THE CONDOR
Ornithological Applications
AmericanOrnithology.org

Volume 122, 2020, pp. 1–15
DOI: 10.1093/condor/duaa021

SPECIAL FEATURE

Applying conservation social science to study the human dimensions of Neotropical bird conservation

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Submission Date: January 26, 2020; Editorial Acceptance Date: March 13, 2020; Published April 29, 2020

ABSTRACT

As the global human population increases, and many bird populations in the Neotropics and the rest of the world continue to decline, the study of the intersection of humans, birds, and conservation has become more relevant than ever. The field of conservation social science is an interdisciplinary field that applies the social sciences and humanities to examine research questions that have implications for biodiversity conservation, and encompasses disciplines as diverse as psychology, economics, and political ecology. An understanding of the human dimensions of biodiversity conservation issues can be an essential element in the success or failure of a conservation initiative, policy, or practice. The purpose of this article is to provide an understanding of the growing body of conservation social science relevant to Neotropical bird conservation research and to demonstrate its importance. We discuss how this research can contribute to addressing 5 major threats to bird conservation in the Neotropics, including future research needs, and we provide 3 case studies of bird conservation social science projects, demonstrating the insights that can be gained. We close with a discussion of how conservation biologists and ornithologists can most effectively work with conservation social scientists.

Keywords: conservation social science, human behavior, human dimensions, social-ecological, traditional ecological knowledge

Aplicando las ciencias sociales de la conservación al estudio de las dimensiones humanas para la conservación de las aves Neotropicales

RESUMEN

A medida que la población humana aumenta, y que muchas poblaciones de aves silvestres en el Neotrópico y en el resto del mundo continúan declinando, el estudio de la intersección entre los humanos, las aves y la conservación se ha vuelto más relevante que nunca. Las ciencias sociales de la conservación son un campo interdisciplinario que utiliza las ciencias sociales y las humanidades para examinar preguntas de investigación con implicaciones para la conservación de la biodiversidad. Esto incluye disciplinas tan diversas como la psicología, la economía y la ecología política. La comprensión de las dimensiones humanas de los temas vinculados a la conservación de la biodiversidad puede ser esencial en el éxito o en el fracaso de iniciativas, políticas o prácticas de conservación. El objetivo de este artículo es el de proporcionar

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evidencia sobre la creciente literatura concerniente a las ciencias sociales de la conservación en cuanto a la investigación y la conservación de las aves neotropicales. Discutimos cómo esta investigación puede contribuir para abordar cinco grandes amenazas a la conservación de las aves en el Neotrópico, incluyendo necesidades de investigación futura. A su vez, proporcionamos tres casos de estudio que ilustran proyectos de conservación de aves basados en las ciencias sociales, demostrando el conocimiento que puede ser adquirido por medio de este enfoque. Concluimos con una discusión que indica cómo los biólogos de la conservación y los ornitólogos pueden trabajar de manera más efectiva con cientistas sociales de la conservación.

Palabras clave: ciencias sociales de la conservación, comportamiento humano, conocimiento ecológico tradicional, dimensiones humanas, socio-ecológicos

INTRODUCTION

In 2004, one of the largest known colonies of Black-necked Swans (*Cygnus melancoryphus*) underwent a population crash at a wetland on the Cruces River in southern Chile. In less than a year, the population fell from a historical average of ~6,000 birds to fewer than 300 (Jaramillo et al. 2007). Thousands of swans emigrated from the wetland or were found dead in the vicinity. The decline began shortly after a pulp mill started operating ~30 km upstream of the colony. The direct cause of the population decline was determined to be the disappearance of the swans' main food source, large-flowered waterweed (*Egeria densa*), caused by the release of discharges from the mill (Jaramillo et al. 2007). Images of dead and dying swans circulated around the country on television and in the newspapers, provoking widespread alarm. A grassroots citizens' movement, *Acción por los Cisnes* [*Action for the Swans*], emerged in response to the incident in the city of Valdivia (Sepúlveda and Villarroel 2012, Sepúlveda-Luque et al. 2018). The Chilean environmental mobilization, which was unprecedented in its size and scope for Chile at the time, revealed systemic flaws in Chile's environmental policy that enabled the disaster, and ultimately led to massive reform of the country's environmental laws (Tironi et al. 2017). Interestingly, the mobilization's main driver was the suffering of the swans, revealing an unexpected bond between the people of Valdivia and this species (Sepúlveda-Luque et al. 2018). In 2013, after many years of legal wrangling, Arauco, the company that owns the mill, was ordered to repair the environmental damage (Primer Juzgado Civil de Valdivia 2013). Since then, citizens, scientists, politicians, and public servants, as well as Arauco, have been striving to address the different measures ordered by the ruling (Sepúlveda 2016, CEHUM 2018). Simultaneously (2012–2016), the ecosystem began to recover, eventually reaching historical averages in numbers of swans (Jaramillo et al. 2018).

This story is one example of the importance of the complex and often contradictory roles that humans play in Neotropical bird conservation. While researchers studying ecological systems often minimize the role people play or think of people as merely "the problem," they are also a critical part of the solution. An understanding of what humans do and why is very important to advancing conservation science and strategies. This interdisciplinary field of research focused on the human dimensions of environmental issues—conservation social science—is essential to bird conservation and the long-term protection of biodiversity.

CONSERVATION SOCIAL SCIENCE

Current levels of biodiversity loss, estimated at up to 1,000 times greater than natural background levels (Gorenflo and Brandon 2006), are unparalleled in recorded history. Today 14% of extant bird species are threatened (i.e. Critically Endangered, Endangered, or Vulnerable) with that number expected to rise in the coming decades (IUCN 2020). By at least one estimate, about 1 in 7 bird species will be extinct in the next 8 decades (Şekercioğlu et al. 2004). As the global human population continues to expand—estimated to reach more than 11 billion by the end of this century (United Nations 2015)—bird populations and the conservation programs to aid them will increasingly depend on the pro-conservation actions of people and public support. Because many biological and ecological outcomes are intimately linked to human behaviors, it is vital to understand how factors such as markets, cultural beliefs and values, laws and policies, institutional and power structures, individual decision-making processes, and human demographic changes shape people's interactions with the environment and how their choices can impact biodiversity (Mascia et al. 2003).

The human dimensions of bird conservation are broad-spanning, defined as "everything in conservation that is not directly about [birds] and habitats" (adapted from Decker et al. 2012), or the social, political, economic, cultural, ethical, and historical aspects of conservation. Given the pervasive impacts of people on wildlife and habitat and the variety of interactions between humans and wildlife and their habitats, most issues related to wildlife and habitat conservation have a direct or indirect human dimensions consideration (Decker et al. 2012). In North America and parts of Latin America "human dimensions" may also be used to refer to a field of study focused on these human dimension considerations (e.g., Manfredo 2008, Cerda et al. 2019). Here, we instead refer to the field of study focused on the human dimensions of biodiversity conservation as "conservation social science" (following Bennett et al. 2017b). Increasingly,

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"conservation social science" is considered the overarching term for the classic social science disciplines (e.g., psychology, sociology, anthropology, economics), applied social sciences (e.g., communication, education, law), interdisciplinary social sciences (e.g., political ecology, science and technology studies, human ecology), and humanities (e.g., philosophy, literature) that examine research questions about people and their environment (Bennett et al. 2017b). Much of the research is interdisciplinary (within and beyond the social sciences) and, increasingly, conservation social scientists are collaborating with natural scientists on topics that address conservation challenges, often using a coupled human–natural systems or social–ecological systems approach (e.g., Carter et al. 2014, Morzillo et al. 2014).

