts rather than testing pre-conceived hypotheses, which was also due to the lack of previous research in the area, as well as the scarce research concerning the topics of investigation within Bulgaria as a whole. Data were collected qualitatively via semi-structured and semi-directive interviews. This allowed for adaptation of the interview schedule to include additional questions when engaging with particularly specialized and knowledgeable informants such as representatives of state agencies, bear researchers, and local authorities.

These interviews were complemented by administration of a questionnaire to local community residents. The 35 questions covered the topics of perceptions toward brown bears, perceived relationship of human–bear relations/conflicts, perceptions of the current management, and conservation policies toward the brown bear, as well as local knowledge concerning bears (see Supplementary Table 1). The questionnaire was not intended to pursue representative sampling of the total population for statistical analysis but merely to complement interviews with comparative qualitative material collected from a broader range of local residents.

Within this research, snowball sampling (Browne, 2005; Young et al., 2015) was used to identify actors who had most encounters with bears and who suffered personal damage—in other words, to find direct participants in the conflicts. The research aimed, moreover, to include different groups of stakeholders such as hunters (the group holding most experience with bears), local authorities, conservation experts (from Regional Inspection of Environment—RIOSV), and employees of the forestry authority (Forestry of Smilyan). Among the informants, males were slightly overrepresented relative to females (due to the domination of male hunters), with both groups ranging in age from 29 to 75 and performing diverse occupations (teachers, bar tenders, farmers, policemen, etc.). This allowed for inclusion of a variety of perspectives to develop a more holistic picture of human–bear interactions in the area.

Twenty-nine interviews were performed among these different groups of stakeholders (some of which included more than one family member). Interviewees have been cataloged in terms of location of residence, occupation, and gender and anonymously coded, as depicted in Supplementary Table 2. Interviews were transcribed and translated from Bulgarian by the first author, after which the results were summarized to capture common patterns and themes (but not formally coded). Direct quotes were then selected that are most representative for each theme, allowing the voices of the respondents to be heard. The interviews were complemented by review of secondary literature including reports from the various governance organizations operating in the area.

Like many social scientific studies of multi-species encounter, understanding of bears’ behavior and perspectives in this case was “dependent upon the goodwill, expertise and field sites of scientists” (Hodgetts and Lorimer, 2015, p. 287; see also e.g., Margulies, 2019). This is due to the fact that bears are large carnivores who are reticent, roam widely, and hence difficult to observe directly, as well as from the lack of published ecological data on the specific study area. Consequently, we had to rely

¹See e.g., <http://www.aaanet.org/issues/policy-advocacy/upload/AAA-Ethics-Code-2009.pdf> (accessed August 1, 2019).

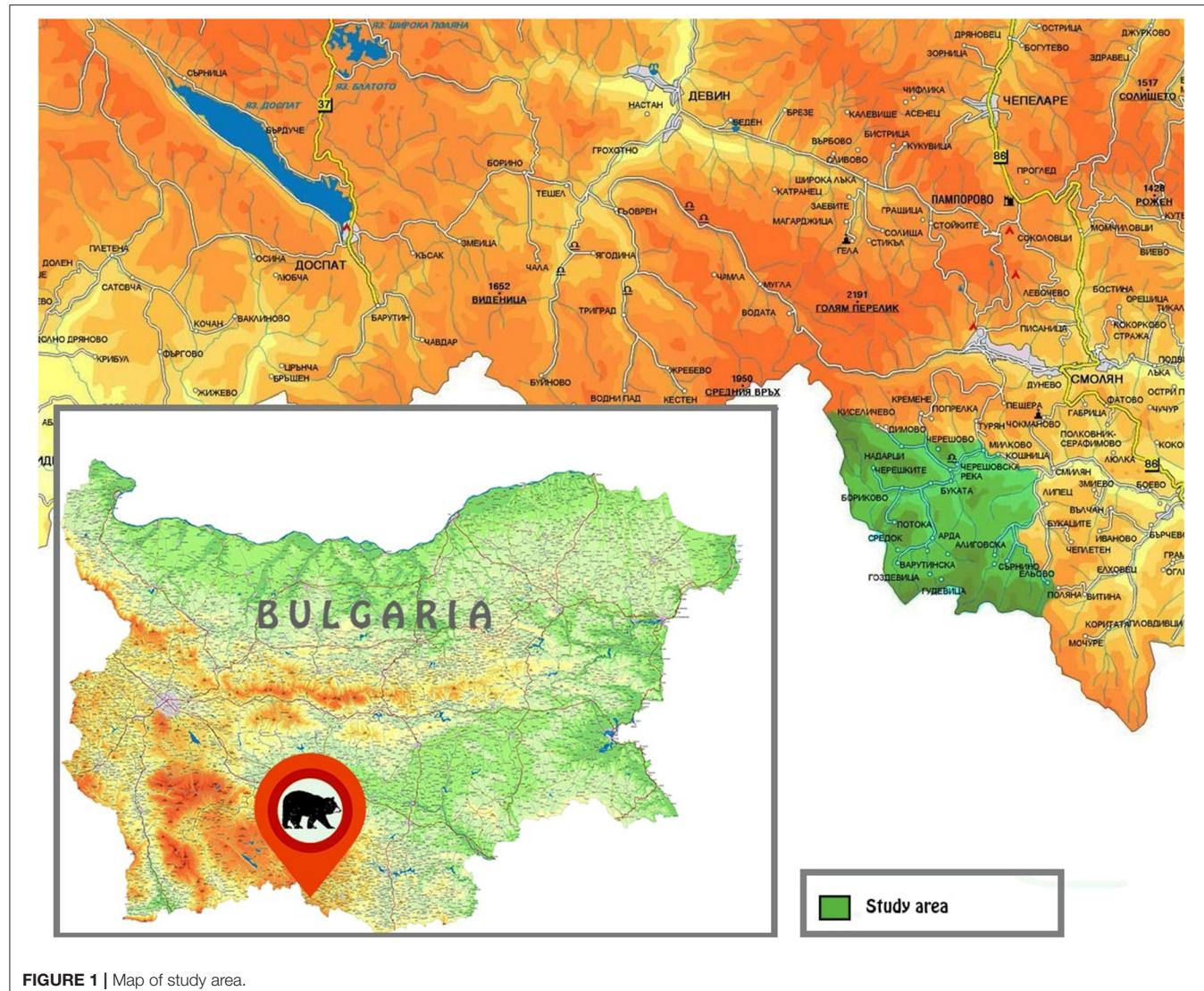


FIGURE 1 | Map of study area.

on interviews with an ecologist who has performed long-term research in the area in order to understand his perspective on bears' behavior. For the purpose of comparative research, we rely on the same ecologist—Julian Perry—as in case #2, as he is the main researcher studying bears in both sites (Yagodina and Arda). Perry is a member of The International Association for Bear Research and Management (IBA) and founder of the non-governmental organization Wild Rodopi, where he works on the Rodopi Bear Project aimed at conservation of the species. In this context, since 2010 he has been conducting a long-term study into the ecology and ethology of brown bears in the Yagodina and Arda regions, and has developed a specific educational tourism programme focused on bear conservation around the village of Yagodina (see Toncheva and Fletcher, 2021). Interview material with Perry presented herein was collected specifically for the current case based on research performed in the case #1 study region only. While research concerning brown bears has also been conducted elsewhere in the country by others (see e.g.,

Gavrilov et al., 2015; Todorov et al., 2020), as our focus is on the behavior of bears in the two study sites specifically we have not included this in our analysis.

In accordance with Latour's notion of "speech prosthesis," for understanding the phenomenology of different perspectives as forms of worldmaking (Latour, 2013), inclusion of Perry's views on bear behavior would "allow non-humans to participate in the discussions of humans, when humans become perplexed about the participation of new entities in collective life" (Kosek, 2010, p. 652, in Madden, 2014, p. 285). Moreover, the ecologist's perspective is based on collection of natural science data concerning brown bears' ecology and behavior via techniques such as use of camera traps, tracking data, and personal observations. Due to the Perry's long term experience, we believe that these data were appropriately collected (following standard ecological study design) and interpreted. Such data reveal general information about the presence, distribution, behavior, and relative abundance of the bears. Camera trapping

and its interpretation, in particular, is able to provide not only additional information on the bear behavior but also to identify the main zones of human–bear cohabitation or specific localities where villagers and bears share a common space and are most likely to come into direct contact and potential conflicts. As this ecologist's research focused on understanding general patterns of bear behavior, it did not include attention to potential differences between individual animals of the sort that some multispecies researchers emphasize as important (e.g., Haraway, 2008; Ampumuza and Driessen, 2020).

In order to highlight factors in case #1 that appear to inhibit peaceful cohabitation, we refer to a different study previously performed in the village of Yagodina, located in the area of the Yagodina-Trigrad gorges where humans and bears currently live in relative harmony (Toncheva and Fletcher, 2021; Toncheva et al., in press). Investigation of this other case (#2) also entailed ethnographic research, performed between June and September 2018 in and around the village, in the course of which 30 semi-structured and semi-directive interviews were conducted with informants selected via snowball and purposive sampling to include different groups of relevant stakeholders (among permanent residents of the village encompassing diverse age groups): hunters, ecotourism guides, employees in tourism, pensioners, and children, among others (for more methodological details see in particular Toncheva and Fletcher, 2021). Additionally, it entailed administration of a similar questionnaire as in case #2 (and on which this subsequent instrument as well as analysis of data collected with it were in fact modeled) (see Toncheva and Fletcher, 2021).

Taken together, the two cases offer a useful basis for comparison as they hold a number of similarities in relation to characteristics of post-socialist transition, population density, and religious and cultural identity as well as the biodiversity of the surrounding landscape. This allows us to hold these various factors relatively constant in the comparison and instead highlight the key differences informing the differential patterns of conflict and coexistence in the two cases, which we do in the following discussion of our findings. Considering the proximity of the two study areas, separated by only 20 km as the crow flies (although the actual travel distance is much greater given the region's mountainous topography), there is a possibility that some of the same bears are present in both regions, as the animals are known to range up to 500 km². Given that tracking of individual animals has not yet been performed in either area, however, it is impossible to gauge whether this is the case.

RESULTS

A Landscape of Fear

In previous articles we showed how relations between people and bears in our case #2 can be understood as a *landscape of tolerance* (Toncheva and Fletcher, 2021; Toncheva et al., in press). This depiction is characterized by factors such as non-transgression of the intimate space of both humans and bears and hence active avoidance by both of potential conflict situations, as well as by the ability of both species to "read" and interpret the

signs the others left behind (see Hinchliffe et al., 2005; Boonman-Berson et al., 2016). The site also encompasses what we term a cohabitation space beyond the village within which occasional non-conflictual encounters between members of the two species occur and which has therefore been peacefully inhabited by both humans and bears thus far (see Toncheva and Fletcher, 2021; Toncheva et al., in press). In the following section, by contrast, we outline the main factors that appear to have led, in case #1, to more negative interactions between humans and bears and that inhibit human–bear conviviality.

Human–bear encounter in case #1 is a lived reality for the population, evidenced by the widespread agreement that bears are present in the surrounding landscape. The residents believe, moreover, that there has been an increase in the bears' population during the last 10 years. In an earlier period (under socialism), bears are believed to have not really been noticed due to their smaller number. An encounter, remembered from the communist times (in 1984), was a case when a bear damaged beehives in the area. The solution to the problem then was lethal control, as the brown bears were not a protected species. The question of the cause of the increased bear population, however, remains unclear for the majority of local residents. A variety of speculative interpretations include suggestions such as that many bears resettled either from a bear reserve area in Rila mountain (Belitsa Dancing Bears' Park), from a nature reserve across the Greek border, from a hunting farm (Kormisosh, previously a bear breeding reserve) or as a result of their protected status, causing a bear "boom"² in the last years. This uncertainty leads to interpretations going so far as to blame the Regional Inspection of Environment and Water (RIOSV Smolyan) and their Rapid Reaction Team (RRT), due to the image of a bear painted on their jeep:

"There were no bears before. They brought them [the people with the jeep]." (03MOCULTF).

Encountering a bear, therefore, is not unusual for local residents. Encounters are indirect and direct, the former occurring via observations obtained from (the hunters') video traps, placed in the nearby forests, via narratives of bear encounters as experienced by others, as well as by "reading" (Boonman-Berson et al., 2016) bears' signs and tracks such as excrement, overturned stones, damaged anthills, etc. These are claimed to be found "all around" the villages and neighboring hamlets, and encountered "every time we exit the village" (11ARDPENF).

