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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 depredation, multiple-use, U.S. Forest Service

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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 ridgetop 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; Connelly, 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**).

[1]The Multiple-Use Sustained-Yield Act of 1960 (Public Law 86–517, 74 Stat. 215, June 12, 1960).

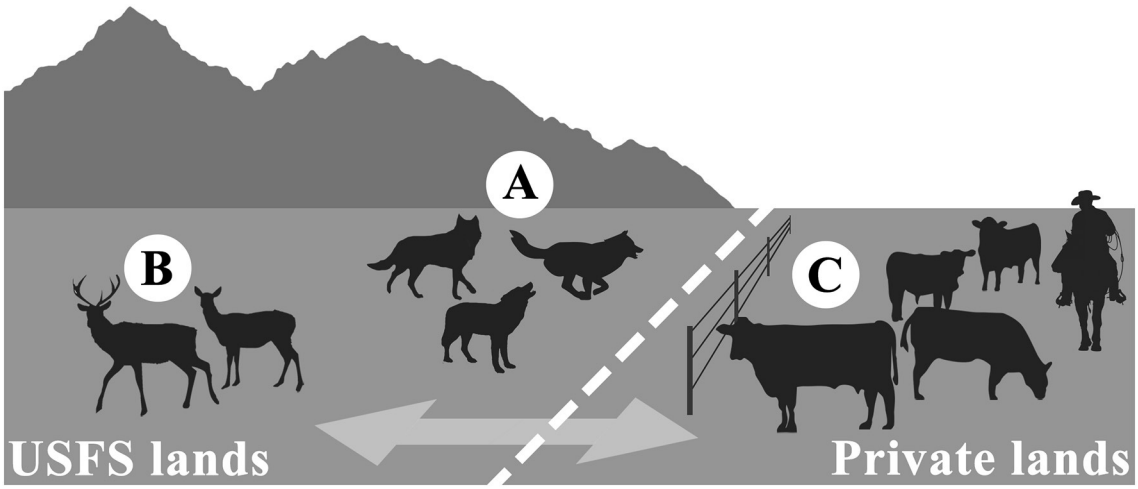

FIGURE 1 | Managing animals across jurisdictions. Livestock producers ("permittees") graze privately-owned sheep and cattle on private lands as well as seasonally on USFS allotments, where they share space with wildlife. Wolves **(A)** prey on wild ungulates (deer and elk) **(B)** as well as opportunistically 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

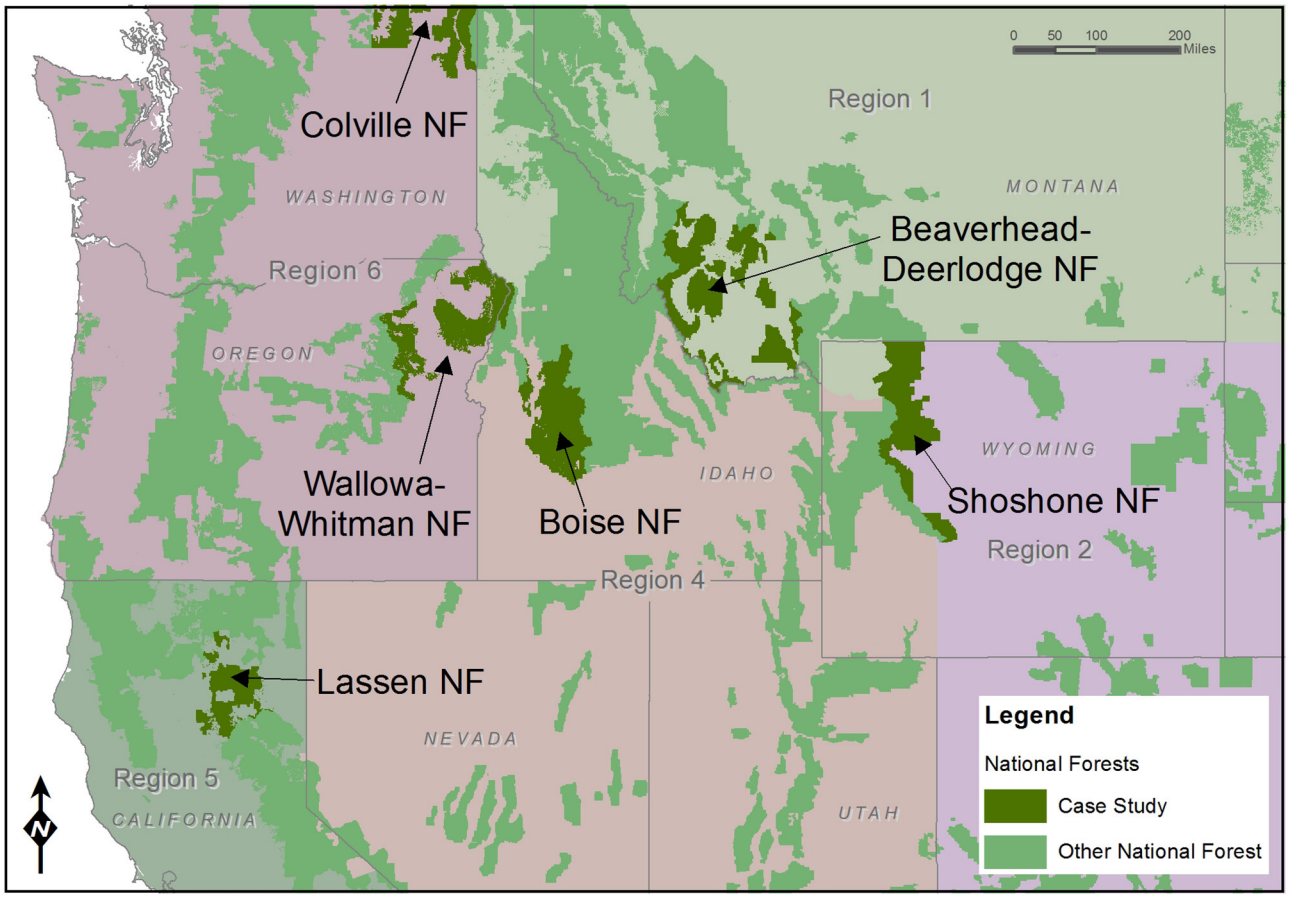

FIGURE 2 | Case study forests and context map.