Applications of conservation social science to bird conservation in the Neotropics are limited and still developing. Within the past few years, international bird conservation initiatives have released plans that call for more extensive conservation social science. For example, Partners in Flight's *Saving Our Shared Birds: A Tri-National Vision for Landbird Conservation* highlights social science research needs for bird conservation for Mexico, the United States, and Canada (Berlanga et al. 2010). Likewise, recent ornithological conferences have included social science tracks and symposia, such as the session "Integrating human-cultural perspectives in bird conservation: The role of ethno-ornithological research and practice" at the 27th International Ornithological Congress in 2018, and sessions on bird conservation social science and the human dimensions of bird conservation at both the Neotropical Ornithological Congress and American Ornithological Society meeting in 2019. Many international organizations are also now calling for the systematic incorporation of conservation social science into biodiversity conservation (Bennett et al. 2017a). In the United States, the first National Bird Conservation Social Science Coordinator was hired in 2017 to work with the bird conservation community to increase conservation social science capacity through the North American Bird Conservation Initiative; as far as we know, no such position yet exists in the other Western Hemisphere countries.

CONSERVATION SOCIAL SCIENCE AND THREATS TO BIRD CONSERVATION

Conservation social science is critical to understanding how to best address threats to birds, as well as how people may be affected by changes in bird populations. While we focus on the former, the latter is equally important as how people are affected by bird population changes will also impact how they respond to conservation efforts. Salafsky et al. (2008:897) define a direct human threat to biodiversity as "proximate human activities or processes that have caused, are causing, or may cause the destruction, degradation, and/or impairment of biodiversity targets." Notably, this widely accepted definition implies that, if we expect to understand and manage the threats to biodiversity, we need to understand the behavior of people. This may involve examining questions such as why people kill birds, convert forests into pastures, disagree with lethal control of invasive species, view birds as an important part of the ecosystem (or not), and hundreds of other questions. Below we provide 5 examples of how conservation social science contributes to understanding the drivers of major threats to the conservation of birds in the Neotropics. Also, where it exists, we review information on how social science contributes to developing and evaluating effective conservation strategies. Further, we suggest key knowledge gaps that, if addressed, could contribute to more effective conservation. In doing so, we end with a discussion of how social science is particularly needed in testing conservation strategies to change human behavior to benefit bird conservation.

Habitat Loss and Fragmentation

The most influential driver of bird diversity loss and abundance in the Neotropics is habitat loss and fragmentation, the primary causes of which are logging of primary forests and conversion of forests and grasslands to agriculture and livestock production (Berlanga et al. 2010, Ibarra et al. 2017), the establishment of plantations of nonnative species, and urbanization. For a more complete discussion of threats, see Stotz et al. (1996). For example, deforestation led to a replacement of habitat specialist bird species with habitat generalists in disturbed Andean temperate forests of southern Chile (Ibarra and Martin 2015). In spite of agriculture's increasing industrialization, about two-thirds of the farmers in the developing world are still small-scale, subsistence farmers (Altieri 2009). Conservation social science can inform better design of conservation programs and policies through the study of the motivations, needs, and constraints of different types of farmers. For example, the international demand for coffee has been a driving force of tropical forest loss. In coffee regions of Costa Rica, there was a remarkable 50% decline of shaded coffee (and its associated biodiversity benefits) from 2000 to 2009 due to conversion to sun coffee, pasture, and crops (Jha et al. 2014). Although shade coffee production presents important conservation opportunities (Bakermans et al. 2012, De Beenhouwer et al. 2013), due to the upfront costs of cultivation, small farms may need economic assistance to convert their farms to shade-grown coffee systems (Gobbi 2000, Mas and Dietsch 2004). Two market-based policy solutions are international certification systems that pay a price premium (Philpott et al. 2008) and payments for ecosystem services (PES) that pay farmers directly for habitat conservation (Wunder 2007, Balvanera et al. 2012). Conservation social science can help to determine if either

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certification or PES is likely to be effective, given the social, political, and economic situation of the community or region.

PES shows promise for protecting large tracts of primary forest that many resident Neotropical birds depend on, but developing effective, long-term PES programs requires understanding how these instruments interact with existing policies and laws, broader social and economic trends, and participants' livelihoods (Wunder 2007, Ibarra et al. 2011, Porras et al. 2013, Chapman 2017). More critically, without an understanding of the human dimensions, PES programs run the risk of crowding out farmers' intrinsic motivations for conservation (Bowles 2008, Muradian et al. 2013, Rode et al. 2015). Yet, PES programs can be designed to avoid motivational crowding out by framing the financial incentives as compensation or help for stewardship (Rosa et al. 2004, Wunder and Vargas 2005, Kosoy et al. 2007, Rode et al. 2015, Chan et al. 2017, Chapman 2017, Olmsted 2017, Chapman et al. 2020). Conservation scientists still need to better understand which settings optimize these conservation policy tools and which potential solutions are most effective for Neotropical birds (Muradian et al. 2013). For both certification and incentive programs, the key to effectiveness is understanding why farmers participate (e.g., Zbinden and Lee 2005) and whether and why they might continue these conservation activities when payments end (Dayer et al. 2018); conservation social science can contribute to both.

Hunting

Human hunting of wild birds for meat is still relatively common in many parts of the Neotropics. Peres (2000) estimated that each year between 9.6 and 23.5 million animals (including mammals, birds, and reptiles) are consumed by residents of rural Amazonia in Brazil. Large birds such as guans and curassows are often overharvested and often less abundant near human settlements (Begazo and Bodmer 1998). Cultural change and economic factors both appear to be associated with hunting and bushmeat consumption. In Bolivia, Luz et al. (2015) found that schooling—used as a proxy for cultural change—was negatively associated with the probability of the Tsimane' (indigenous people of the Bolivian Amazon) engaging in hunting. The authors hypothesize that this pattern may be related to increased opportunities for participating in alternative economic activities that derive from higher levels of schooling, or—alternatively—that schooling may be negatively associated with learning hunting abilities. In another study in Brazil and Colombia, Morsello et al. (2015) found that those who considered bushmeat consumption important for their identity and social relations were more likely to prefer and consume bushmeat. Understanding what drives hunting and bushmeat consumption is fundamental to addressing this problem. However, strategies to tackle this problem also need to be tested. For example, Chaves et al. (2017) studied whether economic incentives (subsidies to lower the cost of chicken, as an alternative source of protein) paired with social marketing (information and community engagement) reduced wildlife consumption in the central Amazon, and found that economic incentives alone did not reduce bushmeat consumption. In contrast, social marketing reduced wild meat consumption by 62%. Interestingly, social marketing reduced bird and mammal, but not turtle, consumption, which the authors suggest might be explained by a social norm of the "appropriateness" of consuming turtle for special occasions, and local pride about these prized catches. This study illustrates the importance of testing conservation interventions and provides a glimpse of the complexities and challenges involving strategies aiming to change human behavior.

The Bird Trade

The pet market is an important yet understudied driver of species loss in the Neotropics (Silva Regueira and Bernard 2012, Tingley et al. 2017) and is one of the major factors in declining populations of parrots and other species (Berkunsky et al. 2017). The critically endangered Spix's Macaw (*Cyanopsitta spixii*) is nearly extinct in the wild, mainly due to the combination of habitat loss and the illegal bird trade (BirdLife International 2016). The problem of the illegal trade has been documented in countries such as Mexico (Iñigo-Elias and Ramos 1991), Brazil (Silva Regueira and Bernard 2012), Venezuela (Sanchez-Mercado et al. 2017), Perú (Daut et al. 2015), and Cuba (Collar and Juniper 1992). In Caatinga, Brazil, birds are commonly used as pets where their ownership is more correlated with their prevalence in cultural practices, rather than socioeconomics (Alves et al. 2013). In Peru, where at least 130 species of birds are illegally sold (Daut et al. 2015), the practice of trading wildlife appears to be opportunistic and financially motivated (Leberatto 2016a). Leberatto (2016b) further identifies 5 types of sellers—casual, transient, opportunistic, hidden, and professional—based on their level of involvement, methods to obtain wildlife, the types of animals sold, and the importance of wildlife relative to other products the seller commercialized. Work in Peru suggests both demand by consumers and the socioeconomic and cultural reality of the seller are drivers of the illegal bird trade (Leberatto 2016a,b). While some of these drivers are likely present in many parts of the Neotropics, others may be place- and context-specific, and need further exploration. In any case, wildlife poaching and trade is unlikely to be stopped by regulations and enforcement alone; rather, strategies focusing on the drivers of trade are urgently needed (see Challender and MacMillan 2014). As illustrated in the case of bushmeat consumption reduction

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through social marketing (Chaves et al. 2017), testing the effectiveness of alternative interventions to reduce both poaching and the demand for wild pets is critical to promote in situ conservation.