Transgression of the intimate village space by the bears is one of the main factors resulting in human–bear conflicts in case #1 (unlike in case #2). Evidence exists of numerous direct encounters (and narratives regarding them), particularly in the village of Mogilitsa, where a bear (or "bears") with cubs regularly crosses the village borders, resulting in "almost the whole village [having] seen a bear" (01MOMAYM). One of the encounters with the aforementioned bear is considered emblematic, as it

²Here and in the following, all quotations not followed by parenthetical referencing are statements from informants who, for ethical considerations, are presented anonymously.

also appeared on TV news: the descent of the bear to the local kindergarten where around 10 apple trees are present:

“We have one bear which walks around the houses during the season of the apples, also near the kindergarten...luckily there were no children there when it descended.” (01MOMAYM).

Bears crossing the village boundaries are encountered “right above the houses,” near the road or by the river when it is descending to drink water. As respondents claim:

“I have seen a bear three times, once it crossed the road, once on the meadow and this week, in front of the house, the cubs were playing. We phoned people not to come around.” (07MOAGRF).

Outside the boundaries of the settlements, bears have been observed on multiple occasions by local hunters near the feeders used for wild game, which attract bears with the provisions of corn, as well as during hunting. People have also seen bears during wood collection, when walking in the forest, and near a local fishery.

The total number of the bears present around the village remains unclear to local residents, who estimate it as between 3 and 10, including a mother with three cubs (some claim there is a mother with 1 or with 2–3 cubs), and increasing every year due to “lack of control over the population” (12ARDMAYM)³. Accounting for outmigration during the last 30 years, many report that nowadays “bears are more than people” (11ARDPENF). The number of bears is considered, consequently, too high for the area around the village and their reduction is seen as a way to improve the situation:

“They need to be reduced...when the year is good they give birth to 2–3 cubs...when there is a mother with 3 cubs nobody dares to go out of the village.” (12ARDMAYM).

Many respondents (>90%) share the belief, in this respect, that human–bear coexistence is not possible and that the bears “need to be placed in reserves,” or kept “far from the village.” However, for part of the population, the presence of the bears seems not to be a problem *per se*; rather, the real problem is deemed their high number (with 5–6 bears around a settlement considered too high):

“People and bears can cohabit as far as there is a balance; if there is certain number of bears per hectare...more becomes dangerous.” (13ARDPENM).

The bears’ perceived omnipresence in this case, as well as the occasional crossing of the village space, has evoked a sense of fear and vulnerability among the local population for individual and group safety, as also exhibited in other cases where humans and carnivores coincide (e.g., Young et al., 2015). This prevents, in some cases, the accomplishment of traditional livelihood activities such as collection of mushroom, herbs and wild

³The number of the bears is most likely inaccurate as they are counted by hunters who claim themselves that bears can be counted by the diverse hunting parties the area, meaning that a bear can be counted by two parties when entering their hunting perimeters.



FIGURE 2 | “Brussels street,” the street “of the bears”.

berries as well as livestock breeding, while not so intensively practiced today:

“Many people are afraid, they don’t enter the forest in order not to meet a bear.” (01MOMAYM); “... We are afraid to walk around. We used to go pick up wild strawberries, we don’t go anymore.” (11ARDPENF).

The general state of fear, which dominates human attitudes toward the bears in case #1 (unlike in case #2; see Toncheva and Fletcher, 2021; Toncheva et al., in press) is described by the mayor of one of the examined settlements, whom many residents approach to complain about the situation:

“People are scared, they come to me and I tell them that I am not able to help...they prefer that there are no bears around, what use do we have from them, so that people are afraid to go to their agricultural lands.” (01MOMAYM).

Despite the fact that no one from the village has suffered a bear attack while undertaking traditional livelihood activities, a narrative about a person from a neighboring settlement, attacked by a bear while collecting mushrooms, was widely known and seen as a lesson for possible danger.

Many respondents (>70%) felt unable to protect themselves and their families from potential bear encounters or attacks. Bears are, in this sense, considered “really scary” by a large part of the local population (>70%). This perception of insecurity forces the local population to avoid walking out in the dark and to become preoccupied with their children’s safety [some spoke of even avoiding “coming to the village because of the bears” (14MOSALF)]. Many respondents (>60%) claimed that they lived in constant “stress” as the possibility of encountering a bear is real day and night. A notorious street, at the high edge of the village, paradoxically named “Bryuksel” (Brussels, Figure 2), is famous for the fact that everybody living there has seen a bear and where nobody comes home after dark.

Despite the fact that vulnerability is not merely imagined, the safety concerns and widespread fear are also enhanced by the villagers’ general attitude and the constant discussions concerning bears, as some acknowledge:

“The fear of the others also determines your fear, while they are in fact not dangerous, they avoid encounters.”; “Every day this is what we discuss...where the bear has been.” (15ARDHUNM).

Another important factor in inciting conflict, discussed in more detail later, is lack of understanding of the bear behavior. The fear reported by a majority of the population is namely a result of the bears’ perceived “unpredictability,” as people claim: “I got scared, as the bear was around 60 m away, I didn’t know how it would react” (15ARDHUNM).

Still, some believe that bears are only dangerous in case the year was “not good” and the animals were unable to find enough food. The bears’ reaction in case of encounter is also described as primarily non-threatening by some respondents: the “bear is curious; it stands up, roars and runs away” (16UPARDHUNM).

With respect to case #2, we demonstrated how closer experience with bears results in better understanding of the bears’ behavior (see Toncheva and Fletcher, 2021; Toncheva et al., in press). This is particularly true for the group of hunters, who have taken the role, in some cases, of de facto “managers” of human–bear relations (see Toncheva and Fletcher, 2021; Toncheva et al., in press). Thus, hunters define bears as “dangerous” only in “particular” situations—if wounded, surprised or if it is a mother bear with cubs. Their encounters, however, can be particularly dangerous due to the practices within specific hunting zones. The only bear attack on a human recorded during the research, occurred during hunting:

“In 2008 our colleague (a hunter) was attacked by bear. It was only 4 m away so he shot it. Later during autopsy they found out that the bear has been shot before, this is obviously why it reacted in this way...so you never know what bear you could encounter” (01MOMAYM).

The government proposed means for protection of the local population, such as the use of bear-protective spray, are not considered particularly efficient due to the fact that one needs to be really close to the bear and requires, moreover, one’s own investments. This is also the case with the measures undertaken by the forestry agents, such as expulsion of a problematic bear, because in most cases the bear returns or becomes aggressive, which only enhances the existing problems. Consequently, locally invented techniques for protection from bears have been developed, such as playing loud music, walking with a torch, using firecrackers, making loud noise, smoking, placing lights around beehives/gardens, and so forth.

Knowing Bears, Knowing Humans

We have previously demonstrated for case #2 the importance of local ecological knowledge (LEK)⁴ for facilitating human–bear cohabitation and how, in particular, bears occupy a significant place within local people’s lifeworlds (see Toncheva and Fletcher, 2021; Toncheva et al., in press). General knowledge of bears, shared by the inhabitants who can read the bears’ signs and

understand the animals as permanent inhabitants, are beneficial for interactions within the shared space (see also Hinchliffe et al., 2005; Boonman-Berson et al., 2016). A similar function is played by particular elements of LEK comprising traditional folklore, which also promote positive images of the bears as symbols of fertility and power (Toncheva and Fletcher, 2021; Toncheva et al., in press).

From the perspective of multispecies research, we have also demonstrated how humans and bears are able, in case #2, to pursue knowledge of one another and act on this knowledge so as to actively minimize potential for conflict (Toncheva and Fletcher, 2021). Despite the fact that some knowledge regarding brown bears is present in case #1, this often appears incomplete or incorrect in comparison to the results of scientific research conducted in the area. In the following, we therefore explore the role of local knowledge (or lack thereof) in fueling human–bear conflict, taking into account the perspectives of both humans and bears (to the extent this can be known via ecologists’ research).

As already mentioned, the number of the bears in the region of Arda remains unclear to the local population. This is not surprising given that even the local conservation agencies claim that bear numbers cannot be accurately assessed due to bears’ distant wanderings, during which they are counted by diverse hunting parties in different areas. Bears are generally described by the population as active throughout the whole day (according to some particularly at night), less precisely than experts who define bears’ active period as between 19:00 and 07:00 and the period of inactivity as between 10:00 and 13:00. Relying on observations, respondents believe that bears give birth to 2–3 cubs, remaining with the mother for 2 years, corresponding to the results of an ecological study in the area. Less clear to local people is the nature of bears’ territories, the exact size of which is unknown. Perry’s ecological research does demonstrate, however, that bears have home ranges of varying sizes depending on season and availability of food, dens, and mates, which are not strictly speaking territories as bears do not actively defend these areas from one another.

The issue of feeding is more widely discussed, as it is directly related to the damage caused by bears. Hence, bears are described as feeding on forest berries (bilberries, raspberries, strawberries), fruits (plums, apples), grass, maize (put out by the hunters), honey, and indeed everything—“if they are *struvnitsi*⁵ they can eat even wild boar” (06MOAGRM). Insufficient food supplies in the nearby forests are, according to some of the respondents, the main reason for bears crossing the settlements borders and the hence the damage bears inflict.

According to Perry, bears are able to find seasonal food in the nearby forests, such as green vegetation (grasses, flowering plants) in early spring, nests of small rodents, fruits (strawberries, raspberries, rosehips, plums, apples, pears, Cornelian cherries, bilberries), and nests of ants and wasps in summer. Finally, in autumn, they feed on beech mast,⁶ while throughout the year, they supplement their food supplies with maize that the hunters put out for wild boar. However, no evidence of bears killing wild

⁴We use the term “local” as it is arguable whether knowledge in the examined area can be considered traditional in the sense of evidencing historical continuity (see Toncheva and Fletcher, 2021).

⁵Omnivorous bears.

⁶The fruit of the beech tree.

boar has been observed in the study area, which is explained as this being too difficult and dangerous for the bears, as well as a waste of energy.

In sum, Perry's ecological research supports many residents' conclusion that "in normal years, there should be enough natural food for the bears in the surrounding mountains, and the bears will mostly choose to eat this wild food," undermining this concern as a major factor in bears crossing the settlements' borders.

Another, possibly more important explanation for the already famous bear(s) with cubs entering the villages, is that the female bear is avoiding a male which would possibly attack and kill the cubs. Indeed, Perry claims in support of this that:

"Females and cubs quite often can be found close to villages during the day time (especially in spring and early summer when the cubs are still very young) as it's a 'safe' place for them to keep away from male bears."

The same is true for newly independent subadult bears, who also often wander around during the day and come close to villages, normally just passing through and using specific times of day and habitats to avoid meeting adult male bears (Berger, 2007; Steyaert et al., 2016). Therefore, young bears or mothers with cubs near the villages will "almost certainly be only temporarily there and will not become a permanent nuisance." This is an important fact that remains unknown to the local population, preventing a more precise understanding of the bears' behavior.

In local knowledge, not all bears are believed to hibernate in winter (predominantly the mothers about to give birth) and this occurs only in case there is enough snow, temperatures have dropped, and bears have been able to provide enough food supply. Some hunters, the group with the most knowledge regarding bears, are able to provide more details regarding bear dens and hibernation areas. Such beliefs, for instance, claiming that not all bears hibernate, while contradicted by ecological data, do seem to be supported by changes in weather conditions in winter produced by global warming, resulting in winters in the Rodopi mountains becoming milder and bears' activity levels consequently varying from winter to winter. Therefore, it is no longer unusual for the bears to temporarily emerge in warmer weather and search for food in the vicinity of their dens.

Of particular importance for human–bear coexistence is knowledge regarding bear behavior in case of encounter with humans. There is common disagreement regarding this behavior, with some respondents claiming that a "bear has no fear of humans" (17ARDHUNM) and would not run away if it encounters one, while others believe that a bear senses the smell and sound of humans and attempts to avoid them. In support of our description of the general situation as a *landscape of fear*, there is overall agreement that bears are dangerous. Deeper knowledge held by particular groups (hunters and foresters), however, maintains that bears are considered dangerous depending on the situation.

Ecological knowledge, on the other hand, suggests that bears are typically very timid and usually try to quickly and silently retreat to shelter if they sense humans' presence. An exception to

this rule is that younger subadult bears, according to Perry, may be occasionally inquisitive, and stand up to observe the human, as "they may never have seen a human before and so be uncertain what the strange-looking 'bear' standing on two feet is!" If the human reacts calmly and talks quietly, the bear will then move away. Although all bears are potentially dangerous because of their strength, claws and teeth, the bears in the Rodopi mountains are described by Perry as not generally aggressive. The worst thing to do, according to him:

"Is for locals to try and scare and frighten the bears, as this will only teach bears that humans are aggressive, and then if a bear meets a human it will then think it has to fight to protect itself"⁷

Mutual learning is, therefore, an essential foundation for successful coexistence, according to Perry:

"If bears learn that humans are not a threat and leave them alone, then the bears will ignore and avoid humans and get on with their lives, the same way as bears try to avoid and ignore other bears."

Some elements of local knowledge could be beneficial for bear conservation. For instance, bears are considered intelligent animals by a number of respondents. An interesting belief regarding bears was also recorded in one of the settlements during the research:

"We have this belief that if you shoot a bear, you will die. This happened to a hunter, he shot a bear in 2009 and died 1 year later" (17ARDHUNM).