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

[a] *USFS Annual Grazing Statistical Report, Fiscal Year 2020.*
[b] *Interview data, 2021.*
[c] *Washington Dept. of Fish and Wildlife.*
[d] *Oregon Dept. of Fish and Wildlife.*
[e] *California Dept. of Fish and Wildlife.*
[f] *HM, 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

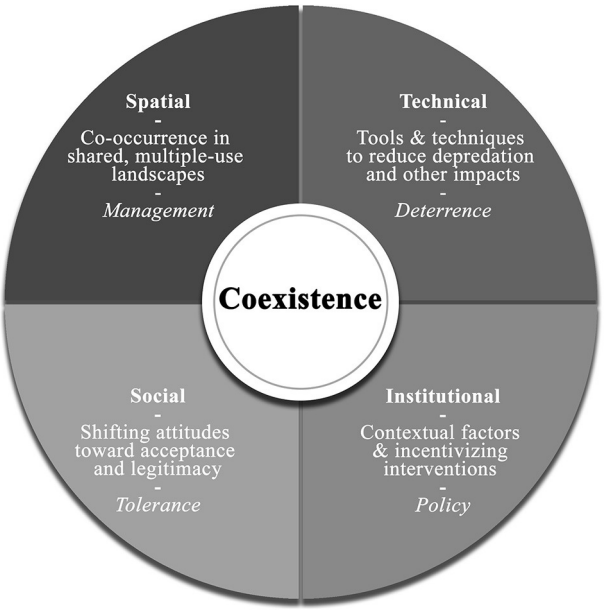

FIGURE 3 | Dimensions of coexistence.

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,

[2]This 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

[3]These 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.

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 concepting 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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REFERENCES

Adams, W. M., and Hutton, J. (2007). People, parks and poverty: political ecology and biodiversity conservation. *Conserv. Soc.* 5, 147–183. Available online at: http://www.jstor.org/stable/26392879

Anderson, R. M., Charnley, S., Epstein, K. et al. In review. The socioecology of fear: a critical geographical consideration of human-wolf-livestock conflict. *Canad. Geograph*. 9:00179.

Anderson, R. M. (2021). Killing for the common good? the (Bio)Politics of Wolf Management in Washington State. *Elementa* 9:179. doi: 10.1525/elementa.2020.00179

Bangs, E., Jimenez, M., Niemeyer, C. et al. (2006). Non-lethal and lethal tools to manage wolf-livestock conflict in the Northwestern United States. *Proceed. Vertebr. Pest Conf.* 22:170. doi: 10.5070/V42210170

Bangs, E. E., and Fritts, S. H. (1996). Reintroducing the Gray Wolf to Central Idaho and Yellowstone National Park. *Wildl. Soc. Bull.* 24, 402–413. Available online at: https://www.jstor.org/stable/3783320

Barnes, M. (2015). *Livestock Management for Coexistence with Large Carnivores, Healthy Land and Productive Ranches. White paper. Bozeman,Montana: Keystone Conservation*. Available online at: http://www.keystoneconservation.us/PDFs/KeystoneConservation_2015_WhitePaper.pdf.

Baruch-Mordo, S., Breck, S. W., Wilson, K. R., and Broderick, J. (2009). A tool box half full: how social science can help solve human–wildlife conflict. *Hum. Dimen. Wildlife* 14, 219–223. doi: 10.1080/10871200902839324

Bernard, H. R. (2017). *Research Methods in Anthropology: Qualitative and Quantitative Approaches*. Sixth edition. Lanham, MD: Rowman and Littlefield.

Blaikie, P. M., and Brookfield, H. (1987). *Land Degradation and Society*. Methuen.

Boronyak, L., Jacobs, B., Wallach, A. et al. (2021). Pathways towards coexistence with large carnivores in production systems. *Agric. Hum. Values* 21:10224. doi: 10.1007/s10460-021-10224-y

Bradley, E. H., Robinson, H. S., Bangs, E. E. et al. (2015). Effects of wolf removal on livestock depredation recurrence and wolf recovery in Montana, Idaho, and Wyoming. *J. Wildl. Manage.* 79, 1337–1346. doi: 10.1002/jwmg.948

Breck, S. W., Kluever, B. M., Panasci, M. et al. (2011). Domestic calf mortality and producer detection rates in the mexican wolf recovery area: implications for livestock management and carnivore compensation schemes. *Biol. Conserv.* 144, 930–936. doi: 10.1016/j.biocon.2010.12.014

Brockington, D. (2002). *Fortress Conservation: The Preservation of the Mkomazi Game Reserve, Tanzania*. Bloomington, IN: Indiana University Press.

Brosius, J. P., Tsing, A. L., and Zerner, C. (1998). Representing Communities: histories and politics of community-based natural resource management. *Soc. Nat. Resourc.* 11, 157–168. doi: 10.1080/08941929809381069

Brugger, J., McClaran, M. P., and Sprinkle, J. E. (2020). 'Storytelling' natural resource conflict on U.S. public lands. *Ethnos* 85, 54–78. doi: 10.1080/00141844.2018.1456476

Bruskotter, J. T., and Wilson, R. S. (2013). Determining where the wild things will be: using psychological theory to find tolerance for large carnivores. *Conserv. Lett.* 7, 158–165. doi: 10.1111/conl.12072

Budowski, G. (1976). Tourism and environmental conservation: conflict, coexistence, or symbiosis? *Environ. Conserv.* 3, 27–31. doi: 10.1017/S0376892900017707

Bui, Q., and Sanger-Katz, M. (2016). *Why the Government Owns So Much Land in the West*. New York, NY: The New York Times. Available online at: https://www.nytimes.com/2016/01/06/upshot/why-the-government-owns-so-much-land-in-the-west.html.