Killing of "Problem" Birds

Most widely documented human–wildlife conflicts involve predators and large herbivores (Redpath et al. 2015); much less is known about human–bird conflicts (e.g., Dayer et al. 2019), which usually involve agriculture and livestock production (Nyhus 2016). Region-wide, a diversity of birds cause damage—or are perceived to do so—to agriculture and other property (e.g., de Grazio and Besser 1970, Bruggers et al. 1998, Trivedi et al. 2004, Silva-Rodríguez et al. 2019). In response to actual or perceived bird damage, people may respond with different management actions, including lethal control (e.g., de Grazio and Besser 1970, Bruggers et al. 1998, Rodríguez et al. 2004, Canavelli et al. 2013). Lethal control may not be effective for some bird species, whereas for other species it may have severe consequences for their populations (Linz et al. 2015). An extreme example is the case of the Guadalupe Caracara (*Caracara lutosa*) on Guadalupe Island, Mexico, which were persecuted to extinction due to their perceived impacts on goats (Hanna 1925). Major declines—possibly to extirpation in Argentina—of the Blue-winged Macaw (*Primolius maracana*) have also been attributed to persecution by farmers in response to crop damage (Bodrati et al. 2006). Although bird damage to crops has received some attention (e.g., Bruggers et al. 1998, Canavelli et al. 2014, Sánchez et al. 2016), the understanding of the human dimensions of human–bird interactions in the Neotropics lags behind. Some efforts conducted in Uruguay and Argentina deserve attention. In Uruguay, 96% of 70 farmers reported bird damage to vineyards, 58% reported that damage was serious, and 41% estimated that birds damaged 10% or more of the grapes. Farmers reported firearms (57%) and toxic baits (41%) among the methods used to manage bird damage, but only 17% thought the methods used were effective (Rodríguez et al. 2004). As illustrated by this example, lethal control is widely supported but not necessarily effective (see also Linz et al. 2015). A key question is what factors drive preferences for management alternatives. Canavelli et al. (2013) addressed this question for Monk Parakeets (*Myopsitta monachus*) in Argentina. The authors found that preference for lethal and reproductive control was higher for those farmers that held negative attitudes toward the birds, whereas preference for other alternatives such as crop protection, agricultural practices, and relocation of parakeets were associated with positive attitudes toward the birds. Other factors were also associated with the use of one or more management strategies, among them perception of the damage caused by parakeets and perceived effectiveness of management actions. Studies such as those described above are scarce in the Neotropics but are a fundamental step to address the many known cases of human–bird conflict.

Invasive Species and Domestic Carnivores

Invasive predators represent a major threat for biodiversity, including birds (Doherty et al. 2016). Free-ranging domestic cats (*Felis catus*) are a well-known threat to birds (Doherty et al. 2016), especially in island systems (Hahn and Römer 2002, Wiedenfeld and Jiménez-Uzcátegui 2008, Medina et al. 2011). Numbers in the Neotropics are hard to come by, but in the United States, cats are estimated to kill between 1.4 and 3.7 billion birds per year (Loss et al. 2013). Free-ranging dogs also represent a threat to birds (Doherty et al. 2016). Dogs prey on the Humboldt Penguin (*Spheniscus humboldtii*; Simeone and Bernal 2000) and have caused mortalities during reintroduction efforts for the endangered Red-billed Curassow (*Crax blumenbachii*) in Brazil (Steiner São Bernardo et al. 2011). The human dimensions of the interactions between wildlife and both dogs and cats have been seldom studied in Latin America (limited research includes Ruiz-Izaguirre and Eilers 2012, Schüttler et al. 2018, Villatoro et al. 2019), although such work has been conducted in other areas of the world (e.g., Williams et al. 2009, Loyd and Miller 2010, Wald et al. 2013). Owned dogs and cats are often allowed to roam (e.g., Silva-Rodríguez and Sieving 2011, Schüttler et al. 2018), even in areas where most people disagree that dogs should be free to roam, as reported in Mexico (Ruiz-Izaguirre and Eilers 2012). Dogs are rarely restricted—or managed at all—in response to their impacts on wild animals, but they may be restricted to protect the dog, people, other domestic animals, or private property (Villatoro et al. 2019). Changing owners' behavior toward their pets is fundamental to address the threat of dogs and cats to birds. This includes better management practices (feeding, health, and roaming restriction) as well as prevention of abandonment (Silva-Rodríguez and Sieving 2011, Villatoro et al. 2019).

The management of invasive species is leading to growing conflicts worldwide (Estevez et al. 2015, Crowley et al. 2017a,b). In Neotropical countries such as Chile, conflict has already emerged around management decisions that involve stray dogs (Silva-Rodríguez et al. 2019). For example, animal rights advocates expressed strong opposition to a regulation that allowed feral dog hunting, leading to the official reversal of the regulation (Montecino-Latorre and San Martin 2019, Silva-Rodríguez et al. 2019, Villatoro et al. 2019). Scenarios of management failure due to public opposition could become more common in the future. The management of other invasive species could lead to conflicts (Shackleton et al. 2019, Villatoro et al. 2019). For example, in Navarino Island, Chile, most people disliked invasive

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species such as American minks (*Neovison vison*) and beavers (*Castor canadensis*), and supported control both to reduce their impacts and to generate income (Schüttler et al. 2011). However, the authors reported that there was disagreement over the use of lethal versus nonlethal management techniques, and also about whether these animals should be eradicated or only controlled. The emergence of conflicts associated with the management of invasive species could lead in the future to major failures in bird conservation. Key aspects that need to be addressed to reduce the potential for conflict include building public trust (Wald et al. 2019), engaging stakeholders in management actions (Novoa et al. 2018), and increasing our understanding of the scenarios that could lead to conflict (Crowley et al. 2019). In fact, social impact assessment of invasive species management is a fundamental need for future management interventions (Crowley et al. 2017b).

Developing Interventions to Change Human Behavior

Much progress has been achieved in understanding bird biology and the consequences of human actions for bird populations. Because the main threats to bird conservation derive from human actions, the solutions require changes in human behavior (Schultz 2011). As described above, human behavior is influenced by many factors, such as norms, attitudes, economics, and legal structures. The solutions to the challenges can also be riddled with human–human conflict over the appropriate approach (Manfredo and Dayer 2004). Simply providing factual information to individuals or policy-makers will typically be ineffective in changing behavior (Schultz 2011, Heberlein 2012). Multiple alternatives (e.g., incentives, social influence tools such as pledges or recognition, structural changes such as changing the built or natural environment so the conservation behavior is easier) need to be studied, ideally in the same or a similar context. This approach would allow managers to determine the best strategies to address and change human behaviors considered problematic for wildlife. Examples of empirical studies of interventions, such as the study by Chaves et al. (2017), are scarce and therefore urgently needed if we expect conservation strategies to be developed on the basis of rigorous evidence (see O'Connell and White 2017, Sutherland and Wordley 2017).

