Biological Conservation 225 (2018) 80–87

Contents lists available at ScienceDirect

Biological Conservation

journal homepage: www.elsevier.com/locate/biocon

Perspective

A conceptual model for the integration of social and ecological information to understand human-wildlife interactions

Stacy A. Lischka[a,b,*], Tara L. Teel[c], Heather E. Johnson[d,1], Sarah E. Reed[b,e], Stewart Breck[f], Andrew Don Carlos[c], Kevin R. Crooks[b]

[a] Research, Policy, and Planning Branch, Colorado Parks and Wildlife, 317 W. Prospect Ave., Fort Collins, CO 80526, USA
[b] Department of Fish, Wildlife, and Conservation Biology, Colorado State University, Fort Collins, CO 80523, USA
[c] Department of Human Dimensions of Natural Resources, Colorado State University, Fort Collins, CO 80523, USA
[d] Research, Policy, and Planning Branch, Colorado Parks and Wildlife, 415 Turner Dr., Durango, CO 81301, USA
[e] Americas Program, Wildlife Conservation Society, 2300 Southern Blvd., Bronx, NY 10460, USA
[f] National Wildlife Research Center, USDA Wildlife Services, 4101 Laporte Ave., Fort Collins, CO 80521, USA

ARTICLE INFO

Keywords:
Social-ecological systems
Black bears
Carnivores
Social science
Human-bear conflict
Colorado

ABSTRACT

There is growing recognition that interdisciplinary approaches that account for both ecological and social processes are necessary to successfully address human-wildlife interactions. However, such approaches are hindered by challenges in aligning data types, communicating across disciplines, and applying social science information to conservation actions. To meet these challenges, we propose a conceptual model that adopts a social-ecological systems approach and integrates social and ecological theory to identify the multiple, nested levels of influence on both human and animal behavior. By accounting for a diverse array of influences and feedback mechanisms between social and ecological systems, this model fulfills a need for approaches that treat social and ecological processes with equal depth and facilitates a comprehensive understanding of the drivers of human and animal behaviors that perpetuate human-wildlife interactions. We apply this conceptual model to our work on human-black bear conflicts in Colorado, USA to demonstrate its utility. Using this example, we identify key lessons and offer guidance to researchers and conservation practitioners for applying integrated approaches to other human-wildlife systems.

1. Introduction

In his prescient work, *Wilderness*, Aldo Leopold (1949: 188) stated that "One of the anomalies of modern ecology is the creation of two groups, each of which seems barely aware of the existence of the other. The one studies the human community, almost as if it were a separate entity, and calls its findings sociology, economics and history. The other studies the plant and animal community and comfortably relegates the hodge-podge of politics to the liberal arts. The inevitable fusion of these two lines of thought will, perhaps, constitute the outstanding advance of this century." This refrain has become common in the conservation sciences since Leopold's plea (e.g., Mascia et al., 2003), yet researchers and practitioners still struggle to work across disciplinary boundaries to achieve conservation success. Although there is growing recognition that approaches that integrate social and ecological knowledge should lead to more effective and sustained conservation solutions, difficulties in aligning data types, challenges of communicating across disciplines, and misperceptions about the quality and utility of social science information continue to plague these efforts (Fox et al., 2006; Pooley et al., 2014). Nonetheless, the potential for this integration remains a critical advance for the next century of conservation (Tallis and Lubchenco, 2014).

The need for social-ecological integration is readily apparent in the management of human-wildlife interactions (HWIs), defined as the spatial and temporal juxtaposition of human and wildlife activities where humans, wildlife, or both are affected (Leong, 2010; Peterson et al., 2010). Although HWIs are the direct result of human and/or animal behavior, numerous social and ecological factors contribute to the conditions shaping those behaviors, defying single-discipline explanations of causal mechanisms (Dickman, 2010). Understanding the complexity of drivers of HWIs is critical, as the value people place on these interactions ultimately provides the foundation for wildlife conservation and management, whether people want to see interactions enhanced (e.g., increased hunting opportunity, recovery of endangered

* Corresponding author at: Rocky Mountain West Program, Wildlife Conservation Society, 212 South Wallace, Suite 101, Bozeman, MT 59715, USA.
E-mail address: slischka@wcs.org (S.A. Lischka).
[1] Current address: U.S. Geological Survey, Alaska Science Center, 410 University Drive, Anchorage, AK, USA 99508.

https://doi.org/10.1016/j.biocon.2018.06.020
Received 8 December 2017; Received in revised form 25 May 2018; Accepted 18 June 2018
0006-3207/ © 2018 Elsevier Ltd. All rights reserved.

species) or reduced (e.g., property damage; Riley et al., 2003).

Whereas a number of recent papers have called for integrated approaches to understanding HWIs, particularly in the context of human-wildlife conflict (e.g., Dickman, 2010; Redpath et al., 2013), progress in this area will be facilitated by a comprehensive framework to guide investigations of the diverse array of social and ecological drivers of HWIs. In response to this need, we propose a conceptual model of HWIs that adopts a social-ecological systems (SES) approach. SESs are systems of biophysical and social factors that interact at multiple spatial, temporal, and organizational scales and whose flow is regulated in dynamic and complex ways (Redman et al., 2004). Our model integrates theory from the social and ecological sciences, building upon recent advances applying a systems approach to understand the human dimensions of conservation (e.g., Manfredo et al., 2016). We add to existing frameworks aimed at addressing SES questions (Binder et al., 2013), including previous applications of SES concepts to HWIs (e.g., Morzillo et al., 2014; Carter et al., 2014), by treating social and ecological systems in equal depth, acknowledging the bidirectional influence of social and ecological processes, and considering both individual-level and broad, external influences on human and animal behavior. In doing so, we provide a heuristic framework to assist researchers and practitioners in understanding the relationship between social and ecological drivers of HWIs and foster interdisciplinary approaches to addressing them. We apply the model to our work on human-black bear (*Ursus americanus*) conflicts to illustrate the benefits of our approach and conclude with a set of lessons learned, offering guidance for applying integrated approaches to other human-wildlife systems.