Buller, H. (2008). Safe from the wolf: biosecurity, biodiversity, and competing philosophies of nature. *Environ. Plann. A* 40, 1583–1597. doi: 10.1068/a4055

Calkin, D. E., Thompson, M. P., and Finney, M. A. (2015). Negative consequences of positive feedbacks in US wildfire management. *For. Ecosyst.* 2:9. doi: 10.1186/s40663-015-0033-8

Carter, N. H., and Linnell, J. D. C. (2016). Co-adaptation is key to coexisting with large carnivores. *Trends Ecol. Evol.* 31, 575–578. doi: 10.1016/j.tree.2016.05.006

Carter, N. H., Riley, S. J., and Liu, J. (2012b). Utility of a psychological framework for carnivore conservation. *Oryx* 46, 525–535. doi: 10.1017/S0030605312000245

Carter, N. H., Shrestha, B. K., Karki, J. B. et al. (2012a). Coexistence between wildlife and humans at fine spatial scales. *Proc. Nat. Acad. Sci.* 109, 15360–15365. doi: 10.1073/pnas.1210490109

Chapron, G., and López-Bao, J. V. (2016). Coexistence with large carnivores informed by community ecology. *Trends Ecol. Evol.* 31, 578–580. doi: 10.1016/j.tree.2016.06.003

Charnley, S., Carothers, C., Satterfield, T. et al. (2017). Evaluating the best available social science for natural resource management decision-making. *Environ. Sci. Policy* 73, 80–88. doi: 10.1016/j.envsci.2017.04.002

Charnley, S., Sheridan, T. E., Nabhan, G. P. (2014). *Stitching the West Back Together: Conservation of Working Landscapes. Summits: Environmental Science, Law, and Policy*. Chicago: University of Chicago Press.

Chesson, P. (2000). Mechanisms of maintenance of species diversity. *Annu. Rev. Ecol. Syst.* 31, 343–366. doi: 10.1146/annurev.ecolsys.31.1.343

Clark, S. G., Rutherford, M. B., and Casey, D. (2005). *Coexisting with Large Carnivores: Lessons from Greater Yellowstone*. Washington, DC: Island Press.

Coleman, J. T. (2008). *Vicious: Wolves and Men in America*. New Haven: Yale University Press.

Collard, R. (2012). Cougar-human entanglements and the biopolitical un/making of safe space. *Environ. Plann. D: Soc. Space* 30, 23–42. doi: 10.1068/d19110

Connelly, S. (2007). Mapping sustainable development as a contested concept. *Local Environ.* 12, 259–278. doi: 10.1080/13549830601183289

Creel, S., Becker, M., Christianson, D. et al. (2015). Questionable policy for large carnivore hunting. *Science* 350, 1473–1475. doi: 10.1126/science.aac4768

Cronon, W. (1996a). "Are You an Environmentalist or Do You Work for a Living?': Work and Nature," in *Uncommon Ground: Rethinking the Human Place in Nature*. Norton WW, 171–85.

Cronon, W. (1996b). "The trouble with wilderness; or, getting back to the wrong nature," in *Uncommon Ground: Rethinking the Human Place in Nature*. Norton WW, 69–90.

Crowley, K., and Head, B. (2017). The enduring challenge of 'wicked problems': revisiting Rittel and Webber. *Policy Sci.* 50, 539–547. doi: 10.1007/s11077-017-9302-4

Davidson-Nelson, S. J., and Gehring, T. M. (2010). Testing FLadry as a nonlethal management tool for wolves and coyotes in michigan. *Hum. Wildlife Interact.* 4, 87–94. doi: 10.26077/mdky-bs63

de Silva, S., and Srinivasan, K. (2019). Revisiting social natures: people-elephant conflict and coexistence in Sri Lanka. *Geoforum* 102, 182–190. doi: 10.1016/j.geoforum.2019.04.004

DeCesare, N. J., Wilson, S. M., Bradley, E. H. et al. (2018). Wolf-livestock conflict and the effects of wolf management. *J. Wildl. Manage.* 82, 711–722. doi: 10.1002/jwmg.21419

DeFries, R., and Nagendra, H. (2017). Ecosystem management as a wicked problem. *Science* 356, 265–270. doi: 10.1126/science.aal1950

Dickman, A. J. (2010). Complexities of conflict: the importance of considering social factors for effectively resolving human–wildlife conflict. *Anim. Conserv.* 13, 458–466. doi: 10.1111/j.1469-1795.2010.00368.x

Dickman, A. J., Macdonald, E. A., and Macdonald, D. W. (2011). A review of financial instruments to pay for predator conservation and encourage human–carnivore coexistence. *Proc. Nat. Acad. Sci.* 108, 13937–13944. doi: 10.1073/pnas.1012972108

Dorrance, M. J. (1983). A philosophy of problem wildlife management. *Wildlife Soc. Bull.* 11, 319–324. Available online at: https://www.jstor.org/stable/3781664

Drury, R., Homewood, K., and Randall, S. (2011). Less is more: the potential of qualitative approaches in conservation research. *Anim. Conserv.* 14, 18–24. doi: 10.1111/j.1469-1795.2010.00375.x

Ehrhart, S., Stühlinger, M., and Schraml, U. (2021). The relationship of stakeholders' social identities and wildlife value orientations with attitudes toward red deer management. *Hum. Dimens. Wildlife* 1–15. doi: 10.1080/10871209.2021.1885767

Eklund, A., López-Bao, J. V., Tourani, M. et al. (2017). Limited evidence on the effectiveness of interventions to reduce livestock predation by large carnivores. *Sci. Rep.* 7:2097. doi: 10.1038/s41598-017-02323-w

Emel, J. (1995). Are you man enough, big and bad enough? ecofeminism and Wolf Eradication in the USA. *Environ. Plann. D: Soc. Space* 13, 707–734. doi: 10.1068/d130707

Epstein, K. E. In review. *Managing Wild Emotions: Wildlife Managers as Intermediaries at the Conflictual Boundaries of Access Relations*.