CASE STUDIES

The following case studies cover a range of species, geographies, research topics, and conservation issues, showing how conservation social science results can be applied to foster effective Neotropical bird conservation. These projects derived their success from a deep understanding and incorporation of the human element, employing various aspects of the social sciences and humanities.

Private Landowners as Stewards of Avian Biodiversity

Location. Nicoya Peninsula, Costa Rica.

Participants. Fundación NicoyAgua, Unafor Chorotega, Fundecongo, Area de Conservación Tempisque, The University of British Columbia, The University of California Davis, The Social Sciences and Humanities Research Council of Canada.

Key species. Great-tailed Grackle (*Quiscalus mexicanus*), Neotropic Cormorant (*Phalacrocorax brasilianus*), Bare-throated Tiger Heron (*Tigrisoma mexicanum*), Purple Gallinule (*Porphyrio martinicus*).

Costa Rica is world-famous for the avian diversity of its national park system, which supports ~850 bird species, including 2 dozen that are globally threatened (Garrigues and Dean 2014, BirdLife International 2016). Less well-known are the many private landowners that steward birds on their farms and forests. Aided by the country's payment for ecosystem services program (FONAFIFO 2014), many Costa Ricans protect forest fragments on mountains and along watercourses, and make use of "live fences" (i.e. trees planted and strung with barbed wire) that help maintain biodiversity in an agricultural matrix (Harvey et al. 2005, Perfecto and Vandermeer 2010, Mendenhall et al. 2014). In order to better understand the role of private landowners as habitat stewards, researchers interviewed 20 farmers and ranchers (18 of whom had received payments for forest protection) on the Nicoya Peninsula about their perceptions of different birds, their views on appropriate relationships between people and birds, and concepts of appropriate behavior regarding birds. They intentionally interviewed a diversity (e.g., farm sizes, gender, region, farm products) of farmers and ranchers in their study region (see Dinat et al. 2019 for full methodology).

The farmers interviewed had positive comments about most bird species, but negative responses to one, the Great-tailed Grackle, which was perceived to be an agricultural pest and nest predator (Dinat et al. 2019). Other species, such as Neotropic Cormorant, Bare-throated Tiger Heron, and Purple Gallinule were sometimes reported to have caused damage to rice crops. One farmer expressed a sentiment that was common among other interviewees:

> "We have one [bird] that causes us problems. The[Great-tailed] grackle comes, and digs out the seeds or the seedlings, we have many problems with him so we have to scare him off." [Interview #2]

These human–bird conflicts emerged primarily with farmers, whose products were prone to damage by birds, and were less common for cattle ranchers, whose products and activities were often compatible with birds.

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Among farmers that expressed views of stewardship toward birds, researchers found 3 levels of stewardship. The first level focused on avoiding harm from people. One farmer who manages his land for forest conservation explained:

> "There are many little kids that hunt with arrows and go around hitting the birds. This they should not do because the little animal is doing no harm. Why harm [the birds]? I do not agree [with harming the birds]." [Interview #18]

The second level of stewardship emphasized how farmers could protect or maintain habitat for birds. Some interviewees expressed concern about frequent forest fires or drought and took steps to provide water sources for birds, while others focused on their role as providers of habitat. For example, one cattle rancher explained that he felt that humans owed birds a debt due to all the pollution and habitat destruction they have caused. When asked how humans might repay that debt, he explained:

> "Protecting areas, leaving more trees, planting trees all over. I think that a silvo-pastoral system would help the birds a lot, because then they would have a place to perch and a place to make their nests. And then probably there would be more insects and so more food for some types of birds. Some birds eat fruit and some insects and other things, so in this way we can compensate." [Interview #5]

The third level of stewardship involved actively promoting bird conservation among neighbors. For example, a farmer who manages land with crops and tree plantations explained:

> "Here I planted bananas . . . My family and I eat them, but we eat maybe one of every 10 that grow. And sometimes the neighbors come and they say 'the birds are eating the bananas. I want some, please give me some bananas.' And I say 'Yes, get a knife and take a child plant and plant it in your garden and in 2 years you will have bananas for yourself. Because these bananas are for the birds and the birds can't plant.' We are destroying the birds so I plant bananas here for them." [Interview #20]

Lessons learned. The positive views found here toward all but one bird species (the Great-tailed Grackle, which thrives in human-dominated landscapes) may be particular to Costa Rica, which has largely oriented its economy around ecotourism and supports conservation via payments to farmers to protect forested areas (Dinat et al. 2019). Understanding the views and relationships between farmers and birds elsewhere in the Neotropics will require further research. The emphasis in this case study on active stewardship (via tree planting or providing water and food for birds) aligns with a general preference by farmers in many parts of the world for active types of conservation (such as building fences or putting up bird boxes) as opposed to requirements or requests that restrict their productive activities (e.g., Burton and Paragahawewa 2011, Fleury et al. 2015, Chapman et al. 2019). Qualitative interviews, like those used in this exploratory study, can help to inform programs and policies for conservation of Neotropical birds, including the question of using voluntary programs vs. regulations. For example, this study identified different types of stewardship practices that some farmers in the region engage in to protect birds as well as the reasoning for such practices. Hypothetically, a bird-focused conservation program could build upon these existing motivations and practices.

Traditional Ecological Knowledge and the Role of Birds in Mapuche Weather Forecasting

Location. Andean temperate forests of southern Chile.

Participants. Mapuche Indigenous communities (Rayen Lelfun, Loncofilo), UC Centre for Local Development (CEDEL), Centre for Intercultural and Indigenous Research (CIIR), Villarrica Campus from Pontificia Universidad Católica de Chile.

Key species. Thorn-tailed Rayadito (*Aphrastura spinicauda*), Patagonia Sierra-Finch (*Phrygilus patagonicus*), Magellanic Woodpecker (*Campephilus magellanicus*), Black-crowned Night-Heron (*Nycticorax nycticorax*), Barn Owl (*Tyto alba*), Austral Pygmy-Owl (*Glaucidium nana*), Rufous-legged Owl (*Strix rufipes*).

Indigenous peoples of the Neotropics have been observing birds for millennia, and incorporating their knowledge of avian taxonomy, behavior, and habitat use for their own survival, culture, religion, and other uses. While Western science (i.e. a knowledge framework relying on laws that have been determined by applying the scientific method to phenomena in the world) has begun to value Traditional Ecological Knowledge (TEK) of indigenous peoples of the Americas, there is still considerable room for growth and collaboration as it relates to Neotropical ornithology. TEK is indigenous or local knowledge about the environment, the use of or values about the environment, and the knowledge system itself (Berkes et al. 2000). TEK differs from Western ornithology in that it is typically oral, holistic, qualitative, observational and experiential, relatively long-term in confined geographies, and integrated into everyday life. By contrast, Western ornithology might be considered written, reductionist, quantitative, experimental or theoretical, relatively short duration in broader geographies,

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and generally not integrated into other aspects of daily life. The 2 approaches share several attributes, such as the desire to recognize and describe patterns; that observations are strongest when taken in natural settings; that observations are verified through repetition; and, perhaps most importantly, that inferences and predictions are made following repeated observations (adapted from Barnhardt and Kawagley 2005).

The "knowledge and control of weather" using biotic indicators to forecast weather has been a long-standing practice of Andean mountain cultures (Orlove 1985, Alves and Barboza 2017). Birds, weather patterns, and the interactions between them have been meticulously observed by Andean mountain cultures for thousands of years; however, with the rapid development of modern technologies and the effects of modern political systems and policies, traditional weather forecasting is becoming less commonly used (Jacques-Coper et al. 2019).