The population of Rodopi mountains is, interestingly, described by conservation agents as the most tolerant of the bears' presence despite the current conflict situation:

"In Pirin [mountain]⁸, for instance, people stand no bears, here people can murmur but have a conscience, a heart...they cause troubles but forget in 2 days." (20SMCONM).

The involvement of conservation agencies in bears' management makes their representatives' knowledge relevant for the present study. The research demonstrates, in this respect, that what is known by conservation experts is not sufficient and based on solid research. For instance, from their perspective the behavior of the bears has very likely undergone changes since receiving protected status. This is mainly considered a result of the more "frequent encounters with humans" (20SMCONM) and provisioning of food for the wild game, leading to adaptation of the bears to seeing humans rather as "friends" (20SMCONM).

Perry's research, however, only partially supports such views. Some transformations, particularly in the border regime at the end of communism, have enabled bears to move more naturally in the border regions "and establish their cross-border home ranges more effectively." Along with the depopulation of the area

⁷See more on bear behavior and awareness of humans in Toncheva and Fletcher (2021).

⁸A mountain range in Southwest Bulgaria with smaller bear population.

and the abandonment of pastures and orchards, the likelihood of bears “to come and search for fruits and ants undisturbed in these newly liberated habitats” is therefore higher. However, there is no ecological evidence to support the assumption that bears become reliant on the food provisioned by the hunters, instead “still continuing to prefer and choose their natural seasonal foods.” The human scent on and around the feeding site also “does not make them seek out humans to find food,” as bears are aware where more nutritious food can be found. Perry claims:

“In general, I don’t believe there has been any negative change in the behavior of bears during the last 10–20 years. There has been a change in the behavior of humans! It is human behavior in the region that needs to be ‘managed’ and adapted so that humans don’t interfere and disturb the “natural” behavior of the bears. If humans are more understanding of what the bears need and how they live and behave, then it is perfectly possible for humans and bears to live ‘convivially’ in the Rodopi!”

This lack of detailed knowledge on the part of responsible agencies seems to be result of the non-establishment of specialized group to deal with bear issues. The tasks of the existing RRTs (discussed further below) remain limited to solving problems related to damage and compensation, while management of bears such as expulsion and lethal control is divided among different actors and institutions⁹. Consequently, conservation experts admit that “more work” (20SMCONM) and state support is needed for the successful conservation of the brown bear and prevention of bear poaching which seems to exist in the region: “we had found corpses of bears, buried... every 2–3 years” (20SMCONM).

A Conflict Economy

We have previously explained how the lack of economic losses caused by brown bears as well as their inclusion in sustainable ecotourism activities have become significant factors in facilitating peaceful human–bear coexistence in case #2 (see Toncheva and Fletcher, 2021; Toncheva et al., in press). Here, we demonstrate how, in case #1, human–bear conflict is exacerbated by economic loss due to bears, and the insufficient state response to this, as well as a lack of alternative economic avenues (such as tourism) directly linked to the bears’ presence.

The economic damage caused by the brown bears in the research area is an important factor for their negative image among the local population. Damage caused by bears refers predominantly to livestock (sheep, calves), beehives, crops (trees and berries), equipment (barrels, cameras), and fodder for wild game. These occur occasionally, with one of the most serious attacks on livestock including damage to 8 sheep in the village of Arda. The affected owners related the following:

“Four years ago (i.e. 2014) a bear attacked the sheep, we had 14 sheep and one evening they didn’t come back... I went up in the forest to look for them. About 400 m. away I found one

⁹Between the Ministry of Environment and Water and their subdivisions—Regional Inspections, the Ministry of Agriculture, Food, and Forestry as well as the regional Forestry units.



FIGURE 3 | Bears feeding on the corn at the game feeders.

near the fence...and wool around the fence as well as bear’s hairs. One came back, badly bitten by the bear, the next day we found one more...I called RIOSV, they came and concluded it was a bear...we found more sheep bitten by it...one was eaten.” (21ARDPENF).

One of the most affected groups, as well as the one that “perceives the damage most seriously” (20SMCONM), due to the specifics of the practice, are the beekeepers. As one of the affected respondents claims of a bear:

“It damaged three of my beehives...I want no money, I have them for the honey. I have six sheep but keep them closed because of the bears. Otherwise what sense does it make to live in a village?” (04MOHUNM).

Damage is also caused to agricultural objects, trees (mainly bearing apples), berries, and other crops. Bears consuming the corn provisioned by the hunting parties for the game (Figure 3), and damaging the feeders and cameras while chasing the wild game away, result in conflicts with the hunters in the area. The corn consumed by the bears is estimated as high as 80% of the total amount left by the hunters, who express their dissatisfaction as per the following: “we pay to go hunting, bears eat the corn...in the end what do we pay for.” (01MOMAYM).

The loss is further enhanced by the aforementioned precarious economic situation and underdevelopment of the region, producing a lack of alternative livelihood strategies apart from tourism. We have demonstrated elsewhere how a local initiative developed as a solution to this issue has been beneficial in a different area of the Rodopi mountains wherein inclusion of bears in a specific form of ecotourism has thus far supported the animals’ conservation and establishment of a rather positive image among local groups, particularly hunters who benefit most from bear-related tourism (Toncheva and Fletcher, 2021; Toncheva et al., in press). The lack of similar initiatives in this case shows how the conflict is instead exacerbated between bears and hunters who receive no state compensation for their loss (more on this below).

Considering the importance of tourism for maintaining the villages, a number of respondents (>20%) see potential benefit from similar projects focused specifically on bears, encouraged by tourists' expressed interest in photographing the animals, but feel that they lack financial resources or knowledge of the legal regulations regarding this type of ecotourism¹⁰:

"Tourism could work. I know of no place with more bears than here in Bulgaria. They are waiting for the jeeps at the feeders." (28MOPOLM).

As a result, in this case the bears seem to play an ambiguous role in tourism at present, rather than being included as actors in the ecotourism process (as in case #2). Their role is evaluated as both positive and negative, ranging from a source of fear to interest (as shown above) for the tourists. As one informant related:

"One lady, a tourist, was walking around and heard roaring, she ran down to the road and a car stopped. The people told her not to be worried because the bear is not hungry right now and she came back to the village highly outraged." (25ARDTOURM).

"Tourists come but they don't walk in the forests...we have trails but don't maintain them because of the bears." (12ARDMAYM).

The importance of economic loss in conditioning attitudes toward bears is reinforced by the perspectives of some respondents who suffered no damage by bears and therefore "have nothing against them" (10MOPENF). In particular, the relatively more "peaceful" human–bear coexistence experienced by one of the settlements (Gorna Arda) results in beliefs that bears descend to the villages only in particular situations, such as in case of hunger. The reason for lack of damage in this particular village is considered to be the abundance of food supplies in the surrounding forests (such as cornelian cherries, apples, etc.)¹¹.

However, due to the prevailing economic situation in the region, the majority of respondents prefer not to have bears in the area in order to be able to roam freely in the nearby forests and "make some money" (07MOAGR): "we want no reserves but normal life for the people" (18ARDPENF).

In relation to the damage and economic loss caused by bears, and in the absence of locally developed initiatives to redress this, an important role in case #1 is played by state-directed mitigation measures such as compensation schemes and removal or lethal control of problematic bears. In accordance with EU regulations, damage from brown bear can be claimed and compensated. According to responsible agencies, the compensation procedure is "elaborated at present" (20SMCONM) and adapted to existing gaps in the Bulgarian legislation. Any case of damage is, in

this respect, inspected by a specialized group—the RRT—in cooperation with the local Forestry units. If reported on time and supported by evidence, the damage is documented "within an hour" (20SMCONM). In support of bear conservation, local conservation agencies aim to not only simplify the procedure, but also compensate a wider range of damages than foreseen by the legislation range. This is a result of ambiguities in the existing legislation that appears vague and hence allows for adaptation "to the current situation" (20SMCONM). As conservation expert claims:

"In practice, there is no regulated procedure so far demonstrating how it should happen, it's adapted according to the law for game...which means that damages should be paid via establishing a court case...so we have worked out this mechanism, so far it's working...it's now being unified, that's why we have no requirement that the livestock is registered, for preventive measures...in most cases damages from game animals are not paid but we pay" (20SMCONM).

However, from the perspective of the local population, two main issues appear to prevent such measures contributing to peaceful human–bear coexistence. These are, first, dissatisfaction with (and often lack of understanding of) the procedure and, second, the perceived inadequacy of the value assigned to the loss. Respondents who suffered bear damage report that they needed to undertake long travel in order to receive the compensation or replace their loss, due to the villages' remote location. Moreover, compensation is received via bank transfers, which is problematic for the elderly population in particular (as many lack bank accounts) as well as others given the absence of banks or ATMs in the villages. As one affected actor claimed:

"What can you claim... it is so complex that in the end you will pay more and it's unknown what you would receive. Just one trip to Smolyan is at least 30 leva, what about the other work." (01MOMAYM).

Also illustrative is the story of the family who suffered the loss of eight sheep and who had to travel approximately 85 km away through the mountains to a town in order to receive their compensation. The received amount seemed also not sufficient to replace the loss. Compounding such issues is a common conviction that the procedure of proving that damage was done by a bear is too complex and relies on the established "system of relations," hence being beneficial only for those who "personally know the inspectors at RIOSV" (09MOPENM). Others lament the lack of adequate information regarding the procedure itself.

As previously mentioned, the group of the hunters, one of the main stakeholders in human–bear relations, receive no compensation, neither for the loss of corn eaten by the bears (and estimated as hundreds of kilograms per year) nor for loss of equipment:

"There is a bear at every feeder, it eats everything and when the boar comes it finds nothing...then it leaves the area... what do we pay for...not to go hunting but to feed the bears." (01MOMAYM).

¹⁰At the end of the research, however, we encountered a potential local initiative—an attempt to establish a bear observation place and a guest house which would accommodate the potential tourists. As it was an individual attempt it remains unclear to what extent it would influence wider human–bear relations in the area in the future.

¹¹In this relation we have to acknowledge some initiatives such as planting fruit trees, aiming to provision food for the bears. However, as the results of this initiative will not be evident in the near future it does not currently contribute to the conflict mitigation.

Regarding the monetary value assigned to damaged property, respondents agree that its level, corresponding to the average prevailing market prices, does not account for other costs, as well as emotional and other values assigned to the assets:

“We are not happy with the compensations. You rely on the calf, the bees, you care about them...then you need to start from the beginning again.” (06MOAGRM).

“If they give you 1,000 lev then what, you won’t have honey next year.” (02MOCARM).

Meanwhile, standard protective measures, such as electric fences, are not widely used as their distribution by state institutions some years ago was not sufficient to cover everyone’s needs. The bears in the area seem, moreover, to be adapting and finding means to avoid the fences, calling into question their basic functionality.

Given all of this, the state conservation policy is considered incapable of embracing the complexity of human–bear relations. Legislation is perceived as anti-human and solely benefiting bears, while the responsible authorities are particularly blamed:

“Laws are insufficient. Only benefit the bears. Nowadays it’s better to be a bear in Bulgaria.” (11ARDPENF).

“Authorities take no measures, they [the bears] will eat us, this is the situation...they are more important than the humans.” (13ARDPENM).

Lack of trust in state agents has forced the population to instead rely on local authorities, who, however, seem to lack the power to deal with the conflict situation. A local mayor claims in this respect:

“In order to take some precautions the bear has to cause problems three times...but what if it encounters a child at night? The animal is afraid, it’s normal, what if they meet at a narrow place? The bear is then protected and the human will suffer. Bears are more protected than people...if something happened institutions would come from I don’t know where.” (01MOMAYM).

Local authorities are, moreover, excluded from decision-making regarding the bears, in addition to not being provided with information concerning bear issues such as research and population monitoring:

“I don’t know whether they count them...they never inform us, who goes where or what they do.” (01MOMAYM).

The same is true, to a large extent, for the local population, as evidenced in statements like the following:

“Ecologists come to count them [bears], but only if there is a problem, then go away. No one cares about us.” (07MOAGRF).

Loss of faith in the capacity of the responsible institutions to find solutions to the problems experienced by the local population has possibly led to methods of “manage[ing] the bears’ number themselves” (17ARDHUNM) (i.e. killing them), questioning to a high extent the success of the bear conservation in the area.

DISCUSSION

This study has demonstrated how various factors prevent humans and bears, in case #1, from establishing successful cohabitation strategies and adapting to living together in a shared landscape. Unlike in case #2, where the lack of concrete management strategies imposed from outside has led to the establishment of bottom-up mechanisms of mutual adaptation and coexistence to create a landscape of tolerance (see Toncheva and Fletcher, 2021; Toncheva et al., in press), humans and bears in case #1 have largely failed to do so, instead living in a shared *landscape of fear*.