Epstein, K., Smutko, L. S., and Western, J. M. (2018). From 'Vision' to reality: emerging public opinion of collaborative management in the greater yellowstone ecosystem. *Soc. Nat. Resourc.* 31, 1213–1229. doi: 10.1080/08941920.2018.1456591

Epstein, K. E. (2020). *High Net Worth Ownership Regimes in Critical Conservation Areas: Implications for Resource Governance*. PhD dissertation, Bozeman, Montana: Montana State University. Available online at: https://static1.squarespace.com/static/5490f581e4b040d63fb03c5f/t/5ff4ab3b4828d60739ce0743/1609870145633/Epstein-high-net-worth-2020__KE$+$%282%29.pdf.

Expósito-Granados, M., Castro, A. J., Lozano, J. et al. (2019). Human-carnivore relations: conflicts, tolerance and coexistence in the American West. *Environ. Res. Lett.* 14:123005. doi: 10.1088/1748-9326/ab5485

Fischer, H. (1995). *Wolf Wars: The Remarkable Inside Story of the Restoration of Wolves to Yellowstone*. Helena, Montana: Falcon Press.

Frank, B., Glikman, J. A., Marchini, S. (2019). *Human-Wildlife Interactions: Turning Conflict into Coexistence*. London: Cambridge University Press.

Fritts, S. H., Bangs, E. E., Fontaine, J. A. et al. (1997). Planning and implementing a reintroduction of wolves to yellowstone national park and Central Idaho. *Restor. Ecol.* 5, 7–27. doi: 10.1046/j.1526-100X.1997.09702.x

Gallie, W. B. (1956). Art as an essentially contested concept. *Philos. Q.* 6, 97–114. doi: 10.2307/2217217

Gallie, W. B. (1969). "Essentially contested concepts," in *The Importance of Language*, ed M. Black, (Ithaca, NY: Cornell University Press), 121–146. doi: 10.7591/9781501741319-010

Gamborg, C., Sandøe, P., and Palmer, C. (2020). Ethical Management of wildlife. lethal versus nonlethal control of white-tailed deer. *Conserv. Sci. Pract.* 2:e171. doi: 10.1111/csp2.171

Gaynor, K. M., Cherry, M. J., Gilbert, S. L. et al. (2021). An applied ecology of fear framework: linking theory to conservation practice. *Anim. Conserv.* 23, 301–321. doi: 10.1111/acv.12629

Gehring, T. M., VerCauteren, K. C., Provost, M. L., and Cellar, A. C. (2010). Utility of livestock-protection dogs for deterring wildlife from cattle farms. *Wildlife Res.* 37:715. doi: 10.1071/WR10023

Gese, E., Keenan, S., and Kitchen, A. (2005). Lines of Defense: Coping with Predators in the Rocky Mountain Region. *USDA National Wildlife Research Center - Staff Publications*, Available online at: https://digitalcommons.unl.edu/icwdm_usdanwrc/97.

Gillham, M. E., and Smith, J. K. (1983). Industry and wildlife: compromise and coexistence. *Endeavour* 7, 162–172. doi: 10.1016/S0160-9327(83)80039-8

Greenough, P. (2003). "Bio-ironies of the fractured forest: india's tiger resources," in *Search of the Rain Forests*, ed C. Slate (Durham: Duke University Press), 167–203.

Guest, G., MacQueen, K., and Namey, E. (2012). *Applied Thematic Analysis*. Sterling, VA: Sage.

Guha, R. (1989). Radical American environmentalism and wilderness preservation: a third world critique. *Environ. Ethics* 11, 71–83. doi: 10.5840/enviroethics198911123

Hackel, J. D. (1999). Community conservation and the future of Africa's wildlife. *Conserv. Biol.* 13, 726–734. doi: 10.1046/j.1523-1739.1999.98210.x

Hamilton, L. C., Lambert, J. E., Lawhon, L. A., Salerno, J., and Hartter, J. (2020). Wolves are back: sociopolitical identity and opinions on management of Canis Lupus. *Conserv. Sci. Practice* 2:e213. doi: 10.1111/csp2.213

Haraway, D. J. (2016). *Staying with the Trouble: Making Kin in the Chthulucene*. Durham, NC : Duke University Press.

Harrison, H. L., and Loring, P. A. (2020). Seeing beneath disputes: A transdisciplinary framework for diagnosing complex conservation conflicts. *Biol. Conserv.* 248:108670. doi: 10.1016/j.biocon.2020.108670

Hays, S. P. (1959). *Conservation and the Gospel of Efficiency: The Progressive Conservation Movement, 1890-1920*. Cambridge: Harvard University Press.

Hoare, R. E., and Du Toit, R. (1999). Coexistence between People and Elephants in African Savannas. *Conserv. Biol.* 13, 633–639. doi: 10.1046/j.1523-1739.1999.98035.x

Huntsinger, L. (2016). "The tragedy of the common narrative: re-telling degradation in the American West," in *The End of Desertification? Disputing Environmental Change in the Drylands*, ed R. Behnke, M. Mortimore (New York, NY: Springer), 293–323.