Between 2012 and 2019, as part of a long-term project on the conservation of natural and cultural heritage in southern temperate forests of Chile, Ibarra and colleagues studied the role of birds in a traditional weather forecasting system of a Mapuche indigenous community, the resource management practices triggered by avian indicators of weather changes, and the historical and contemporary factors affecting the maintenance of weather forecasting TEK (Ibarra and Barreau 2014, Ibarra et al. 2018). These researchers conducted observations, informal and semi-structured interviews, and identified and discussed local bird species with community members (n = 35 participants).

Mapuche participants identified 12 bird species as weather indicators. According to villagers, 7 of the species descend from the mountains when snow, storms, or heavy rain are imminent. Using birds as a weather forecasting method, either the sudden arrival of an unexpected species or an uncommon behavior of another, provided local farmers with a means for reducing uncertainty while improving decisions in resource management. For example, community members took actions to protect their herds from storms, collected firewood, harvested and bundled grass, and harvested apples based on impending weather, as indicated by the arrival of different bird species.

Most adults, especially elders, in the community had a comprehensive knowledge of birds and their role as weather indicators. However, younger generations were less likely to be knowledgeable in this area. The lack of access to forests, because of historical (non-Mapuche) land appropriation, along with the widespread institution of westernized school regimes, were reported as the main factors interrupting the transmission of knowledge (Barreau et al. 2016). According to participants, traditional weather forecasting methods are still utilized along with modern forecasting systems (i.e. information derived from television broadcasts or the internet). However, older farmers stressed that traditional methods are preferred as these are more site-specific and many times a more reliable means for reducing uncertainty and improving decisions in resource management.

Implications. This ongoing project has demonstrated that a better understanding of historical and contemporary social–ecological dimensions of environmental issues may improve conservation actions as the latter need to be culturally sensitive in order to be accepted by local communities. To accomplish this, this project developed avian co-monitoring programs, community-based tourism initiatives, and projects promoting intergenerational dialogues about birds, forests, and local biocultural heritage. These initiatives have allowed the generation of complementary income for some local participants; the creation and documentation of narratives for visitors (e.g., students, tourists, researchers) about local forests and birds; and honoring elders as they serve as stewards of knowledge, intertwined with practice and beliefs, of long-term changes in the territory.

Guatemalan Agroecosystems Benefit Smallholder Farmers and Neotropical Birds

Location. Cloud forest agroecosystems in the Highlands of Guatemala, Alta Verapaz.

Participants. Three Q'eqchi' Mayan villages, Guatemalan nonprofit Community Cloud Forest Conservation, and The Cornell Lab of Ornithology.

Key species. *Neotropical Migrants*: Black-and-white Warbler (*Mniotilta varia*), Blue-headed Vireo (*Vireo solitarius*), Common Yellowthroat (*Geothlypis trichas*), Gray Catbird (*Dumetella carolinensis*), Lincoln's Sparrow (*Melospiza lincolnii*), Wood Thrush (*Hylocichla mustelina*); *Highland Endemics*: Blue-and-white Mockingbird (*Melanotis hypoleucus*), Bushy-crested Jay (*Cyanocorax melanocyaneus*), Green-throated Mountain-gem (*Lampornis viridipallens*), Rufous-collared Robin (*Turdus rufitorques*); *Forest Residents:* Common Chlorospingus (*Chlorospingus flavopectus*), Gray-breasted Wood-Wren (*Henicorhina leucophrys*), Scaly-throated Foliage Gleaner (*Anabacerthia variegaticeps*), Slate-colored Solitaire (*Myadestes unicolor*), Slate-throated Redstart (*Myioborus miniatus*).

While identifying conservation strategies that support both people and wildlife is deemed important, it is uncommon for research programs to integrate research questions related to both outcomes within the same study. For example, ornithologists have been studying Neotropical shade coffee systems for decades, documenting the benefits a diverse canopy structure brings to biodiversity

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(Greenberg et al. 1997, Perfecto et al. 2004), yet the stewards of the shade coffee—the coffee farmers themselves—are not often included in the research to understand how diverse agroecosystems may benefit human livelihoods. The assumed benefits to humans in polyculture systems is that a greater crop diversity via overstory fruit, nut, and fiber trees may help to diversify farmer incomes or diets, but only recently has a scientific link been made between greater crop diversity and greater dietary diversity, an indicator of nutrition (Swindale and Bilinsky 2006, Powell et al. 2015). The economic benefits to smallholder farmers in shade coffee systems vs. the alternative (i.e. shadeless monocultures) is a continual debate among economists and conservationists (Lyngbaek et al. 2001; Kremen 2015). As such, including human and wildlife research objectives within the same study system, such as Neotropical agroecosystems, is needed to better develop and promote mutually beneficial strategies that could otherwise be missed.

From 2013 to 2016, a collaborative research project between a Guatemalan nonprofit named Community Cloud Forest Conservation (CCFC), three Q'eqchi' Mayan villages, and the Cornell Lab of Ornithology sought to understand the specific ways in which diverse agroecosystems can benefit both human and bird communities in the same system in the highlands of Guatemala, a biocultural hotspot (Gifford 2016). To understand the overlapping synergies in agroecosystems for conservation and communities, the researchers used a community-based development model and a mixed-methods approach that combined farmer interviews, avian point counts, vegetation surveys, and participatory workshops including over 15 stakeholder groups.

The ecological research explored the relative conservation value of Q'eqchi' Mayan agroecosystems in 3 villages to support resident and migratory birds at local and landscape scales. The researchers examined avian occupancy to identify key attributes that promoted habitat use by 6 Neotropical migrant, 4 endemic, and 5 forest resident bird species across 3 agricultural habitats (monocultures of corn/beans, broccoli, or other horticulture; non-coffee polycultures; and shade coffee) and 3 forest habitats (pine plantations, secondary forest, and primary cloud forest). (For more explanation of methods, see Gifford 2016.) Overall, the research collaborators found that structural diversity within the 6 habitats, as well as forest cover within the landscape, were the most important attributes that predicted habitat use by focal bird species. More specific microhabitat and landscape recommendations to support Neotropical bird conservation within agroecosystems included maintaining >20% canopy cover in farms and >60% in forest habitats with 150–550 trees ha^{-1}; protection of epiphytes; and landscapes that were managed for 25–40% forest within the matrix (Gifford 2016).

The social science research was carried out in the same 3 villages and focused on the extent to which crop diversity within cloud forest agroecosystems affected farmers' household dietary diversity (following Hatløy et al. 2000) as well as their income diversity. The research specifically explored the relative value of these agroecosystems to farmers in terms of income and nutrition. Through 42 interviews with Q'eqchi' households located close to avian observation points in 3 villages, the researchers identified 74 common crops grown and consumed in cloud forest agroecosystems. Their results confirmed that crop diversity was (1) positively related to dietary diversity such that households with higher crop diversity consumed more types of crops and (2) crop diversity was positively related to on-farm income diversity such that households with higher crop diversity also sold more types of products in markets (Gifford 2016). In addition to supporting biodiversity, the researchers concluded that diverse agroecosystems can be an effective strategy to address poverty and malnutrition within rural Guatemalan communities because a wider range of on-farm and income-generating practices can buffer against market shocks and unexpected famines (as in Hausermann and Eakin 2008) as well as diversify diets, a key target in reducing malnutrition (Gifford 2016).