A main factor contributing to this reality is the regular transgression of the intimate village space by the bears, accompanied by a common misinterpretation of this behavior by the local population. Direct and indirect encounters are thus marked by the perceived “unpredictability” of the bear behavior and anxiety on the part of humans. The constant feelings of “stress” and “fear” experienced by local residents and resulting diminishment of forest activities contribute to inhibit establishment of better mechanisms informing proper behavior in case of encounter. Unlike in case #2, where “both actors can be understood to “read” each other’s signs” (see Toncheva and Fletcher, 2021; Toncheva et al., in press) and incorporate this into practices of respect and avoidance, thereby increasing mutual awareness and predictability, this happens to a much lesser extent in case #1, wherein people put far less effort into studying and understanding bear behavior. The bear here has become, on the contrary, a symbol of threat to personal safety and an obstacle for development for the local population. Such negative attitudes in turn reinforce bears’ apparent perception of people as aggressive antagonists and competitors for space and resources.

Previously, we have also shown how rather peaceful coexistence grants bears a significant place in local people’s lifeworlds in case #2, exemplified by bears’ appearance as characters in jokes and poems (Toncheva and Fletcher, 2021; Toncheva et al., in press). Moreover, elements of LEK comprising traditional folklore promote positive images of bears as symbols of fertility and power, enhanced by the performance of stress releasing rituals in case of bear encounter that contribute to mitigating potentially negative effects of such an encounter (Toncheva and Fletcher, 2021; Toncheva et al., in press). In case #1, by contrast, while some LEK regarding bears exists, it is often relatively incomplete or inaccurate in comparison with scientific knowledge, thus inhibiting rather than facilitating coexistence. An exception (in terms of efficacy not accuracy), in relation to folklore, is the single encountered fragment of traditional belief that killing a bear would provoke reciprocal consequences for the human.

In particular, bear behavior has often been misinterpreted as dangerous even when it is likely not. In some cases, this is even acknowledged by local actors, particularly in their explanations of the factors influencing aggressive bear behavior. LEK in relation to bears’ ecology also remains fragmented in case #2, ranging from possession of facts corresponding with current scientific knowledge to overestimation of various dynamics to simple vagueness and uncertainty (Toncheva and Fletcher, 2021;

Toncheva et al., *in press*). There we have shown that lack of practical experience with bears results in more fragmented and superficial knowledge (Toncheva and Fletcher, 2021; Toncheva et al., *in press*), and this appears to be true in case #1 as well, heightening fear of bears among those who know of bears only through brief encounter or through narratives related by others.

Further, including bears as actors in the “multispecies network” has shown how their behavior is often misinterpreted, as well as their curiosity when “trying to know the humans,” which is instead seen as a sign of aggression by many people. This is valid even for conservation experts who fail to acknowledge the needs of the animals or lack relevant data for establishing a better picture of their habits and behavior. Therefore, rather than the co-production of knowledge and mechanisms for cohabitation evident in case #2 (Toncheva and Fletcher, 2021), here bears are still attributed with negative characteristics such as being “problematic,” while humans remain largely unable to look through the “eyes of the bears” and thus grant them relevant space within the network of multispecies relations.

We have previously outlined the role of the hunters as “bear managers” in case #2, largely due to the origin of their LEK in direct experience and observations of the bears in relation to their participation in ecotourism delivery (Toncheva and Fletcher, 2021; Toncheva et al., *in press*). In case #1, by contrast, hunters do not generally play a similar role despite possessing deeper knowledge of bears. While in case #2 hunters also act as experts when applying adaptation measures, as well as transmitting information and guidance to other segments of the local population (Toncheva and Fletcher, 2021), in case #1 they are instead one of the groups most negatively impacted by bears, suffering damage at their feeders and game being chased away by the animals.

Regarding the economic dimension of human–bear coexistence, in case #2 we have previously demonstrated how locally developed ecotourism focused on bears functions as an economic incentive, albeit a relatively modest one, for local people to tolerate bears’ presence (Toncheva and Fletcher, 2021; Toncheva et al., *in press*). This initiative’s success is due to a few factors: its maintenance in low levels which limits ecological impacts; self-mobilization by local people who thus remain managers of their own resources and influential actors in tourism design and delivery; and its relatively low profits and non-reliance on market expansion (Büscher and Fletcher, 2020), thereby prevent conflicts but benefiting local hunters as those most affected by the bears’ presence (Toncheva and Fletcher, 2021; Toncheva et al., *in press*). In case #1, on the other hand, we have demonstrated how a combination of factors, such as the underdevelopment of the region, the ambiguous position of bears in tourism, and the reliance on conventional compensatory mechanisms, fails to mitigate the effects of negative human–bear interaction.

CONCLUSION

Through comparison analysis of the relative incidence of human–bear conflict and coexistence in our two contrasting case studies, the preceding discussion has highlighted a variety of characteristics that help to account for this discrepancy. In

so doing, the analysis also highlights ways that such factors resonate with elements of the convivial conservation proposal previously outlined.

First, our analysis supports this proposal’s assertion of the need for “more sensitivity in terms how non-humans are studied and managed” (Büscher and Fletcher, 2020, p. 195) in developing integrated conservation spaces that humans and wildlife cohabit. It also supports the proposal’s emphasis on the need to encourage mutual tolerance and adaptation within such spaces.

Notwithstanding the various problematic issues noted in the preceding discussion, case #1 is also marked by a certain level of tolerance toward bears, expressed not only by conservation experts but by some local residents too. Further encouragement of such tolerance, for example through dissemination of guidelines for negotiating human–bear encounters based on efforts to understand the bears’ perspective in such encounters of the sort that are present in case #2, could provide a good basis for conflict mitigation and a bridge toward mutual adaptation and conviviality.

Our comparative analysis also supports convivial conservation’s assertion of the need for greater democratization in conservation governance (Büscher and Fletcher, 2020). As our analysis demonstrates, case #1 is characterized by a distinct lack of democratic participation by local communities in policymaking regarding brown bears, which therefore appears to deal rather superficially and inadequately with the problems apparent in human–bear interaction. This is in marked contrast to case #2 of relatively successful cohabitation characterized by fairly democratic decision-making by local residents unimpeded by state-level authorities (Toncheva and Fletcher, 2021; Toncheva et al., *in press*). Despite the fact that the importance of genuine democratic participation in enabling community-based conservation has been reemphasized many times, research has shown that this often remains a rhetorical commitment with no real granting of rights (Dressler et al., 2010). A lack of genuine commitment to democratic participation appears problematic in our conflict case, as evidenced by widespread feelings of despair and lack of trust in state authorities and conservation agencies. A shift from HWC to conviviality in this case would, therefore, likely be facilitated by greater democratic engagement achieved via inclusion of local authorities and community members in discussion and decision-making.

Finally, our two cases are also differentiated by the extent to which they evidence finance mechanisms directly linked to conservation strategies that do not promote overdependence on market engagement—another core principle of convivial conservation (Büscher and Fletcher, 2020). In case #2, bear tourism has become an important (if limited) source of funding from and for bear conservation contributing to relatively peaceful coexistence (Toncheva and Fletcher, 2021; Toncheva et al., *in press*), which, while indeed harnessing markets for conservation finance, is small-scale enough to be part of a diversified income stream and hence does not encourage excessive market dependency. Case #1, by contrast, exhibits no similar mechanism. On the contrary, in this latter case the existing financial mechanism intended to support bear conservation—the damage compensation scheme—seems to be achieving the opposite due to operational deficiencies.

Development of responsible tourism emphasizing “engaged visitation” rather than spectacular voyeurism (Büscher and Fletcher, 2020), and which includes the bears as respected actors, could thus likely facilitate convivial coexistence in case #1 as well. Possibly even more effective would be to implement something like a “conservation basic income (CBI),” which Fletcher and Büscher (2020) propose as a truly non-market mechanism similar to a “basic income grant” (see Ferguson, 2015). Such a basic income could serve as an alternative livelihood for local residents to compensate for economic impacts of living with bears unencumbered by bureaucratic requirements or delays in distribution of benefits.

Our analysis, in sum, has demonstrated the utility of cross-case comparison in helping to elucidate the factors contributing to human–wildlife coexistence. It has also shown that the principles of convivial conservation can function as an appropriate framework both for assessing these factors and for promoting coexistence more broadly. We therefore invite other researchers to follow a similar analytical approach in working to further understand and develop conditions for convivial coexistence.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding author/s.

ETHICS STATEMENT

Ethical review and approval was not required for this study with human participants, in accordance with the local legislation and institutional requirements.

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AUTHOR CONTRIBUTIONS

ST designed the study, conducted fieldwork research, transcribed the interviews, and wrote first draft of the paper. RF contributed to conceptual framework of the study and wrote sections of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fcsc.2021.682835/full#supplementary-material>

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Coexistence Praxis: The Role of Resource Managers in Wolf-Livestock Interactions on Federal Lands

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In resource management, new terms are frequently introduced, reflecting ongoing evolution in the theory and practice of ecology and governance. Yet understandings of what new concepts mean, for whom, and what they imply for management on the ground can vary widely. Coexistence—a prominent concept within the literature and practices around human-wildlife conflict and predator management—is one such term: widely invoked and yet poorly defined. While for some coexistence is the latest paradigm in improving human-wildlife relations, the concept remains debated and indeed even hotly contested by others—particularly on the multiple-use public lands of the American West, where gray wolf conservation, livestock production, and the claims of diverse stakeholders share space.

The multiple meanings of coexistence present serious challenges for conservation practice, as what the concept implies or requires can be contested by those most central to its implementation. In this study we examine wolf-livestock management—a classic case of human-wildlife conflict—by focusing on the experiences and perspectives of U.S. Forest Service (USFS) managers. We reviewed coexistence's multivalence in the literature, complementing semi-structured interviews conducted with USFS employees on case study forests from across the western states. Through this, we highlight the complexity and multi-dimensionality of the concept, and the unique yet under-explored perspective that resource managers bring to these debates.

This work draws on insights from political ecology to emphasize the situatedness of manager practice—taking place within a broader set of relations and contextual pressures—while extending political ecologists' traditional focus on the resource user to a concern with the resource manager as a key actor in environmental conflicts. Through our engagement with the experiences and perceptions of USFS managers, who must balance conservation aims with long-established land uses like livestock grazing, we hope to clarify the various dimensions of coexistence. Our hope is that this work thus increases the possibility for empathy and collaboration among managers and stakeholders engaged in this complex socio-ecological challenge.

Keywords: American West, environmental governance, gray wolves, human-wildlife conflict, land management, livestock predation, multiple-use, U.S. Forest Service

INTRODUCTION

“I don’t believe in coexistence.” These were the words of a U.S. Forest Service (USFS) range specialist as they hiked with a member of our author team through a small ridgeline meadow in a densely forested grazing allotment of the Colville National Forest in Washington state. Examining the ground for possible wolf tracks, we discussed the challenges they had faced in their role as a land manager following the return of wolves to this landscape over the past 12 years, and the ensuing social conflict sparked by frequent attacks on livestock. They clarified that they see interventions around wolf conflict as incompatible with coexistence as a “technical term”: “Anytime... you have to intervene or... apply a high level of resources to make something work, to me that’s not coexistence—that’s *management*.” In their view, frequent use of the concept perpetuates a notion that wolves and livestock are going to learn to live in “peace and harmony”—an idea that “makes [them] cringe.” As they put it, “there’s going to be conflict.”

In resource management, new terms are frequently introduced, reflecting ongoing evolution in the theory and practice of ecology and governance. Yet understandings of what new concepts mean, for whom, and what they imply for work on the ground can vary widely. While coexistence is, for some, the latest paradigm in improving human-wildlife relations (e.g., Frank et al., 2019), for others—especially those in the multiple-use landscapes of the American West—it can be a cringe-worthy position. That terms can take on multiple meanings is a hallmark of semiotics and discourse analysis, but conceptual ambiguity can present serious difficulties for practices of collaborative conservation—as what a particular concept implies or requires can be contested by those most central to its implementation (Charnley et al., 2014; Epstein et al., 2018). Following efforts around other “essentially contested” concepts (Gallie, 1956, 1969; Connolly, 2007), we hope here to better illuminate the varied perceptions and practices surrounding coexistence among resource managers working on wolf-livestock conflict in the western United States.

Wolves present a classic case of human-wildlife conflict (HWC), a complex and often intractable global challenge for policymakers, managers, and those who share landscapes with carnivores and other megafauna species that threaten human life and livelihood (Treves and Karanth, 2003; Woodroffe et al., 2005; Dickman, 2010; Frank et al., 2019). Although widely regarded as a conservation success story (Mech, 1995; cf. Mech, 2012), the return of gray wolves (*Canis lupus*) to the Intermountain West has rekindled political controversy and social conflict. In the decades since federal reintroduction to Yellowstone National Park and Central Idaho in 1995 and 1996, significant thought, effort, and funds have been put toward sharing landscapes between people, livestock, and recolonizing wolf populations. Despite varying combinations of program and policy responses across states in the region—nonlethal deterrents, compensation for losses, and the use of public hunting seasons and lethal control—concerns and controversy remain over wolf conservation, livestock depredation, and the management efforts of state and federal agencies

(Clark et al., 2005; Young et al., 2015; Expósito-Granados et al., 2019; Martin, 2021b).