Igoe, J. (2004). *Conservation and Globalization: A Study of National Parks and Indigenous Communities from East Africa to South Dakota. Case Studies on Contemporary Social Issues*. Belmont, CA, USA: Thomson/Wadsworth.

Iliopoulos, Y., Astaras, C., Lazarou, Y. et al. (2019). Tools for co-existence: fladry corrals efficiently repel wild wolves (Canis Lupus) from experimental baiting sites. *Wildlife Res.* 46, 484–498. doi: 10.1071/WR18146

Jacoby, K. (2003). *Crimes Against Nature: Squatters, Poachers, Thieves, and the Hidden History of American Conservation*. https://www.google.com/search?client=firefox-b-d&q=Berkeley$+$California&stick$=$H4sIAAAAAAAAAOPgE Berkeley, CA : University of California Press.

Johansson, M., Sandström, C., Pedersen, E., and Ericsson, G. (2016). Factors governing human fear of wolves: moderating effects of geographical location and standpoint on protected nature. *Eur. J. Wildl. Res.* 62, 749–760. doi: 10.1007/s10344-016-1054-5

Jones, K. (2010). From big bad wolf to ecological hero: canis lupus and the culture(s) of nature in the American–Canadian West. *Am. Rev. Canad. Stud.* 40, 338–350. doi: 10.1080/02722011.2010.496902

Kinka, D., and Young, J. K. (2019). Evaluating domestic sheep survival with different breeds of livestock guardian dogs. *Rangeland Ecol. Manage.* 72, 923–932. doi: 10.1016/j.rama.2019.07.002

Kosek, J. (2006). *Understories: The Political Life of Forests in Northern New Mexico*. Durham, NC : Duke University Press.

Lance N, Primm S, Inman K. n.d. *Wolves on the Landscape: A Hands-on Resource Guide to Reduce Depredations. Montana Fish, Wildlife and Parks; People and Carnivores; Wildlife Conservation Society*. Available online at: https://wildlifefriendly.org/wp-content/uploads/2015/09/WolfResourcesGuide_Primm-et-all.pdf.

Lance, N., Breck, S., Sime, C. et al. (2010). "Biological, technical, and social aspects of applying electrified fladry for livestock protection from wolves (Canis Lupus)," in *USDA National Wildlife Research Center—Staff Publications*. Available online at: https://digitalcommons.unl.edu/icwdm_usdanwrc/1259.

Lave, R., Biermann, C., and Lane, S. N. (2018). *The Palgrave Handbook of Critical Physical Geography*. New York, NY: Springer.

Lave, R., Wilson, M. W., Barron, E. S. et al. (2014). Intervention: critical physical geography. *Canad. Geograph.* 58, 1–10. doi: 10.1111/cag.12061

Lennox, R. J., Gallagher, A. J., Ritchie, E. G., and Cooke, S. J. (2018). Evaluating the efficacy of predator removal in a conflict-prone world. *Biol. Conserv.* 224, 277–289. doi: 10.1016/j.biocon.2018.05.003

Limerick, P. N. (1987). *The Legacy of Conquest: The Unbroken Past of the American West*. New York, NY: W. W. Norton and Company.

López-Bao, J. V., Bruskotter, J., and Chapron, G. (2017). Finding space for large carnivores. *Nat. Ecol. Evol.* 1, 1–2. doi: 10.1038/s41559-017-0140

Lute, M. L., and Carter, N. H. (2020). Are we coexisting with carnivores in the American West? *Front. Ecol. Evol.* 8:48. doi: 10.3389/fevo.2020.00048

Lute, M. L., Carter, N. H., López-Bao, J. V., and Linnell, J. D. C. (2018). Conservation professionals agree on challenges to coexisting with large carnivores but not on solutions. *Biol. Conserv.* 218, 223–232. doi: 10.1016/j.biocon.2017.12.035

Madden, F., and McQuinn, B. (2014). Conservation's blind spot: the case for conflict transformation in wildlife conservation. *Biol. Conserv.* 178, 97–106. doi: 10.1016/j.biocon.2014.07.015

Malcom, J., Schwartz, M. W., Evansen, M. et al. (2019). Signatories. Solve the biodiversity crisis with funding. *Science* 365, 1256–1256. doi: 10.1126/science.aay9839

Manfredo, M., Teel, T., and Bright, A. (2003). Why Are Public values toward wildlife changing? *Hum. Dimens. Wildlife* 8, 287–306. doi: 10.1080/716100425

Manfredo, M. J., Teel, T. L., and Henry, K. L. (2009). Linking society and environment: a multilevel model of shifting wildlife value orientations in the Western United States*. *Soc. Sci. Q.* 90, 407–427. doi: 10.1111/j.1540-6237.2009.00624.x

Manfredo, M. J., Teel, T. L., Sullivan, L., and Dietsch, A. M. (2017). Values, trust, and cultural backlash in conservation governance: the case of wildlife management in the United States. *Biol. Conserv.* 214, 303–311. doi: 10.1016/j.biocon.2017.07.032

Margulies, J. D., and Karanth, K. K. (2018). The production of human-wildlife conflict: a political animal geography of encounter. *Geoforum* 95, 153–164. doi: 10.1016/j.geoforum.2018.06.011

Marshall, K. N., Stier, A. C., Samhouri, J. F. et al. (2016). Conservation challenges of predator recovery. *Conserv. Lett.* 9, 1–8. doi: 10.1111/conl.12186

Martin, J. V. (2020). *In the Shadow of the Wolf: Wildlife Conflict and Land Use Politics in the New West. PhD dissertation, Berkeley*, California: University of California, Berkeley. Available online at: https://escholarship.org/uc/item/6zk5g54g.