Lessons learned. This social–ecological research illustrates that diverse agroecosystems (i.e. with structural and crop diversity) that also retain forest in the landscape are better able to support resident and migratory birds compared to less diverse systems, and they also support smallholder farmers by way of promoting more diverse diets and income streams (Gifford 2016). Simultaneously studying human and avian research objectives across a forest–agroecosystem landscape provided stronger evidence of the value of diverse agroecosystems. The partnering nonprofit, CCFC, has actively integrated this research into their programs, training female Q'eqchi' Mayan leaders in agroecology, conservation leadership, and Neotropical bird conservation across the region. To help ensure the research findings could be communicated and implemented on the ground by other local stakeholders, the 3 organizations collaborating on the research organized an all-day, tri-lingual participatory workshop where more than 15 stakeholder groups came together to discuss win–win strategies for people and the environment in the region. Participants broke out into small discussion groups to design sustainable landscapes for conservation and communities through an idea-mapping activity (Figure 1). Strategies included promoting diversified agroecosystems, improving ecological awareness, and determining the drivers of cloud forest deforestation at all scales. In conclusion, using a collaborative, mixed-methods approach with clear ecological and social objectives allowed researchers to better promote both bird conservation and sustainable

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FIGURE 1. In an idea-mapping activity in August 2014 from the research application, participatory workshop with stakeholder groups in Alta Verapaz, Guatemala, a Chamelco college student explains her biodiversity-friendly agroecosystem design with terracing, shade coffee, milpa polycultures, and fruit trees. Photo by Gemara Gifford.

livelihood recommendations in the region's forest–farmland landscapes.

CONCLUSION

The growing interest in human dimensions of bird conservation and conservation social science is due to the recognition of the impacts people have on ecosystems, as well as their critical role in the success or failure of conservation strategies. The successful conservation of Neotropical birds hinges on the incorporation of conservation social science, along with ecological research. Conservation biologists and ornithologists are now working with conservation social scientists to address conservation social science questions to solve pressing issues, which will likely improve outcomes for the conservation of Neotropical birds. Further advances will be achieved if social scientists are directly involved in these projects (see Heberlein 2012, Martin 2020). Yet, barriers to integration of the social and natural conservation sciences remain, such as perceptions that social scientists are not interested in conservation issues or biologists are not interested in social science (Fox et al. 2006, Ibarra and Pizarro 2016). To support the growth and integration of conservation social science in Neotropical bird conservation, researchers and conservation practitioners would benefit from increased conservation social science knowledge and skills, involving conservation social scientists from the beginning of interdisciplinary projects, integrating social science into conservation planning and implementation, and building conservation social science capacity in organizations and agencies (Bennett et al. 2017a). Opportunities to publish conservation social science manuscripts in ornithological journals, such as this one, allow for enhanced understanding of conservation social science and its contributions to bird conservation. While interdisciplinary research can be challenging and time-consuming, only by working together will natural and social scientists be able to effectively understand and tackle the conservation threats birds face.

ACKNOWLEDGMENTS

We thank the study participants described in the case studies in Costa Rica, Guatemala, and Chile for their time. Grethel Rojas transcribed interview material from Costa Rica, and Claude Blanc assisted with fieldwork. Amanda Rodewald, Eduardo Iñigo-Elias, Miguel Gómez, Wesley Hochachka, and Viviana Ruiz-Gutierrez contributed to the Guatemalan case study research. Rodney Siegel and Jessica Barnes reviewed a draft of this manuscript.

Funding statement: E.S. was supported by the Comisión Nacional de Investigación Científica y Tecnológica (FONDECYT Iniciación No. 11171006). M.C. and A.E. acknowledge the Social Sciences and Humanities Research Council of Canada (SSHRC) for an Insight grant (435-2013-2017) and the National Geographic Young Explorers Grant (#C335-16) for providing funding for field data collection. J.T.I. acknowledges support from the CONICYT/FONDAP/15110006, CONICYT PIA/BASAL FB0002, and the Center for the Socioeconomic Impact of Environmental Policies (CESIEP). A.M. acknowledges support from the U.S. Fish and Wildlife Service (USFWS) through the Neotropical Migratory Bird Conservation Act (NMBCA, grant F18AP00472). G.G. acknowledges the Disney Worldwide Conservation Fund, the Athena Fund, the Cornell Atkinson Center for Sustainability Biodiversity Fund, the EINAUDI International Travel grant, the Cornell University College of Agriculture and Life Sciences Alumni Association, the Kramer fund, and the Gates Millennium Scholarship for financial support and collaborating partners Community Cloud Forest Conservation and the Q'eqchi' Mayan communities of Alta Verapaz, Gutatemala, for their contributions to the research.

Ethics statement: The Costa Rican case study was conducted under the auspices of the University of British Columbia, with approval from the Behavioral Research Ethics Board, permit: H16-01171. The Chilean case study was conducted with the approval of the Ethics Board of the Pontificia Universidad Católica de Chile (2016: 160415004 and 2018: 1524864138465) and the Behavioural Research Ethics Board of the University of British Columbia (2012). Researchers also obtained approval from local authorities and each participant of the community in 2012, 2016, and 2018. The Guatemalan case study was conducted under Cornell University Institutional Review Board ID: 1405004717.

Author contributions: A.A.D. and S.A. conceived of, recruited, and coordinated the collaborative group to craft this manuscript. A.A.D., E.S., and S.A. led the writing and editing of this manuscript. A.A.D., E.S., S.A., M.C., B.Z.,

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and A.M. wrote sections of the paper. M.S. and A.E. wrote the Costa Rican case study based on their original research. J.T.I. wrote the Chilean case study based on his original research. G.G. wrote the Guatemalan case study based on her original research. C.S.L. wrote the swan introduction based on her past research.

LITERATURE CITED

Altieri, M. A. (2009). Agroecology, small farms, and food sovereignty. Monthly Review 61:102–113.

Alves, R. R. N., and R. R. D. Barboza (2017). Animals as ethnozooindicators of weather and climate. In Ethnozoology: Animals in our Lives (R. R. N. Alves and U. P. Albuquerque, Editors). Academic Press, Cambridge, MA, USA. pp. 383–420.

Alves, R. R. N., R. C. L. Leite, W. M. S. Souto, D. M. Bezerra, and A. Loures-Ribeiro (2013). Ethno-ornithology and conservation of wild birds in the semi-arid Caatinga of northeastern Brazil. Journal of Ethnobiology and Ethnomedicine 9:14.

Bakermans, M. H., A. D. Rodewald, A. C. Vitz, and C. Rengifo (2012). Migratory bird use of shade coffee: The role of structural and floristic features. Agroforestry Systems 85:85–94.

Balvanera, P., M. Uriarte, L. Almeida-Leñero, A. Altesor, F. DeClerck, T. Gardner, J. Hall, A. Lara, P. Laterra, M. Peña-Claros, et al. (2012). Ecosystem services research in Latin America: The state of the art. Ecosystem Services 2:56–70.

Barnhardt, R., and A. O. Kawagley (2005). Indigenous knowledge systems and Alaska native ways of knowing. Anthropology and Education Quarterly 36:8–23.

Barreau, A., J. T. Ibarra, F. S. Wyndham, A. Rojas, and R. A. Kozak (2016). How can we teach our children if we cannot access the forest? Generational change in Mapuche knowledge of wild edible plants in Andean temperate ecosystems of Chile. Journal of Ethnobiology 36:412–432.

Begazo, A. J., and R. E. Bodmer (1998). Use and conservation of Cracidae (Aves: Galliformes) in the Peruvian Amazon. Oryx 32:301–309.

Bennett, N. J., R. Roth, S. C. Klain, K. M. A. Chan, D. A. Clark, G. Cullman, G. Epstein, M. P. Nelson, R. Stedman, T. L. Teel, et al. (2017a). Mainstreaming the social sciences in conservation. Conservation Biology 31:56–66.

Bennett, N. J., R. Roth, S. C. Klain, K. Chan, P. Christie, D. A. Clark, G. Cullman, D. Curran, T. J. Durbin, G. Epstein, et al. (2017b). Conservation social science: Understanding and integrating human dimensions to improve conservation. Biological Conservation 205:93–108.

Berkes, F., J. Colding, and C. Folke (2000). Rediscovery of traditional ecological knowledge as adaptive management. Ecological Applications 10:1251–1262.