As wide-ranging and highly adaptable megafauna predators, wolves transgress both jurisdictional and spatial-psychological boundaries, creating challenges for conservation and management. In the western U.S., wolf management requires coordination across multiple resource agencies at state and federal levels, and often produces frictions between the various goals of public land administration. Past efforts to understand the dynamics of wildlife conflict have tended to focus on public lands constituents (e.g., livestock producers, environmental NGOs), and conflicting values and interests (grazing opportunities vs. environmental protections, and the appropriateness of certain animals in certain spaces) (Philo and Wilbert, 2000; Buller, 2008; Johansson et al., 2016). In contrast, our work here explores the central—yet underexplored—role of the resource manager as a key actor in the promotion of coexistence (cf. Moseley and Charnley, 2014; Epstein, 2020; Martin, 2021a). Political ecology scholarship provides important tools for considering the co-production of the material and discursive around environmental conflicts, and usefully conceptualizes conservation as an always social and political practice (Neumann, 2005; Perreault et al., 2015; Robbins, 2019). This framework highlights the situatedness of resource managers within a broader context and set of relations, and provides important insights into the tensions between management and coexistence exemplified in our opening vignette.

Our analysis draws from a set of semi-structured interviews conducted in spring and summer of 2021 addressing the perceptions of USFS managers in the western U.S. and what coexistence means to them in practice. Despite exuberance surrounding the concept, some argue that coexistence has been “too seldom defined and rarely studied” (Pooley et al., 2021, p.785). Our contribution here is to explore coexistence’s many possible meanings and dimensions through a critical assessment of the HWC literature, and by examining how the varied uses of the term align with the perceptions and practices of managers working on the ground. Hence we invoke the term *praxis* to emphasize the dialectical relationship between theory and practice and the processes through which ideas are enacted in the world. This work is an early contribution from a larger regional overview and comparative study of wolf-livestock management practices in national forests across the western U.S., sponsored and coordinated by the USFS Pacific Northwest Research Station.

In what follows, we first situate our research within the broader literature and historical arc of wolf return and conflict in the American West, emphasizing the added value of a focus on federal land managers as central players in the pursuit of coexistence with wildlife. We then clarify our methodological approach, which is grounded in qualitative social science research and informed by political ecology. From there we explore coexistence’s various definitions and applications in the HWC literature, before turning to the attitudes and practices of Forest Service managers across the western U.S. We then elaborate on these findings by identifying emerging lessons around the inseparability of wolf questions from broader regional issues, and the structural obstacles faced by managers contending

with these complex challenges. We conclude by reiterating the insights gained from this research for HWC and environmental governance broadly.

THE WOLF QUESTION

Following decades of concerted private and federal removal efforts, by the 1930s wolves had been nearly eliminated from the contiguous U.S. By mid-century, however, changes in public and scientific attitudes toward predators—alongside national economic and demographic shifts toward urbanization and away from extractive industry reliance—resulted in a reassessment of wolf policy (Jones, 2010; Manfredo et al., 2017). In 1974 wolves became one of the first species listed under the Endangered Species Act (ESA), initiating processes for restoration to a portion of their former range. By the 1990s reintroduction plans had come together, and wild-caught Canadian wolves (*Canis lupus occidentalis*) were released into Central Idaho and Yellowstone National Park in 1995 and 1996 (on this history, see Fischer, 1995; Bangs and Fritts, 1996; Fritts et al., 1997).

Wolf reintroduction has been widely regarded as a biological success, with populations rapidly increasing in number and range. In Yellowstone, wolf return became a touchstone for rewilding (Ripple and Beschta, 2005, 2012; Monbiot, 2014), with trophic cascade effects often described as making the park “whole” again (Robbins et al., 2014, p.183; cf. Mech, 2012; Middleton, 2014). Wolf populations also grew rapidly beyond the park, expanding across the region and triggering delisting in Montana and Idaho by the early 2000s. Today wolves have proliferated across the region, with packs in Oregon, Washington, and California, as well as reintroduction efforts beginning in Colorado, and underway in Arizona and New Mexico (of Mexican wolves, *Canis lupus baileyi*).

At the same time, tensions surrounding wolves remain among the most emblematic examples of HWC, a prominent issue for managers and stakeholders around the world (Woodroffe et al., 2005; Frank et al., 2019). Wolf return poses challenges for ranchers and rural communities concerned with the costs and consequences of sharing space with predators, and for agencies charged with managing habitat and species of concern. Wolf impacts include direct and indirect effects on livestock and other wildlife (such as wild ungulates), as well as increased public scrutiny over the management of public rangelands that now host wolves. Anti-wolf sentiment can at times appear disproportionate to wolves’ material impacts—particularly when compared to similar effects from other predator species and threats to rural livelihoods (Nie, 2003; Clark et al., 2005; Muhly and Musiani, 2009). Recent expansions of hunting and trapping in Idaho and Montana, the 2020 referendum for reintroduction in Colorado, and federal delisting of the species in early 2021 highlight the enduring polarization and controversy associated with regional wolf management.

Conflict surrounding gray wolves has ignited much scholarly interest. Alongside growing recognition of the human dimensions of HWC, research has increasingly looked to the social sciences to supplement exploration and engagement

with the wicked problems of conservation (Baruch-Mordo et al., 2009; Dickman, 2010; Peterson et al., 2010; Redpath et al., 2015; Charnley et al., 2017; Martin, 2021b; on wicked problems, see Rittel and Webber, 1973; Crowley and Head, 2017; DeFries and Nagendra, 2017; Mason et al., 2018). Research on the human dimensions of wolf conflict draws attention to the various ways social attitudes, perceptions, and values affect interactions among wolves, livestock, and human groups. Conflict is often framed as a question of competing wildlife value orientations: the utilitarian (emphasizing human land use for livestock production), in opposition to the mutualist (emphasizing conservation and care toward wildlife) (Nie, 2002; Manfredo et al., 2003, 2009, 2017; Teel et al., 2007). While this scholarship suggests that the wolf question serves as a reflection of social orientation, other research argues that conflicts over wolves also stand in for and even amplify broader regional anxieties (Hamilton et al., 2020; Martin, 2020)—especially in polarized political contexts in which value orientations are closely aligned with both rural-urban divisions and political affiliation (van Eeden et al., 2017, 2021).

Social science and humanities-informed perspectives also read American wolf conflict through a broader lens, emphasizing the region’s history of colonial dispossession (with important racialized and gendered dimensions) and subsequent struggles over public lands access and use (Emel, 1995; Wilson, 1997; Coleman, 2008; Robbins et al., 2014; Wise, 2016; see also Hays, 1959). The federal government owns and manages nearly half (47%) of land area in the American West, including a majority of the territory in some states. Large tracts of forest and range under the domain of the Bureau of Land Management (247.3 million acres) and the USFS (192.9 million acres) remain an important habitat for many species as well as a valuable source for timber, mineral resources, and livestock grazing (Bui and Sanger-Katz, 2016; Huntsinger, 2016; see also Stegner, 1992; Sheridan, 2001; Merrill, 2002).

Particularly following the extension of environmental regulations from the 1960s forward, much of this public land has been managed according to the doctrine of “multiple-use.”¹ Land management agencies are thereby charged with balancing extractive economic uses—including livestock grazing—with recreation and conservation aims (Rowley, 1985; Sayre, 2017; Wolters and Steel, 2020). We focus here on lands governed by the USFS according to multiple-use principles as key geographies of wolf-livestock interaction and conflict, as well as potential sites of coexistence interventions. Wolves’ mobility and adaptability underscore the tensions of multiple-use and highlight the important role of resource managers in navigating conflict between diverse users and management aims in shared spaces. Furthermore, although the managing agencies and regulations governing wolves have shifted significantly over the past several decades, the USFS has had a relatively consistent role as management authority over national forest lands, which serve as both wolf habitat and part of long-standing livestock grazing programs in the region (Figure 1).

¹The Multiple-Use Sustained-Yield Act of 1960 (Public Law 86-517, 74 Stat. 215, June 12, 1960).

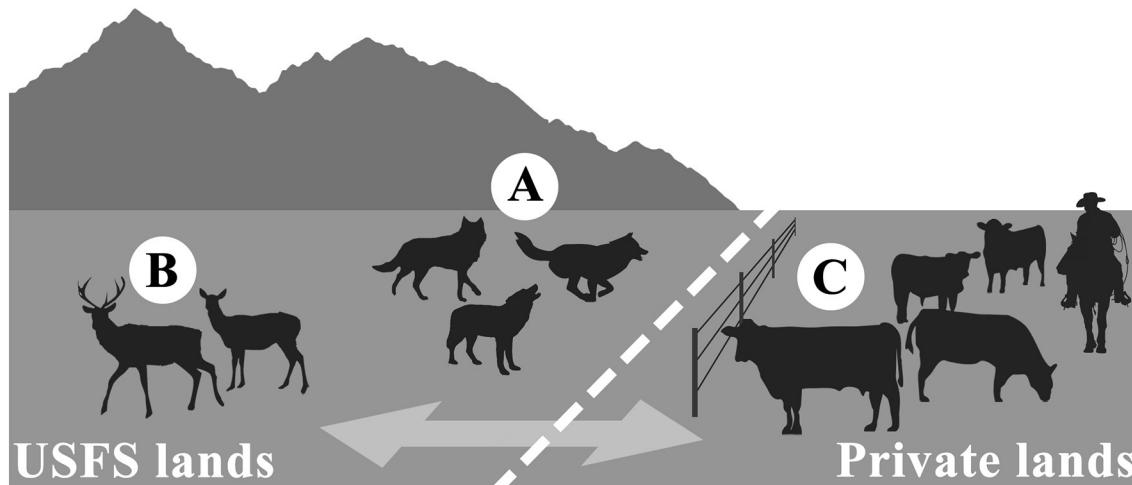


FIGURE 1 | Managing animals across jurisdictions. Livestock producers (“permittees”) graze privately-owned sheep and cattle on private lands as well as seasonally on USFS allotments, where they share space with wildlife. Wolves (A) prey on wild ungulates (deer and elk) (B) as well as opportunistically on domestic livestock (C). Wolves are managed by the U.S. Fish and Wildlife Service while under ESA protections, and otherwise by state-level fish and wildlife agencies. State agencies manage public hunting seasons (“harvest”) of wild ungulates and, where allowed by state wolf plans and regulations, wolves. They also authorize USDA APHIS Wildlife Services to deploy nonlethal deterrents in collaboration with livestock operators, as well as carry out lethal control actions for “problem wolves” in response to confirmed depredation events.

METHODS

Analytical Approach

This study takes a political ecology approach to the challenges of sustaining wolf and livestock populations on public lands in the American West. Invested in the social, economic, and political context and co-production of environmental conflicts (Robbins, 2019), the “big tent” of political ecology has done much to demonstrate the utility of critical perspectives for a variety of governance issues in the region (McCarthy, 2002; Walker, 2003; Schroeder et al., 2006; Martin et al., 2019). In particular, such a perspective stresses a need to understand “common sense” and “apolitical” explanations for conservation and resource management as reflections of both historical socio-political relations as well as current interests of particular actors and institutions. For example, political ecology research on protected areas and other top-down conservation agendas has explored how ideas of wilderness, nature, and ecosystem management are bound up with race, class, and both the histories and ongoing effects of colonialism and capitalism (Limerick, 1987; Guha, 1989; Cronon, 1996b; Jacoby, 2003; Igoe, 2004; Kosek, 2006; West et al., 2006; Adams and Hutton, 2007).

In our research, we draw these insights together with more recent work on critical physical geography (Lave et al., 2014, 2018) to consider in greater depth those in the position to manage conflict and define, practice, and promote or hinder coexistence. In this, we extend political ecology’s traditional engagement with the dynamics of resource *users* (Blaikie and Brookfield, 1987) by reorienting attention onto resource *managers*. In addition to providing a novel perspective on wolf-livestock conflict, this focus also reflects important aspects of the authors’ positionality: a team of critically-trained social

scientists who are also professional researchers, academics, and agency affiliates with long-standing engagement in resource management issues across the study region. Our approach thus strives to balance critical theory and practical application, to engage environmental problems with eyes toward broader structural processes and socio-political realities, while taking seriously the lived experiences and perspectives of resource managers on the ground. By approaching questions of wolf-livestock coexistence with both pragmatism and empathy, our hope is to use political ecology as both “hatchet” and “seed”: to provide critique, explanation, and to identify generative openings for creative alternatives (Martin et al., 2019; Robbins, 2019).