Martin, J. V. (2021a). *Between Scylla and Charybdis: Environmental Governance and Illegibility in the American West*. Geoforum.

Martin, J. V. (2021b). Peace in the Valley? qualitative insights on collaborative coexistence from the wood river wolf project. *Conserv. Sci. Pract.* 3:e197. doi: 10.1111/csp2.197

Martin, J. V., Epstein, K., Bergmann, N. et al. (2019). Revisiting and revitalizing political ecology in the American West. *Geoforum* 107, 227–230. doi: 10.1016/j.geoforum.2019.05.006

Mason, T. H. E., Pollard, C. R. J., Chimalakonda, D. et al. (2018). Wicked conflict: using wicked problem thinking for holistic management of conservation conflict. *Conserv. Lett.* 11:e12460. doi: 10.1111/conl.12460

McCarthy, J. (2002). First world political ecology: lessons from the wise use movement. *Environ. Plann. A* 34, 1281–1302. doi: 10.1068/a3526

Mech, L. D. (1995). "Foreword," in *Wolf Wars: The Remarkable Inside Story of the Restoration of Wolves to Yellowstone*. Tysons, VA: Falcon Press.

Mech, L. D. (2012). Is science in danger of sanctifying the wolf? *Biol. Conserv.* 150, 143–149. doi: 10.1016/j.biocon.2012.03.003

Merrill, K. R. (2002). *Public Lands and Political Meaning: Ranchers, the Government, and the Property Between Them*. Washington, DC: University of California Press.

Middleton, A. (2014). Is the Wolf a Real American Hero? *The New York Times*. Available online at: https://www.nytimes.com/2014/03/10/opinion/is-the-wolf-a-real-american-hero.html.

Middleton, A. D., Morrison, T. A., Fortin, J. K. et al. (2013). Grizzly bear predation links the loss of native trout to the demography of migratory elk in yellowstone. *Proc. R. Soc. B Biol. Sci.* 280:20130870. doi: 10.1098/rspb.2013.0870

Miller, J. R. B., and Schmitz, O. J. (2019). Landscape of fear and human-predator coexistence: applying spatial predator-prey interaction theory to understand and reduce carnivore-livestock conflict. *Biol. Conserv.* 236, 464–473. doi: 10.1016/j.biocon.2019.06.009

Miller, J. R. B., Stoner, K. J., Cejtin, M. R. et al. (2016). Effectiveness of contemporary techniques for reducing livestock depredations by large carnivores. *Wildl. Soc. Bull.* 40, 806–815. doi: 10.1002/wsb.720

Monbiot, G. (2014). *How Wolves Change Rivers. Documentary, Short. Sustainable Man*, TED. Available online at: https://www.youtube.com/watch?v=ysa5OBhXz-Q.

Moreira-Arce, D., Ugarte, C. S., Zorondo-Rodríguez, F., and Simonetti, J. A. (2018). Management tools to reduce carnivore-livestock conflicts: current gap and future challenges. *Rangeland Ecol. Manage.* 71, 389–394. doi: 10.1016/j.rama.2018.02.005

Moseley, C., and Charnley, S. (2014). Understanding micro-processes of institutionalization: stewardship contracting and national forest management. *Policy Sci.* 47, 69–98. doi: 10.1007/s11077-013-9190-1

Muhly, T. B., and Musiani, M. (2009). Livestock depredation by wolves and the ranching economy in the Northwestern U.S. *Ecol. Econo.* 68, 2439–2450. doi: 10.1016/j.ecolecon.2009.04.008

Nepal, S. K., and Weber, K. E. (1995). Prospects for coexistence: wildlife and local people. *Ambio* 24, 238–245.

Neumann, R. P. (2002). *Imposing Wilderness: Struggles over Livelihood and Nature Preservation in Africa*. California Studies in Critical Human Geography. University of California Press. Availble online at: http://www.ucpress.edu/book.php?isbn=9780520234680

Neumann, R. P. (2005). *Making Political Ecology*. Hodder Arnold.

Nie, M., Barns, C., Haber, J. et al. (2017). Fish and wildlife management on federal lands: debunking state supremacy. *Environmental Law* 47:126. SSRN Scholarly Paper ID 2980807. https://papers.ssrn.com/abstract=2980807.

Nie, M. A. (2002). Wolf recovery and management as value-based political conflict. *Ethics Place Environ.* 5, 65–71. doi: 10.1080/13668790220146465

Nie, M. A. (2003). *Beyond Wolves: The Politics of Wolf Recovery and Management*. Minneapolis: University of Minnesota Press.

ODFW (2019). *ODFW Non-Lethal Measures to Minimize Wolf-Livestock Conflict*. Oregon Department of Fish and Wildlife. Available online at: https://www.dfw.state.or.us/Wolves/docs/ODFW_Non-lethal_Measures.pdf.

Ohrens, O., Santiago-Ávila, F., and Treves, A. (2019). "The twin challenges of preventing real and perceived threats to human interests," in *Human–Wildlife Interactions: Turning Conflict into Coexistence*, eds B. Frank, J. A. Glikman, S. Marchini (Cambridge: Cambridge University Press), 242–64.

Oriol-Cotterill, A., Valeix, M., Frank, L. G. et al. (2015). Landscapes of coexistence for terrestrial carnivores: the ecological consequences of being downgraded from ultimate to penultimate predator by humans. *Oikos* 124, 1263–1273. doi: 10.1111/oik.02224

Perreault, T., Bridge, G., and McCarthy, J. (2015). *The Routledge Handbook of Political Ecology*. Routledge.

Peterson, M. N., Birckhead, J. L., Leong, K. et al. (2010). Rearticulating the Myth of Human–Wildlife Conflict. *Conserv. Lett.* 3, 74–82. doi: 10.1111/j.1755-263X.2010.00099.x

Philo, C., and Wilbert, C. (2000). *Animal Spaces, Beastly Places: New Geographies of Human-Animal Relations*. Critical Geographies. New York, NY: Routledge.