Berkunsky, I., P. Quillfeldt, D. J. Brightsmith, M. C. Abbud, M. R. E. Aguilar, U. Alemán-Zelaya, R. M. Aramburú, A. Arce Arias, R. Balas McNab, T. J. S. Balsby, et al. (2017). Current threats faced by Neotropical parrot populations. Biological Conservation 214:278–287.

Berlanga, H., J. A. Kennedy, T. D. Rich, M. C. Arizmendi, C. J. Beardmore, P. J. Blancher, G. S. Butcher, A. R. Couturier, A. A. Dayer, D. W. Demarest, et al. (2010). Saving Our Shared Birds: Partners in Flight Tri-National Vision for Landbird Conservation. Cornell Lab of Ornithology, Ithaca, NY, USA.

Bernardo, C. S. S., H. Lloyd, F. Olmos, L. F. Cancian, and M. Galetti (2011). Using post-release monitoring data to optimize avian reintroduction programs: A 2-year case study from the Brazilian Atlantic Rainforest. Animal Conservation 14:676–686.

BirdLife International (2016). Cyanopsitta spixii. The IUCN Red List of Threatened Species. doi:10.2305/IUCN.UK.2016-3.RLTS.T22685533A93078343.en

Bodrati, A., K. Cockle, J. I. Areta, G. Capuzzi, and R. Fariña (2006). El Maracaná Lomo Rojo (*Primolius maracana*) en Argentina:¿de plaga a la extinción en 50 años? El Hornero 21:37–43.

Bowles, S. (2008). Policies designed for self-interested citizens may undermine "the moral sentiments": Evidence from economic experiments. Science 320:1605–1609.

Bruggers, R. L., E. Rodriguez, and M. E. Zaccagnini (1998). Planning for bird pest problem resolution: A case study. International Biodeterioration & Biodegradation 42:173–184.

Burton, R. J. F., and U. H. Paragahawewa (2011). Creating culturally sustainable agri-environmental schemes. Journal of Rural Studies 27:95–104.

Canavelli, S. B., L. C. Branch, P. Cavallero, C. González, and M. E. Zaccagnini (2014). Multi-level analysis of bird abundance and damage to crop fields. Agriculture, Ecosystems & Environment 197:128–136.

Canavelli, S. B., M. E. Swisher, and L. C. Branch (2013). Factors related to farmers' preferences to decrease Monk Parakeet damage to crops. Human Dimensions of Wildlife 18:124–137.

Carter, N. H., A. Viña, V. Hull, W. J. McConnell, W. Axinn, D. Ghimire, and J. Liu (2014). Coupled human and natural systems approach to wildlife research and conservation. Ecology and Society 19:43.

CEHUM (2018). Analizaron recuperación del Humedal del río Cruces. Centro de Humedales Río Cruces (CEHUM). http://www.cehum.org/analizaron-recuperacion-del-humedal-del-rio-cruces/

Cerda, C., E. A. Silva-Rodríguez, and C. Briceño, (Editors) (2019). Naturaleza en Sociedad: Una Mirada a la Dimensión Humana de la Conservación de la Biodiversidad. Editorial Ocho Libros, Santiago, Chile.

Challender, D. W., and D. C. MacMillan (2014). Poaching is more than an enforcement problem. Conservation Letters 7:484–494.

Chan, K. M. A., E. Anderson, M. Chapman, K. Jespersen, and P. Olmsted (2017). Payments for ecosystem services: Rife with problems and potential—for transformation towards sustainability. Ecological Economics 140:110–122.

Chapman, M. (2017). Agri-'culture' and biodiversity: Rethinking payments for ecosystem services in light of relational values. Ph.D. dissertation, The University of British Columbia, Vancouver, BC, Canada.

Chapman, M., T. Satterfield, and K. M. A. Chan (2019). When value conflicts are barriers: Can relational values help explain farmer participation in conservation incentive programs? Land Use Policy 82:464–475.

Chapman, M., T. Satterfield, H. Wittman, and K. M. A. Chan (2020). A payment by any other name: Is Costa Rica's PES a payment for services or a support for stewards? World Development 129:104900.

Chaves, W. A., D. R. Valle, M. C. Monroe, D. S. Wilkie, K. E. Sieving, and B. Sadowsky (2017). Changing wild meat consumption: An experiment in the Central Amazon, Brazil. Conservation Letters 11:1–10.

Collar, N. J., and A. T. Juniper (1992). Dimensions and causes of the parrot crisis. In New World Parrots in Crisis: Solutions from