Research Methods

Our analysis and discussion of coexistence praxis here is informed by a review of the HWC literature along with qualitative data on the perspectives of USFS managers engaged in range and wildlife management practices on public grazing lands. These are also components of a larger, region-wide assessment and study of wolf-livestock conflict and management across the American West. Initiated at the request of USFS range managers engaged in wolf-livestock conflict management in Region 6 (Oregon and Washington), this work compares practices and perspectives on the drivers and social-ecological context of similar conflicts in other USFS regions. Research began in September 2020 and is ongoing.

We collected primary data for this study in spring and summer 2021, conducting semi-structured interviews with USFS employees associated with wolf management and/or public lands livestock grazing programs. Our interview participants represent six different national forests across six western states (California, Idaho, Montana, Oregon, Washington, and

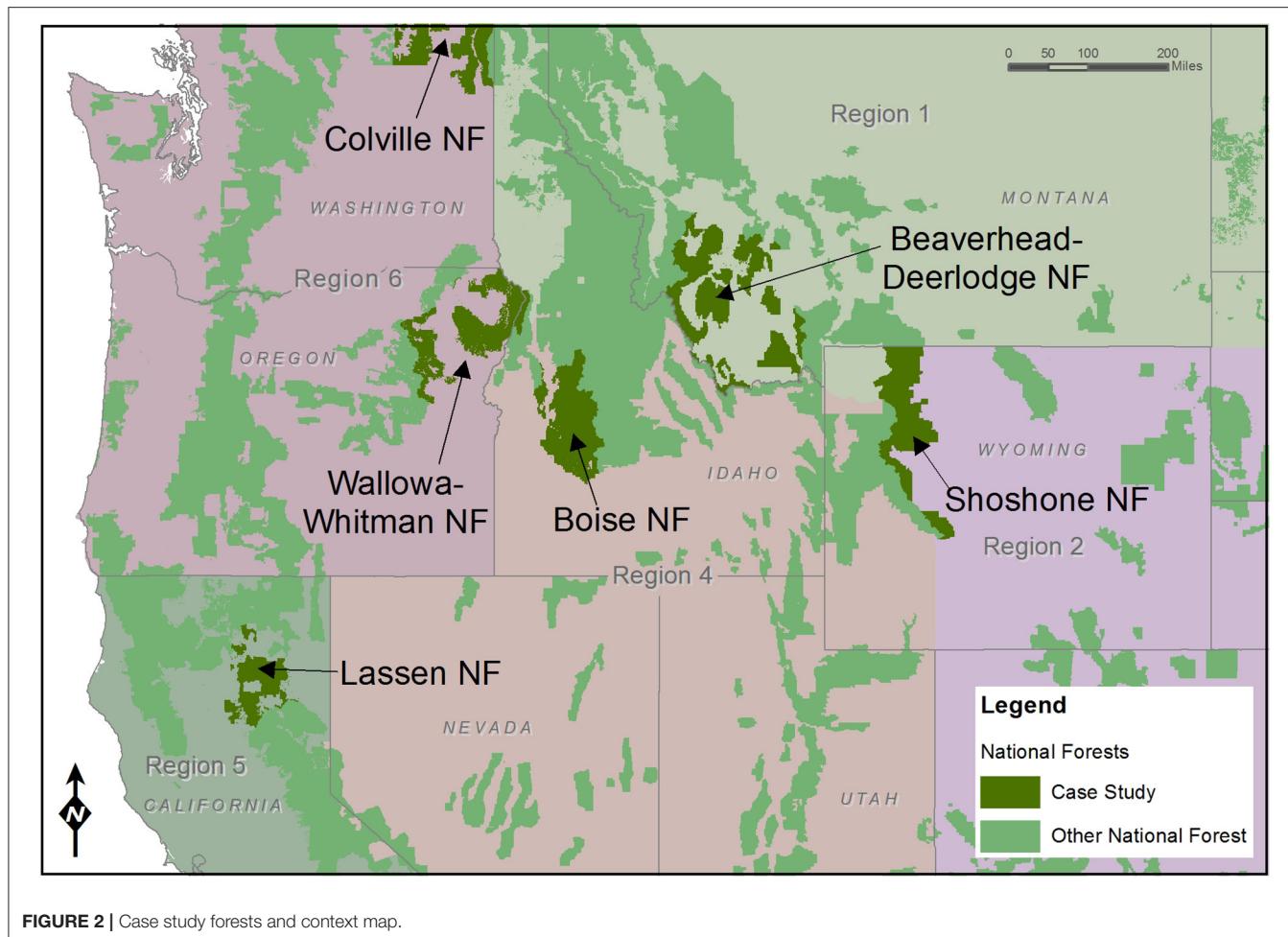


FIGURE 2 | Case study forests and context map.

Wyoming) from five different USFS regions (Figure 2). These forests were purposefully selected in consultation with key informants, including regional and forest-level range program managers. Selection criteria included: sizable grazing program and established wolf populations; representation from different states and USFS regions; diverse wolf management policy histories; historic or current wolf-livestock conflict; numerous strategies employed to mitigate conflict; and willingness to participate in the study (Table 1 provides basic characteristics relevant to wolf-livestock conflict for the case study forests).

We identified interview participants using snowball sampling techniques (Bernard, 2017), beginning with regional and forest-level range program managers who were briefed about the study and its purpose during at least one virtual monthly meeting of their regional range program. We targeted managers responsible for overseeing wildlife and grazing issues on the sample forests. Potential participants were sent email messages describing the study and requesting their (voluntary) participation. A total of 23 managers were interviewed between March and July 2021 (Table 1). Prior to the interview, each participant provided written (email) and/or verbal consent. As researchers affiliated with the USFS,

all authors have undergone the agency's scientific ethics and integrity training and/or university-approved training on research with human subjects.

We conducted interviews by telephone or using virtual platforms and recorded these conversations (participants all gave verbal consent to be recorded). Conversations lasted between 45 and 90 minutes and followed a semi-structured interview guide designed collectively by the author team. Questions aimed to generate information about each forest's wolf population, wolf-livestock interactions, and conflict mitigation programs, as well as more general insights related to interviewees' perspectives on the social dimensions of HWC. Particular attention was given to elucidating definitions of coexistence alongside reflections on its nature and feasibility given the social-ecological context and history of each site. Using a qualitative research methodology (Sayre, 2004; Drury et al., 2011), data about coexistence were generated both directly through targeted questioning and indirectly through discussions of wolf-livestock dynamics and programmatic responses. Interviews were transcribed and then coded in Atlas.ti, a qualitative data analysis software, following a thematic analysis intended to identify core themes and patterns (Guest et al., 2012).

TABLE 1 | Status of wolves and livestock on case-study national forests, 2020–2021.

National forest	Beaverhead-Deerlodge	Shoshone	Boise	Lassen	Colville	Wallowa- Whitman
State	MT	WY	ID	CA	WA	OR
USFS region	1	2	4	5	6	6
Managers interviewed	6	3	3	4	3	4
Wolf packs on NF, 2021 (estimated)	10 ^b	12-14 ^b	8-18 ^b	1 (12-15 animals) ^b	12 (≥ 55 animals) ^{b,c}	11 (≥ 82 animals) ^d
Year established	late 1990s ^b	late 1990s ^b	1995/96 ^{b,*}	2016 ^{b,e}	2009 ^{b,c,*}	2008 ^{d,*}
# Grazing permittees ^a	216	59	36	17	32	91
# Authorized cattle, HMs ^{a,f}	133,510	42,009	22,156	17,784	20,833	81,528
# Authorized goats/sheep, HMs ^{a,f}	20,511	2,004	30,250	0	0	15,118

^aUSFS Annual Grazing Statistical Report, Fiscal Year 2020.^bInterview data, 2021.^cWashington Dept. of Fish and Wildlife.^dOregon Dept. of Fish and Wildlife.^eCalifornia Dept. of Fish and Wildlife.^fHM, Head-month, “one month’s use and occupancy of the range by one animal” (United States Forest Service [USFS], 2005, p.7).^{*}Sightings reported prior to these dates.

WHAT DOES COEXISTENCE MEAN?

As a longstanding and well-studied concept in community ecology, coexistence describes different populations sharing resources within the same niche or locality (Schoener, 1974; Chesson, 2000). While this definition typically refers to competitive dynamics between nonhuman species, it is a relevant reference point for land managers and others trained in the natural sciences (Chapron and López-Bao, 2016). Early usage of coexistence with regards to *human* uses of the landscape, however, appears linked with discussions of coexistence between tourism and conservation (Budowski, 1976) and between recreation or industry and wildlife (Tanner et al., 1977; Gillham and Smith, 1983). In the North American context, Dorrance describes “the objective of minimizing conflicts and promoting harmonious coexistence between wildlife and human interests” (Dorrance, 1983, p.323). Literature speaking to the potential for coexistence between wildlife conservation and local peoples’ interests and needs, particularly in South Asia and Africa, emerges in the mid-1990s and early 2000s (Nepal and Weber, 1995; Hoare and Du Toit, 1999; Venkataraman, 2000; Saberwal et al., 2001; Neumann, 2002; Woodroffe et al., 2005). This usage aligns with efforts around community-based natural resource management (Western et al., 1994; Brosius et al., 1998; Hackel, 1999), as well as political ecology critiques of “fortress conservation” and other environmental initiatives that exclude particular humans and activities from areas designated for wildlife (Brockington, 2002; West et al., 2006).

Coexistence has been defined in diverse ways in the literature on HWC. The concept is fundamentally geographic, concerned with *where* wildlife is supposed to live, and if and how people might share space with them (Treves and Bruskotter, 2014; Marshall et al., 2016; López-Bao et al., 2017).

Treves and Santiago-Ávila (2020) define human-wildlife coexistence as “sharing a landscape (not necessarily close in space or time), even if encounters seldom occur.” Yet the term often implies something more than simple co-occurrence. Coexistence often serves as foil or opposite to *conflict* (Woodroffe et al., 2005; Frank et al., 2019)—although see Treves and Santiago-Ávila on the emerging subfield of “human-wildlife conflict *and* coexistence” (Treves and Santiago-Ávila, 2020 emphasis added) pointing to the ways in which these concepts are increasingly linked rather than counterposed.

The conflicts described, notably, occur not just between humans and wildlife directly, but also frequently between human groups *over* wildlife (Peterson et al., 2010; Redpath et al., 2015)—including over whether and how animals belong in particular places, a theme shared with animal geography (Philo and Wilbert, 2000; Urbanik, 2012). Some scholarship emphasizes psychological aspects as a key dimension of coexistence, particularly around the perception of risk (Carter et al., 2012b; Bruskotter and Wilson, 2013; Johansson et al., 2016), and there is now significant HWC scholarship concerned with human perceptions, attitudes, and identity—with coexistence framed as a question of tolerance and social values (Manfredo et al., 2003; Treves and Karanth, 2003; Teel et al., 2007; Madden and McQuinn, 2014; van Eeden et al., 2017, 2021; Ehrhart et al., 2021).

Furthermore, so-called “landscapes of coexistence” (Oriol-Cotterill et al., 2015; see also Western et al., 2019) rely on active interventions aimed at reducing the human costs of sharing landscapes with wildlife. Particularly in areas used by both livestock and carnivores, this usage of coexistence describes strategies to reduce livestock mortality as well as other costs to producers (notably, conflating *human-predator*

with *predator-livestock* coexistence). Such efforts lean heavily on deterrents aimed at preventing depredation, frequently positioned as “nonlethal alternatives” to the lethal control of “problem individuals.” While these tools and techniques are often described as “straightforward” (Western Wildlife Outreach, 2014), questions remain around their effectiveness and associated costs (on the efficacy and ethics of lethal vs. nonlethal wildlife management, see Miller et al., 2016; Eklund et al., 2017; DeCesare et al., 2018; Lennox et al., 2018; Moreira-Arce et al., 2018; van Eeden et al., 2018; Treves et al., 2019; Gamborg et al., 2020; Boronyak et al., 2021).

Others have attempted to specify these questions through the concept of *co-adaptation*, a broader “socio-ecological framework for operationalizing coexistence” (Lute and Carter, 2020). Carter and Linnell (2016) thus define coexistence as a state in which humans and carnivores co-adapt in shared landscapes, emphasizing learning and shifting behaviors of humans and predators through mutual adaptation. From this perspective, nonlethal deterrents aim to cause changes in predator behavior, as through the production of a “landscape of fear” in which predators learn to avoid humans and/or livestock (Miller and Schmitz, 2019; Wilkinson et al., 2020; Gaynor et al., 2021; Anderson et al., in review). Other approaches stress adaptation on the human side, such as monitoring of predator populations to reduce predator-livestock overlap, and adoption of livestock husbandry techniques to reduce attractants to and interactions with predators (Stone et al., 2017; Martin, 2021b). Adaptations on the livestock side (although largely driven by humans) include switching to livestock breeds better able to defend themselves against predators, training livestock to adopt behaviors similar to wild ungulates that make them less vulnerable to depredation and negative encounters (Barnes, 2015), and synchronizing the calving season with that of wild ungulates to cause “predator saturation” (Breck et al., 2011). A wide suite of approaches has been applied to wolf conflict management in the western U.S. (Table 2), many described in “hands-on” guides aimed at supporting livestock producers with deterrence and husbandry techniques (e.g., Gese et al., 2005; Western Wildlife Outreach, 2014; Stone et al., 2016; ODFW, 2019; Lance et al., n.d.).