Pooley, S., Bhatia, S., and Vasava, A. (2021). Rethinking the study of human–wildlife coexistence. *Conserv. Biol.* 35, 784–793. doi: 10.1111/cobi.13653

Rakestraw, L. (1958). Sheep grazing in the cascade range: John Minto vs. John Muir. *Pacific Historic. Rev.* 27, 371–382. doi: 10.2307/3636813

Redpath, S. M., Bhatia, S., and Young, J. (2015). Tilting at wildlife: reconsidering human–wildlife conflict. *Oryx* 49, 222–225. doi: 10.1017/S0030605314000799

Ripple, W. J., and Beschta, R. L. (2005). Linking wolves and plants: aldo leopold on trophic cascades. *Bioscience* 55, 613–621. doi: 10.1641/0006-3568(2005)0550613:LWAPAL2.0.CO;2

Ripple, W. J., and Beschta, R. L. (2012). Trophic cascades in yellowstone: the first 15 years after wolf reintroduction. *Biol. Conserv.* 145, 205–213. doi: 10.1016/j.biocon.2011.11.005

Rittel, H. W. J., and Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy Sci.* 4, 155–169. doi: 10.1007/BF01405730

Robbins, P. (2019). *Political Ecology: A Critical Introduction*. 3rd Edition. London: Wiley-Blackwell. Available online at: https://www.wiley.com/en-us/Political$+$Ecology%3A$+$A$+$Critical$+$Introduction%2C$+$3rd$+$Edition-p-9781119167440.

Robbins, P., Hintz, J., and Moore, S. A. (2014). *Environment and Society: A Critical Introduction*. 2nd edition. Hoboken, New Jersey: Wiley-Blackwell.

Rowley, W. D. (1985). *U.S. Forest Service Grazing and Rangelands: A History*. Washington, DC: Texas AandM University Press.

Saberwal, V. K., Rangarajan, M., and Kothari, A. (2001). *People, Parks, and Wildlife: Towards Coexistence*. New Delhi: Orient Longman.

Sayre, N. F. (2004). Viewpoint: the need for qualitative research to understand ranch management. *J. Range Manage.* 57, 668–674. doi: 10.2111/1551-5028(2004)0570668:VTNFQR2.0.CO;2

Sayre, N. F. (2017). *The Politics of Scale: A History of Rangeland Science*. Chicago, IL: University of Chicago Press.

Schoener, T. W. (1974). Resource partitioning in ecological communities. *Science* 185, 27–39. doi: 10.1126/science.185.4145.27

Schroeder, R. A., St. Martin, K., and Albert K. E. (2006). Political Ecology in North America: Discovering the Third World Within? *Geoforum* 37, 163–168. doi: 10.1016/j.geoforum.2005.05.003

Sheridan, T. E. (2001). Cows, condos, and the contested commons: the political ecology of ranching on the arizona-sonora borderlands. *Hum. Organ.* 60, 141–52. doi: 10.17730/humo.60.2.991hqu9q6ryf5aav

Skogen, K., Mauz, I., and Krange, O. (2008). Cry Wolf!: narratives of wolf recovery in France and Norway. *Rural Soc.* 73, 105–133. doi: 10.1526/003601108783575916

Steele, J. R., Rashford, B. S., Foulke, T. K. et al. (2013). Wolf (Canis Lupus) predation impacts on livestock production: direct effects, indirect effects, and implications for compensation ratios. *Range Ecol. Manage.* 66, 539–544. doi: 10.2111/REM-D-13-00031.1

Stegner, W. (1992). *Beyond the Hundredth Meridian: John Wesley Powell and the Second Opening of the West*. Penguin.

Stone, S. A., Breck, S. W., Timberlake, J. et al. (2017). Adaptive use of nonlethal strategies for minimizing wolf–sheep conflict in Idaho. *J. Mammal.* 98, 33–44. doi: 10.1093/jmammal/gyw188

Stone, S. A., Edge, E., Fascione, N. et al. (2016). *Livestock and Wolves: A Guide to Nonlethal Tools and Methods to Reduce Conflicts*. Second Edition. Washington, D.C.: Defenders of Wildlife. Available online at: https://defenders.org/sites/default/files/publications/livestock_and_wolves.pdf.

Tanner, M. F., Hackett, B., Collins, N. R. et al. (1977). Recreation and conservation in water areas: promoting recreation, amenity and wildlife in coexistence. *J. R. Soc. Arts* 125, 253–265. Available online at: https://www.jstor.org/stable/41372481

Teel, T. L., Manfredo, M. J., and Stinchfield, H. M. (2007). The Need and Theoretical basis for exploring wildlife value orientations cross-culturally. *Hum. Dimen. Wildlife* 12, 297–305. doi: 10.1080/10871200701555857

Treves, A., and Bruskotter, J. (2014). Tolerance for predatory wildlife. *Science* 344, 476–477. doi: 10.1126/science.1252690

Treves, A., and Karanth, K. U. (2003). Human-carnivore conflict and perspectives on carnivore management worldwide. *Conserv. Biol.* 17, 1491–1499. doi: 10.1111/j.1523-1739.2003.00059.x

Treves, A., Krofel, M., and McManus, J. (2016). Predator control should not be a shot in the dark. *Front. Ecol. Environ.* 14, 380–388. doi: 10.1002/fee.1312

Treves, A., Krofel, M., Ohrens, O., and van Eeden, M. L., (2019). Predator control needs a standard of unbiased randomized experiments with cross-over design. *Front. Ecol. Evol.* 7:462. doi: 10.3389/fevo.2019.00462

Treves, A., and Santiago-Ávila, F. J. (2020). Myths and assumptions about human-wildlife conflict and coexistence. *Conserv. Biol. J. Soc. Conserv. Biol.* 34, 811–818. doi: 10.1111/cobi.13472

United States Forest Service [USFS] (2005). *Chapter 2230: Grazing and Livestock Use Permit System. Forest Service Manual* (2200).Available online at: https://www.fs.fed.us/cgi-bin/Directives/get_dirs/fsm?2200. (accessed August 1, 2021).