2. SES model of human-wildlife interactions

In the simplest form, HWIs can be conceptualized as the result of two distinct, but interacting systems: social and ecological (Fig. 1a). Although human and animal behaviors are the proximate drivers of HWIs, the context shaping those behaviors is defined by multiple, nested levels of external social and ecological influences (Fig. 1b) and attributes of individual humans and animals (Fig. 1c). When viewed through a single disciplinary lens, these systems may appear to operate independently; however, the ecological and social systems often overlap spatially, and feedbacks among social and ecological drivers (represented by curved arrows in Fig. 1b) are critical determinants of HWIs.

Within the ecological system, wildlife activities are influenced by a suite of internal and external factors occurring across hierarchical levels (Fig. 1b; see Table 1 for definitions of *italicized* terms). These levels of decreasing organizational complexity – ranging from ecosystems to individuals (Krebs, 2001) – provide the framework within which wildlife activities occur and the context for HWIs. At the broadest level of external influence, *ecosystems* define interactions between organisms and their abiotic and biotic environment, and prescribe the nature, direction, and distribution of the flow of energy and nutrients. At the next level, ecological *communities* determine interactions among species through processes such as predation and competition, further constraining the distribution and behavior of individual animals. The last tier of external influence occurs at the *population* level, where local dynamics influence the abundance, density, survival, and reproduction of individuals, which in turn, can strongly affect animal behavior. In addition to these external influences, *individual behavior* is the consequence of various individual attributes of animals (Fig. 1c). Attributes such as demographic characteristics (e.g., age, sex), reproductive status, *physiological condition*, *social status*, *temperament*, previous experience, and genes can all shape animal behavior directly or indirectly (Davies et al., 2012).

Mirroring the multilevel conceptualization of the ecological system, human activities are affected by external and internal influences within the social system (Manfredo et al., 2014, 2016; Fig. 1b, c; Table 1). At the broadest level, patterns in *society*, such as language, culture, economic development, and human migration, shape the context within which people live and interact with the natural environment. *Institutions* and governance structures, such as decision-making authority, policies, and methods for public engagement, comprise the next level of external influence and affect people's perceptions and expectations about decision-making processes, power, and resource allocation. At the finest level of external influence, *groups*, such as community organizations and other affiliations with which people identify, impose and reinforce *norms* for acceptable behavior in relation to one's social and environmental surroundings. *Individual behavior* is also driven by various individual attributes (Fig. 1c), ranging from general (*values*) to specific (*attitudes*, personal *norms*) cognitive influences, as well as socio-demographic characteristics, *emotions*, previous experience, and genes. Although traditional approaches to understanding conservation-related behaviors have assumed that rational choice and cognitive influences guide individual actions, recent advances call for greater attention to non-cognitive (e.g., *emotions*) and broader-level (e.g., *groups*, *institutions*) factors captured by our model (Manfredo et al., 2014, 2016).

By explicitly acknowledging the suite of external and internal factors operating within both the social and ecological systems, researchers are better able to identify the relative roles of each in driving HWIs, and importantly, account for spatial overlap and feedbacks within and between the two interacting systems (Redman et al., 2004; Manfredo et al., 2016). For example, *ecosystem* characteristics, such as the location of rivers and streams, can affect animal distribution, as well as patterns of human migration and residential development, which are *societal*-level drivers. *Institutional* influences, such as decisions to reintroduce a threatened species, can alter predator-prey dynamics within ecological *communities* and affect human *attitudes* by impacting people's wildlife-related experiences. In addition to these top-down and cross-system effects, individual human and animal behaviors can scale up through both social and ecological systems to affect processes occurring at higher levels. For example, collective human actions can affect institutional response, as when voting behavior on state referenda limits the methods that wildlife agencies can use to manage species. As illustrated in the case study below, our model can serve as a conceptual map to facilitate conversations across disciplines about information gaps, research questions, and management strategies that better account for the complex and dynamic nature of HWIs.

3. Case study: applying the conceptual model to understand drivers of human-black bear conflicts

3.1. Background

Although interactions between humans and black bears can be positive, they often result in threats to human property and safety (e.g., bears breaking into vehicles), nuisances (e.g., spilled trash; Gore et al., 2006a), and increased bear mortality (e.g., lethal removal; Treves and Karanth, 2003). As human development has encroached on bear habitat, conflicts resulting from bears foraging for anthropogenic food near human development (e.g., garbage and fruit trees; Lewis et al., 2015) have increased (Hristienko and McDonald, 2007), becoming a major management challenge for wildlife agencies. Although wildlife agencies have invested significant resources in a variety of approaches to reduce conflicts, such as translocation, education, and harvest, these efforts have generally yielded limited success in reducing conflicts in residential settings (Gore et al., 2006b; Treves et al., 2010; Baruch-Mordo et al., 2011). Investigators recognize that both ecological and social factors contribute to human-bear conflicts (Baruch-Mordo et al., 2009), yet few studies have attempted to integrate both types of information to guide management.

As part of a large-scale study to better understand both the ecological and social factors associated with increases in human-bear conflicts, several authors of this paper conducted an experiment in

Download English Version:

https://daneshyari.com/en/article/8847124

Download Persian Version:

https://daneshyari.com/article/8847124

Daneshyari.com