Carter and Linnell argue that coexistence in shared landscapes requires that “human interactions with carnivores are governed by effective institutions that ensure long-term carnivore population persistence, social legitimacy, and tolerable levels of risk” (Carter and Linnell, 2016, p.525). These findings suggest that applied interventions often go hand-in-hand with policy-based approaches—such as government regulations regarding the harvest of predator species, use of lethal control in response to conflict, and conflict-mitigation programs to provide financial compensation for predator-caused losses—or can be undermined through perverse incentives (Dickman et al., 2011; Martin, 2021b).

In sum, our review locates coexistence as an apt “umbrella concept” (Expósito-Granados et al., 2019, p.2), which encompasses tools and techniques for the management of multiple species (including humans), policy and institutions, as

well as tolerance and social values. Yet HWC and coexistence also raise questions around hazard and risk, including how “tolerable” is defined and for whom, that benefit from a political ecology engagement. Our goal here is to put the core concerns of existing HWC scholarship in dialogue with critical analytics attuned to political economic context, transformations, and broader socio-cultural conflicts (e.g., Greenough, 2003; Buller, 2008; Collard, 2012; Margulies and Karanth, 2018; de Silva and Srinivasan, 2019). In the sections that follow, we report on and discuss the roles and perspectives of USFS resource managers to frame coexistence as situated social practice, highlighting manager positionality within the broader context of public lands resource governance. This analysis contributes a novel perspective on coexistence—one seen through the eyes of those managing key geographies of HWC—as well as insights onto the limitations and opportunities for wolf-livestock management through the lens of social practice.

MANAGER PERSPECTIVES ON COEXISTENCE

We asked USFS managers across our study region to report on their understandings of coexistence, how they have engaged the concept in their work, and its relevance for management practice around wolf-livestock conflict. In line with our review of the literature, participants’ responses reveal the multivalence and mutability of the term, i.e. its ability to take on different meanings and applications.

For many of those interviewed, maintaining public lands for both livestock grazing and wildlife was a key component of coexistence, understood as management for multiple uses on shared landscapes. For one manager on the Colville, coexistence meant that both wolf populations and the local agricultural economy would remain “viable.” While the balance was, at times, positioned squarely between “sustainable cow grazing and sustainable wolf habitat,” as a manager on the Wallowa-Whitman put it, others described a more comprehensive perspective reflective of their agency’s multiple-use commitment. As one Beaverhead-Deerlodge manager put it, coexistence was “everything that everybody wants on the landscape at the same time”—pointing to both a sense of idealism in the term’s application, as well as the seemingly impossible position in which managers could find themselves.

Managers described how the specific scale, timing, and spatiality of coexistence could vary, with interviewees often referring to conflict “hot spots”: areas with “good wolf habitat,” active dens, or rendezvous sites, where livestock conflict was highly probable and/or persistent. These hot spots necessitated some sort of avoidance measure, or else chronic—and hence seemingly ineffective, in terms of conflict reduction—lethal control actions. As one former manager on the Wallowa-Whitman put it, “There are some parts of the landscape where a wolf just cannot live safely... There’s just such [a] high probability for conflict, there’s a low chance of success there. There’s other parts of the landscape... where wolves seem to be persisting in stable packs over the long term with very few conflicts.” It was

TABLE 2 | Tools and techniques: wolf conflict management across western U.S. national forests.

Approach	Mechanism	Examples
Reconnaissance	Monitoring wolf presence and movements allows land managers and/or livestock producers to proactively avoid interactions and reduce spatial overlap between wolves and livestock.	Radio and/or GIS collars, wildlife cameras, howl surveys, public reporting of wolf sightings.
Husbandry	By changing approaches to livestock management, producers may be able to reduce attractants to wolves and minimize likelihood of conflict.	Herding or range riding to protect livestock; removal of livestock carcasses and bone piles; additional protection of calving/lambing areas; prompt removal/treatment of sick or injured livestock; changes to timing of turnout onto grazing allotments; relocating herds or changing pasture use; techniques of “low-stress livestock handling” (Bangs et al., 2006; Barnes, 2015; Stone et al., 2017).
Deterrents	Non-lethal hazing and distancing technologies, developed to deter wolves from attacking livestock. Mechanisms include direct disruption of attacks, aversive conditioning, and spatial interventions to physically enclose livestock areas (see Wilkinson et al., 2020).	Livestock guardian dogs (Gehring et al., 2010); fladry and electrified “turbo-fladry” (Davidson-Nelson and Gehring, 2010; Lance et al., 2010; Iliopoulos et al., 2019; Young et al., 2019); noise-makers; non-lethal munitions; automated devices such as Foxlights and radio-activated guard boxes (Bangs et al., 2006; Barnes, 2015; Stone et al., 2017).
Lethal control	Targeted removal of “problem wolves” in areas where conflict occurs. Removal may be incremental (one wolf targeted at a time) or full pack removal. (Effectiveness debated: see Bradley et al., 2015; DeCesare et al., 2018).	Aerial shooting (from helicopter), trapping (generally by USDA APHIS Wildlife Services agents), or issuing kill permits to affected livestock producers.
Hunting	Generalized (non-targeted) wolf population reduction. Killing wolves reduces or limits numbers and works to increase wolves’ fear of humans / prevent habituation.	Regulated, legal hunting seasons (managed by state fish and wildlife agencies); designation of wolves as a “shoot-on-sight” species.
Compensation	Financial payments to affected livestock producers for wolf-caused losses, with aims of reducing financial burdens, increasing social tolerance, and building support for conservation efforts (Dickman et al., 2011; Steele et al., 2013).	Payments to producers for confirmed wolf kills (procedures vary by location and have changed over time).

further noted that “intuitively, it makes sense that the [wolves] start figuring out where they can persist, and people figure out where they can tolerate that species.” While this sentiment evokes co-adaptation (Carter and Linnell, 2016; Lute and Carter, 2020), it also raises the question of spatial scale: whether coexistence is, in practice, less about getting along together than existing sustainably apart (see Carter et al., 2012a).

Another aspect of managers’ conceptualization of coexistence was the recognition that sharing landscapes with wolves required novel approaches to range and livestock management vis-à-vis the recent past—making coexistence a technical question of finding the right tools and techniques for conflict deterrence. While their descriptions included many of the approaches described above (Table 2), managers did not see their role as one of deployment, stressing instead the purview of individual operators, Wildlife Services, or state wildlife agencies in conflict mitigation (Figure 1). Furthermore, the question of public vs. private lands often weighed heavily on managers’ assessment of the appropriateness and effectiveness of the tools. Fladry, for instance, was often described as effective on small scales and private lands, but inappropriate for national forests given their remoteness and the mobility of livestock over large scale allotments; on the Beaverhead-Deerlodge, for example, “It just immediately became cost-ineffective.” Similarly, range riding was often described as too costly and labor intensive, or otherwise inappropriate to rugged, forested terrain.

Some informants—particularly in states with a history of state-sanctioned lethal control, like Idaho, Montana, and Wyoming—saw targeted removal and hunting seasons as critical components of wolf management. Here the ability to lethally control wolves—both as “problem” individuals and at the level of the population—was seen as key to promoting coexistence. On the Boise, one manager explained, “I think what is important for me and the resource... is being able to manage the species.” Additionally, managers often perceived a transformative power in hunting for generating social tolerance (Anderson, 2021). On the Shoshone, one noted, “I think people went from feeling helpless to, ‘All right. If I don’t like wolf numbers, I can go carry a tag during hunting season.’ I think that really made a difference to where wolves were more palatable to a larger population of the public.”

In states where wolves have been on the landscape for multiple decades, managers noted that coexistence required a long-term shift in attitudes and values. As one manager on the Beaverhead-Deerlodge put it, “It would change, in my mind, the attitudes of both landowners and species advocates that we’re willing to give on both sides, to allow both sides to succeed. That’s what success looks like for me... more so than large packs, or the number of packs, or the number of depredations... how do we allow wolves to exist within our social structure? How are we going to accept... the different values that are there?” For national forests where return was more recent (as in Washington, Oregon,

and California), wolf arrival represented a serious turning point in both social expectations and ecosystem dynamics. As one manager on the Wallowa-Whitman described it, coexistence “might just be [a] change of paradigm, change of idea... [or] maybe the whole system has to get rearranged because we introduced a new thing that wasn’t there previously.”

This was an “issue of acceptance,” according to one former Wallowa-Whitman employee, a recognition that wolves were “here to stay.” Such acceptance could come with time: “Back in the earlier days, it was every [depredation] made the newspapers and radio, and it was a big thing. Now we don’t hear about it as much”—“Every single attack on a cow or a sheep is no longer big news.” Yet conflict was also, as expressed by one Colville manager, a question of “conflicting social values” and political polarization—disagreements that could hinder the shift toward tolerance and coexistence. For the managers we interviewed, navigating these social dimensions required its own set of practices and strategies (see Epstein, *In review*). As one manager on the Boise described, the work of coexistence requires “lots of talks” with other agencies, and long-term relationships with producers, demonstrating the collaborative aspects of coexistence and managers’ stated investment in communication and trust-building for reducing conflict (Charnley et al., 2014).

Multiple managers described the need for social acceptance of loss—both of individual wolves and of domestic animals—as requisite to coexistence. On the Beaverhead-Deerlodge, a manager put it this way: “Coexistence to me is accepting that we’re gonna lose some cows, accepting that we’re gonna lose some poodles at Big Sky, and accepting that we’re gonna target remove some wolves, and more that we’re going to select for the animals we never see”—alluding again to questions of spatial scale and distribution. Another on the Colville described similarly: “We’re gonna experience some reasonable losses when it comes to livestock grazing. We’re probably gonna be actively managing wolf populations. They may [even] be a game species at some point.” On the Wallowa-Whitman it was hoped they might eventually “get away from this ‘you should never kill a wolf’ or ‘you should always kill a wolf’ dynamic, and recognize there are places where you should not... [and] there’s places where sometimes you need to.”

Shifting attitudes among producers toward the acceptance of livestock loss and wolves on the landscape was pursued through both technical and social interventions, but also required supportive policies outside the Forest Service—emphasizing the role of institutional and policy factors in shaping coexistence. Managers noted the importance of financial compensation programs for livestock producers who experienced losses, although the form these took mattered. Compensation only for confirmed depredations failed to capture non-fatal impacts or the full number of lost animals given the likelihood of late- or non-discovery of carcasses on remote ranges (Breck et al., 2011; Steele et al., 2013). In California, where wolves arrived in 2011 (with a pack established only in 2016), the ongoing lack of any kind of compensation program has “hindered” coexistence. However, this left open the “still to be determined” possibility of designing a more effective system for producers, perhaps along “pay-for-presence” lines in which producers receive compensation for

sharing space with wolves rather than for dead livestock (Zabel and Holm-Müller, 2008; Zabel et al., 2014; see also Dickman et al., 2011).

As noted above, managers expressed awareness of their positionality as government agents and public land managers, acknowledging their need to straddle the multiple, often polarized perspectives of stakeholder groups. On the Shoshone, one manager explained: “I know for some people, coexistence means you can never kill a wolf and maybe on the other end, coexistence might mean never having to lose a calf. I don’t know. To me, it’s recognizing that some of that is gonna go on either end if you will.” One Boise manager reflected, “We want people to have a successful livelihood, and we also want to have wolves present on the landscape... trying to balance the two can be tricky.” These findings match those of other surveys of conservation professionals: Lute et al. (2018) found that “human adaptation to carnivores” and “acceptance of some conflict” were key aspects of how they conceptualize successful coexistence—or, as one manager from Beaverhead-Deerlodge put it, “coexistence comes with conflict.”

On the Beaverhead-Deerlodge, where wolves have had a strong presence for decades, managers emphasized that coexistence had been achieved: “I think you’re watching it.” One manager on the Wallowa-Whitman noted, “I feel like we’re right there right now. There’s a balance of acceptance that they’re on the landscape. There isn’t this constant argument as to, ‘why isn’t someone doing something about getting rid of them?’ That’s past.” Elsewhere, however, managers were less sanguine, reluctant to even use the word—as in our opening vignette from the Colville. A conceptualization of coexistence as a natural state in which species share space without competition makes the concept incompatible, in some managers’ view, with active and ongoing management interventions to reduce depredation—hence “I don’t believe in coexistence.” On the Boise, where wolf reintroduction has accompanied decades of largely intractable conflict, wolf-livestock dynamics were described as a “no-win situation” where “everybody’s paying the price.” This sort of stark disagreement no doubt reflects differing experiences across our case study forests, as well as the need for future work to probe more deeply into differing applications and interpretations of the term.