Urbanik, J. (2012). *Placing Animals: An Introduction to the Geography of Human-Animal Relations*. Plymouth, UK: Rowman and Littlefield Publishers.

van Eeden, L. M., Dickman, C. R., Ritchie, E. G., and Newsome, T. M. (2017). Shifting public values and what they mean for increasing democracy in wildlife management decisions. *Biodivers. Conserv.* 26, 2759–2763. doi: 10.1007/s10531-017-1378-9

van Eeden, L. M., Eklund, A., Miller, J. R. B. et al. (2018). Carnivore conservation needs evidence-based livestock protection. *PLoS Biol.* 16:e2005577. doi: 10.1371/journal.pbio.2005577

van Eeden, L. M., Rabotyagov, S. S., Kather, M. et al. (2021). Political affiliation predicts public attitudes toward gray wolf (*Canis Lupus*) conservation and management. *Conserv. Sci. Pract.* 3:e387. doi: 10.1111/csp2.387

Venkataraman, A. (2000). Incorporating traditional coexistence propensities into management of wildlife habitats in India. *Curr. Sci.* 79, 1531–1535. Available online at: https://www.jstor.org/stable/24104845

Walker, P. A. (2003). Reconsidering 'regional' political ecologies: toward a political ecology of the rural American West. *Prog. Hum. Geogr.* 7, 7–24. doi: 10.1191/0309132503ph410oa

Walker, P. A. (2018). *Sagebrush Collaboration: How Harney County Defeated the Takeover of the Malheur Wildlife Refuge*. https://www.google.com/search?client=firefox-b-d&q=Corvallis$+$Oregon&stick$=$H4sIAAAAAAAAAOP Corvallis, OR: Oregon State University Press.

Wescoat, J. L. (1987). The 'practical range of choice' in water resources geography. *Prog. Hum. Geogr.* 11, 41–59. doi: 10.1177/030913258701100103

West, P., Igoe, J., and Brockington, D. (2006). Parks and peoples: the social impact of protected areas. *Annu. Rev. Anthropol.* 35, 251–277. doi: 10.1146/annurev.anthro.35.081705.123308

Western Wildlife Outreach (2014). *Wolf-Livestock Nonlethal Conflict Avoidance: A Review of the Literature*. Port Townsend, WA: Western Wildlife Outreach.

Western, D., Wright, M., and Strum, S. C. (1994). *Natural Connections: Perspectives in Community-Based Conservation*. Washington, DC: Island Press.78

Western, G., Macdonald, D. W., Loveridge, A. J., and Dickman, A. J. (2019). Creating landscapes of coexistence: do conservation interventions promote tolerance of lions in human-dominated landscapes? *Conserv. Soc.* 17:204. doi: 10.4103/cs.cs_18_29

White, G. F. (1961). The choice of use in resource management. *Nat. Resour. J.* 1, 23–40.

Wilkinson, C. E., McInturff, A., Miller, J. R. B. et al. (2020). An Ecological Framework for Contextualizing Carnivore–Livestock Conflict. *Conserv. Biol.* 3:13469. doi: 10.1111/cobi.13469

Wilson, M. A. (1997). The wolf in yellowstone: science, symbol, or politics? deconstructing the conflict between environmentalism and wise use. *Soc. Nat. Resourc.* 10, 453–468. doi: 10.1080/08941929709381044

Wise, M. D. (2016). *Producing Predators: Wolves, Work, and Conquest in the Northern Rockies*. Lincoln: University of Nebraska Press.

Wolters, E. A., and Steel, B. S. (2020). *The Environmental Politics and Policy of Western Public Lands*. Corvallis, OR: Oregon State University. Available online at: https://open.oregonstate.education/enviromentalpolitics/.

Woodroffe, R., Thirgood, S., and Rabinowitz, A. (2005). *People and Wildlife, Conflict Or Co-Existence?* Cambridge: Cambridge University Press.

Wuerthner, G. (2017a). "Wolf Project Harassment," in *The Wildlife News* (blog). Available online at: https://www.thewildlifenews.com/2017/07/12/wolf-project-harassment/.

Wuerthner, G. (2017b). *Coexistence between Wolves and Livestock Is a Delusion. High Country News*. Available online at: https://www.hcn.org/articles/opinion-coexistence-between-wolves-and-livestock-is-a-delusion.

Young, J. K., Ma, Z., Laudati, A., and Berger, J. (2015). Human-carnivore interactions: lessons learned from communities in the American West. *Hum. Dimens. Wildl.* 20, 349–366. doi: 10.1080/10871209.2015.1016388

Young, J. K., Steuber, J., Few, A. et al. (2019). When Strange bedfellows go all in: a template for implementing non-lethal strategies aimed at reducing carnivore predation of livestock. *Anim. Conserv.* 22, 207–209. doi: 10.1111/acv.12453

Zabel, A., Bostedt, G., and Engel, S. (2014). Performance payments for groups: the case of carnivore conservation in Northern Sweden. *Environ. Resourc. Econ.* 59, 613–631. doi: 10.1007/s10640-013-9752-x

Zabel, A., and Holm-Müller, K. (2008). Conservation performance payments for carnivore conservation in Sweden. *Conservation Biology* 22, 247–251. doi: 10.1111/j.1523-1739.2008.00898.x

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