In many ways the perspectives expressed by USFS managers mirror insights from the literature. In contrast with the idea that coexistence is purely a “technical term” with precise meaning, synonymous with perfect harmony, our wider discussions with managers confirm that coexistence is complex and multi-dimensional. Clarifying these dimensions helps us unpack the sometimes-divergent uses and contrasting interpretations of the term. The four aspects identified here (**Figure 3**) overlap, commingle, and highlight coexistence’s simultaneously descriptive and prescriptive valances. The word describes conditions of spatial co-occurrence, but also implies a normative goal of shared space between conservation and rural livelihoods. It can describe a state of social tolerance for wildlife—something achieved to a greater or lesser degree in a place or populace—as well as affective efforts to shift attitudes toward acceptance and legitimacy on the landscape in question. And coexistence is



both the set of technical tools and institutional policies that help reduce negative interactions, as well as the value-laden judgment that these efforts reflect worthy and necessary societal goals. Each of these aspects can be associated with particular practices as well, carried out by particular actors. Next, we draw inspiration from political ecology to examine managers' reflections and practices in light of their positionality and the broader context of regional resource governance.

MANAGEMENT AS SOCIAL PRAXIS

While managers' descriptions of and reflections on coexistence bring some clarity to the concept's multivalence and multiple dimensions, our qualitative data also reveal important insights about the positionality of USFS employees navigating wolf conflicts on public lands. Inspired by political ecology perspectives on human-environment dynamics and the value of locating environmental conflicts within their broader social and political contexts, our discussion here highlights the relational and situated nature of resource management. Contextualizing coexistence in this way reveals important insights about the opportunities and constraints facing USFS employees in mediating human-wildlife conflicts.

Forest Service efforts in the region take place within a complex division of responsibility across multiple landowners, agencies, and stakeholders, including permittees and state fish and wildlife agencies (Figure 1). Managers' perspectives emphasize their position within a particular federal land agency and the expected responsibilities—and limitations—that accompany it. One manager on the Colville pointed to how the USFS "always tried to be careful and mindful of doing our work and not trying to do other agencies' or people's work. We don't get into a lot

of conversations about how the state should be managing the wildlife or wolves. We also shouldn't be speaking about how ranchers should manage their businesses. What we're to do is manage the resources and habitat out on national forest land."

This need for Forest Service managers to "stay in their lane"—e.g., leaving wildlife management questions to state agencies—was often repeated, but so too was a sense of incongruity vis-à-vis complex ecological dynamics and their capacity to influence wolf-livestock interactions at different spatial and temporal scales. Fluctuations in elk numbers and distribution—a population managed by state agencies—can influence rates of wolf depredation on livestock on USFS lands, as can severe winters, development patterns, and even climate change. At the same time, the impacts of wolf depredation for producers may be exacerbated by these threats, and by other predators like grizzly bears (Middleton et al., 2013). As one range specialist on the Beaverhead-Deerlodge noted, even with "great partners" in the state and other federal agencies, this complexity can create a "gap" in which "things get at odds once in a while"—an attitude that reflects the challenges associated with environmental governance in the region.

In their role as employees of a federal agency, USFS managers also navigate deep-rooted disputes over land use and regional environmental politics. Tensions between livestock grazing and conservation on national forest lands intersect with both originary debates and ongoing legal struggles over the use and purpose of the public domain (Rakestraw, 1958; Hays, 1959; Rowley, 1985). These can also manifest in contemporary political polarization and at times conspiratorial attitudes and perspectives (Walker, 2018; Wolters and Steel, 2020). A manager on the Wallowa-Whitman noted an often-heard claim questioning the endemism of the local wolf population: "You've got the anti-wolf crowd that promotes ideas like, 'these wolves are larger, meaner, 'Canadian wolves' that didn't evolve here. Therefore, they don't belong here'" (Martin, 2020).

While such pejorative arguments seek to raise doubts about the feasibility of effective resolutions to wolf-livestock conflict, so too does the skepticism of so-called "radical" environmental groups who—despite numerous examples of regional success—continue to view the needs of wildlife and livestock as fundamentally incompatible (Wuerthner, 2017a,b; cf. Stone et al., 2017; Brugger et al., 2020; Martin, 2021b). Despite acknowledgment that "a lotta people have met in the middle, from a social perspective," managers pointed to the potential for wolves to generate extreme positions—often bound up with issues far beyond wolves themselves, and ultimately serving as barriers to collaboration and acceptance (Manfredo et al., 2017; van Eeden et al., 2021).² Hence manager's perspectives on coexistence relate to their position "in the middle," as a manager on the Boise put it: "the animals are on us... and the permittees are on us, and so... we try to just keep everyone with positive connections and relationship[s]."

Interventions promoted around the region (Table 2) generally aim to reduce conflict through various tools and techniques,

²This tendency appears to extend to wolf issues worldwide; compare Skogen et al. (2008).

focusing on ecological and behavioral mechanisms of wolves and/or livestock (Wilkinson et al., 2020; Martin, 2021b; Anderson et al., in review). These technical interventions can certainly impact depredation rates (Stone et al., 2017; Moreira-Arce et al., 2018; Kinka and Young, 2019), but it may be their potential for giving stakeholders a feeling of control that helps alleviate the psychological dimensions of conflict, affecting human “hearts and minds.” Having someone “show up” and “bein’ willin’ to listen,” as one Lassen manager put it, can go a long way toward reducing animosity as well. Having tools available—even if their material effectiveness is questionable—helps with producers’ feelings of helplessness. Several managers alluded to the affective potential of interventions, and similar pragmatism was expressed around both lethal control and hunting seasons, in which “a little blood” could go a long way for tolerance (Anderson, 2021)³. In the experiences of our informants, coexistence is thus often as much about managing *people* as it is about managing animals (Treves and Karanth, 2003; Peterson et al., 2010; Epstein, 2020; Anderson et al., in review). A focus on managers’ positionality—as they contend with multiple-use commitments around complex ecosystems and processes amid political polarization and structural constraints (Martin, 2021a)—illuminates features of a holistic, more-than-technical praxis of coexistence (Figure 3).

Despite the often-voiced desires of stakeholders, it is increasingly clear that there is no easy answer or “silver bullet” for living with wolves. Deterrents must be deployed alongside efforts to shift mindsets, while both necessitate supportive policies and institutions. Yet managers often described being asked to grapple with things outside their control and without adequate resources. Federal land use policy and guidelines—along with the political stance and scope of federal agencies themselves—set limits on the range of choice available for managers on the ground in negotiating wolf-livestock conflict (cf. White, 1961; Wescoat, 1987). Rules are made and priorities set at higher levels of the agency or by other governmental bodies. Funding and resources are likewise allocated at higher levels and among competing concerns—for the Forest Service, this often means prioritizing wildfire spending (Calkin et al., 2015)—leaving other program areas such as monitoring and range and wildlife management under-supported (Malcom et al., 2019; Martin, 2021a,b). Such external pressures and structural limitations clarify the broader context influencing managers’ matter-of-fact discussions on the costliness of coexistence tools and techniques, and their perceived inability to make particular interventions (e.g. requiring usage of nonlethals) or address the demands of producers on national forest allotments (e.g. around range use patterns).

Importantly, recent research has begun to question the broader legal context framing the “age-old struggle,” as a manager on the Beaverhead-Deerlodge put it, in which the USFS manages

habitat while the states manage wildlife. The extensive law review of Nie et al. (2017) argues against the doctrine of “state supremacy,” suggesting instead that federal agencies in fact hold great leeway in their management of lands *and* the wildlife on those lands. Yet pressures on managers to “stay in their lane” extend beyond the formal legal sphere. A political ecology analysis reminds us to consider governance as co-produced, multi-scalar, and power-infused. An eye toward the situated practice of on-the-ground managers helps put wolf-livestock management questions within a wider regional and historical context: one in which managers and stakeholders act in the shadow of the northern spotted owl controversy, the Wise Use movement, and the Malheur takeover (Cronon, 1996a; McCarthy, 2002; Walker, 2018). Between socio-political polarization, higher-level regulatory hurdles, and under-funding of on-the-ground efforts, managers can often be left feeling that their hands are tied, their choices constrained.

In contrast with our opening vignette, we propose that coexistence is not a state of nonintervention, of perfect harmony and zero losses—recall “coexistence comes with conflict.” Our discussions with managers across the region instead help us to think of coexistence as a *process*: navigating the tensions inherent in sharing space with wildlife, finding levels of loss acceptable for both livestock producers and wolf proponents, and “staying with the trouble” (Haraway, 2016). As one Boise manager pithily explained “It’s always *work*.” Even under the best of circumstances, coexistence requires practical and affective labor on the part of managers (Epstein, In review). Navigating these tensions requires pragmatism and collaboration, even as managers simultaneously contend with the particularities of local context and influences beyond their individual control. This points toward the need to think about coexistence as something necessitating higher level structural change, and moving our framework from conflict mitigation or resolution to one of conflict transformation (Madden and McQuinn, 2014; Brugger et al., 2020; Harrison and Loring, 2020).

CONCLUSION

As Lute and Carter (2020) argue, “Human-carnivore coexistence is an oft-stated goal but assumptions about what constitutes coexistence can lead to goal misalignment and undermine policy and program efficacy.” Through our literature review and interviews with USFS managers across the region, we have shown that coexistence remains highly multidimensional and often underspecified and ambiguous. Examining the concept of coexistence from the perspective of land managers—who must balance conservation aims with long-established land uses, including livestock grazing—sheds light onto this multidimensionality while clarifying coexistence as a process rather than an end goal. Our approach also reflects political ecology insights around co-production: coexistence is not just a question of changing attitudes, but must be also about practices; it cannot just be about the right tools, but must contend with questions of trust and social relations; it is not only about the work of those on the ground, but must also address

³These attitudes complicate the conclusions of Treves et al. (2016), van Eeden et al. (2018), and others regarding the evidentiary basis for certain management techniques in reducing depredation. If interventions serve as a mollifier of human conflict (and hence potentially avoid worse outcomes for wolf populations), there may yet be validity to their usage *even in the absence of proven effectiveness*, a prospect that calls for further social science study (Creel et al., 2015; cf. DeCesare et al., 2018; Ohrens et al., 2019).

higher-level structures, policies, and the broader socio-political context that can either support or undermine the best intentions and efforts.

On the Boise, one of the first national forests to have an established wolf population following federal reintroduction, one manager noted, “I do feel pride that the forest that I work on [helped in] releasing those animals to reestablish a more normal and robust population. I think that’s a terrific history, and I really appreciate the fact that I was here and was able to see this kind of wave of them reoccupy what historically they would have.” USFS grazing allotments where wolves and livestock co-occur serve as a valuable microcosm for considering the broader potential and pitfalls of conservation in shared landscapes. For managers, much of the trouble surrounding coexistence comes not from a lack of enthusiasm, expertise surrounding wolves, livestock, or the socio-ecological systems they manage, nor from a misrecognition of the socio-political hurdles they face. Ultimately, as insights from political ecology help clarify, manager decision-making is socially and politically constrained. Public lands management remains fraught, inseparable from the region’s history and ongoing political contestation (Brugger et al., 2020). Future research might consider how this reframing—of environmental management as situated social praxis, and of coexistence as complex and multi-dimensional—might translate into practical and policy changes given the sometimes-contradictory imperatives managers face, and the multiple value-laden claims on shared public lands.

Land managers represent an under-explored set of actors vis-à-vis wildlife coexistence, managing habitat and contending with sometimes conflictual human values and land uses—not only in the American West but worldwide. They are the “boots on the ground” when it comes to practices of coexistence and are uniquely positioned in debates over how to promote conservation while navigating diverse perceptions and values and managing social relations between stakeholder groups. Our hope with this study is to contribute toward the development of common understandings of a central concept in both the literature and on-the-ground practice around HWC and wolf conservation—and in so doing increase the possibility for collaboration and empathy among those engaged in this complex social-ecological challenge.

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DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

Ethical review and approval was not required for the study of human participants in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements. Written informed consent was not obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article. All authors have undergone the scientific ethics and integrity training of the USFS and/or university-approved training on research with human subjects. All research participants gave verbal consent to be interviewed and recorded.

AUTHOR CONTRIBUTIONS

SC designed and directed the project. JM, KE, and RA conducted the bulk of the research referenced, splitting up case study forests between them. All authors contributed to the conceiving and writing of this manuscript; order of authorship roughly corresponds to writing contributions. All authors contributed to the article and approved the submitted version.

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