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Conservation Biology (S. R. Beissinger and N. F. R. Snyder, Editors). Smithsonian Institution Press, Washington, DC, USA. pp. 1–24.
Crowley, S. L., S. Hinchliffe, and R. A. McDonald (2017a). Conflict in invasive species management. Frontiers in Ecology and the Environment 15:133–141.
Crowley, S. L., S. Hinchliffe, and R. A. McDonald (2017b). Invasive species management will benefit from social impact assessment. Journal of Applied Ecology 54:351–357.
Crowley, S. L., S. Hinchliffe, and R. A. McDonald (2019). The parakeet protectors: Understanding opposition to introduced species management. Journal of Environmental Management 229:120–132.
Daut, E. F., D. J. Brightsmith, A. P. Mendoza, L. Puhakka, and M. J. Peterson (2015). Illegal domestic bird trade and the role of export quotas in Peru. Journal for Nature Conservation 27:44–53.
Dayer, A. A., S. H. Lutter, K. Sesser, C. Hickey, and T. Gardali (2018). Private landowner conservation behavior following participation in voluntary incentive programs: Recommendations to facilitate behavioral persistence. Conservation Letters 11:1–11.
Dayer, A. A., A. Williams, E. A. Cosbar, and M. Racey (2019). Blaming threatened species: Media portrayal of human–wildlife conflict. Oryx 53:265–272.
De Beenhouwer, M., R. Aerts, and O. Honnay (2013). A global meta-analysis of the biodiversity and ecosystem service benefits of coffee and cacao agroforestry. Agriculture, Ecosystems & Environment 175:1–7.
Decker, D. J., S. J. Riley, and W. F. Siemer (2012). Stakeholder engagements in wildlife management. In Human Dimensions of Wildlife Management (D. J. Decker, S. J. Riley, and W. F. Siemer, Editors). Johns Hopkins University Press, Baltimore, MD, USA. pp. 139–156.
De Grazio, J. W., and J. F. Besser (1970). Bird damage problems in Latin America. In Proceedings of the 4th Vertebrate Pest Conference, West Sacramento, California, March 3–5 (R. H. Dana, Editor). California Vertebrate Pest Committee. pp. 162–167.
Dinat, D., A. Echeverri, M. Chapman, D. S. Karp, and T. Satterfield (2019). Eco-xenophobia among rural populations: The Great-tailed Grackle as a contested species in Guanacaste, Costa Rica. Human Dimensions of Wildlife 24:332–348.
Doherty, T. S., A. S. Glen, D. G. Nimmo, E. G. Ritchie, and C. R. Dickman (2016). Invasive predators and global biodiversity loss. Proceedings of the National Academy of Sciences USA 113:11261–11265.
Estévez, R. A., C. B. Anderson, J. C. Pizarro, and M. A. Burgman (2015). Clarifying values, risk perceptions, and attitudes to resolve or avoid social conflicts in invasive species management. Conservation Biology 29:19–30.
Fleury, P., C. Seres, L. Dobremez, B. Nettier, and Y. Pauthenet (2015). "Flowering Meadows," a result-oriented agri-environmental measure: Technical and value changes in favour of biodiversity. Land Use Policy 46:103–114.
FONAFIFO [Fondo Nacional de Financiamiento Forestal Costa Rica] (2014). Pago de Servicios Ambientales. http://www.fonafifo.go.cr/psa/
Fox, H. E., C. Christian, J. C. Nordby, O. R. W. Pergams, G. D. Peterson, and C. R. Pyke (2006). Perceived barriers to integrating social science and conservation. Conservation Biology 20:1817–1820.
Garrigues, R., and R. Dean (2014). The Birds of Costa Rica: A Field Guide. Cornell University Press, Ithaca, NY, USA.
Gifford, G. (2016). Agroecosystems for communities and conservation: Linking bird conservation and sustainable livelihoods in the highlands of Guatemala. Master's thesis, Cornell University, Ithaca, NY, USA. https://ecommons.cornell.edu/handle/1813/43614
Gobbi, J. A. (2000). Is biodiversity-friendly coffee financially viable? An analysis of five different coffee production systems in western El Salvador. Ecological Economics 33:267–281.
Gorenflo, L. J., and K. Brandon (2006). Key human dimensions of gaps in global biodiversity conservation. BioScience 569:723–731.
Greenberg, R., P. Bichier, A. C. Angon, and R. Reitsma (1997). Bird populations in shade and sun coffee plantations in central Guatemala. Conservation Biology 11:448–459.
Hahn, I., and U. Römer (2002). Threatened avifauna of the Juan Fernández Archipelago, Chile: The impact of introduced mammals and conservation priorities. Cotinga 17:56–62.
Hanna, G. D. (1925). Expedition to Guadalupe Island, México in 1922: General report. Proceedings of the California Academy of Sciences (Fourth Series) 14:217–275.
Harvey, C. A., A. Villanueva, J. Villacís, M. Chacón, D. Muñoz, M. López, M. Ibrahim, R. Gómez, R. Taylor, J. Martínez, et al. (2005). Contribution of live fences to the ecological integrity of agricultural landscapes in Central America. Agriculture, Ecosystems and Environment 111:200–230.
Hatløy, A., J. Hallund, M. M. Diarra, and A. Oshaug (2000). Food variety, socioeconomic status and nutritional status in urban and rural areas in Koutiala (Mali). Public Health and Nutrition 3:57–65.
Hausermann, H., and H. Eakin (2008). Producing "viable" landscapes and livelihoods in central Veracruz, Mexico: Institutional and producer responses to the coffee commodity crisis. Journal of Latin American Geography 7:109–131.
Heberlein, T. A. (2012). Navigating environmental attitudes. Conservation Biology 26:583–585.
Ibarra, J. T., and A. Barreau (2014). Calling the rain, descending from mountains: Birds in the Mapuche traditional weather forecasting in Andean temperate forests. 11th Chilean Ornithological Conference, Coquimbo, Chile.
Ibarra, J. T., and K. Martin (2015). Biotic homogenization: Loss of avian functional richness and habitat specialists in disturbed Andean temperate forests. Biological Conservation 192:418–427.
Ibarra, J. T., and J. C. Pizarro (2016). Haciaunaetno ornitolog interdisciplinaria, intercultural e intergeneracional para la conservación biocultural. Revista Chilena de Ornitología 22:1–6.
Ibarra, J. T., A. Barreau, C. del Campo, C. Camacho, G. J. Martin, and S. McCandless (2011). When formal and market-based conservation mechanisms disrupt food sovereignty: Impacts of community conservation and payments for environmental services on an indigenous community of Oaxaca, Mexico. International Forestry Review 13:318–337.
Ibarra, J. T., A. Barreau, N. Pessa, and J. Caviedes (2018). Listening to elders: Birds and forests as intergenerational links for nurturing social-ecological memory in the southern Andes. 16th International Congress of Ethnobiology, Belem, Brazil.
Ibarra, J. T., M. Martin, K. L. Cockle, and K. Martin (2017). Maintaining ecosystem resilience: Functional responses of tree

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cavity nesters to logging in temperate forests of the Americas. Scientific Reports 7:4467.
Iñigo-Elias, E. E., and M. A. Ramos (1991). The Psittacine trade in Mexico. In Neotropical Wildlife Use and Conservation (J. G. Robinson and K. H. Redford, Editors). The University of Chicago Press, Chicago, IL, USA. pp. 380–392.
IUCN [International Union for the Conservation of Nature] (2020). The IUCN Red List of threatened species. https://www.iucnredlist.org
Jacques-Coper, A., G. Cubillos, and J. T. Ibarra (2019). The Andean Condor as bird, authority, and devil: An empirical assessment of the biocultural keystone species concept in the high Andes of Chile. Ecology and Society 24:35.
Jaramillo, E., N. A. Lagos, F. A. Labra, E. Paredes, E. Acuña, D. Melnick, M. Manzano, C. Velásquez, and C. Duarte (2018). Recovery of Black-necked Swans, macrophytes and water quality in a Ramsar wetland of southern Chile: Assessing resilience following sudden anthropogenic disturbances. Science of the Total Environment 628:291–301.
Jaramillo E., R. Schlatter, H. Contreras, C. Duarte, N. Lagos, E. Paredes, J. Ulloa, G. Valenzuela, B. Peruzzo, and R. Silva (2007). Emigration and mortality of Black-necked Swans (*Cygnus melancoryphus*) and disappearance of the macrophyte *Egeria densa* in a Ramsar wetland site of southern Chile. Ambio 36:607–609.
Jha, S., C. M. Bacon, S. M. Philpott, V. E. Mendez, P. Laderach, and R. A. Rice (2014). Shade coffee: Update on a disappearing refuge for biodiversity. BioScience 64:416–428.
Kosoy, N., M. Martinez-Tuna, R. Muradian, and J. Martinez-Alier (2007). Payments for environmental services in watersheds: Insights from a comparative study of three cases in Central America. Ecological Economics 61:446–455.
Kremen, C. (2015). Reframing the land-sparing/land-sharing debate for biodiversity conservation. Annals of the New York Academy of Sciences 1355:52–76.
Leberatto, A. C. (2016a). Understanding the illegal trade of live wildlife species in Peru. Trends in Organized Crime 19:42–66.
Leberatto, A. C. (2016b). A typology of market sellers of protected wildlife across Peru. Deviant Behavior 38:1352–1370.
Linz, G. M., E. H. Bucher, S. B. Canavelli, E. Rodriguez, and M. L. Avery (2015). Limitations of population suppression for protecting crops from bird depredation: A review. Crop Protection 76:46–52.
Loss, S. R., T. Will, and P. P. Marra (2013). The impact of free-ranging domestic cats on wildlife of the United States. Nature Communications 4:1396.
Loyd, K. A. T. and C. A. Miller (2010). Influence of demographics, experience and value orientations on preferences for lethal management of feral cats. Human Dimensions of Wildlife 15:262–273.
Luz, A. C., J. Paneque-Gálvez, M. Guèze, J. Pino, M. J. Macía, M. Orta-Martínez, and V. Reyes-García (2015). How does cultural change affect indigenous peoples' hunting activity? An empirical study among the Tsimane' in the Bolivian Amazon. Conservation and Society 13:382.
Lyngbæk, A. E., R. G. Muschler, and F. L. Sinclair (2001). Productivity and profitability of multistrata organic versus conventional coffee farms in Costa Rica. Agroforestry Systems 53:205–213.
Manfredo, M. J. (2008). Who Cares About Wildlife? Social Science Concepts for Exploring Human–Wildlife Relationships and Conservation Issues. Springer, New York, NY, USA.
Manfredo, M. J., and A. A. Dayer (2004). Concepts for exploring the social aspects of human–wildlife conflict in a global context. Human Dimensions of Wildlife 9:1–20.
Martin, V. Y. (2020). Four common problems in environmental social research undertaken by natural scientists. BioScience 70:13–16.
Mas, A. H., and T. V. Dietsch (2004). Linking shade coffee certification to biodiversity conservation: Butterflies and birds in Chiapas, Mexico. Ecological Applications 14:642–654.
Mascia, M. B., J. P. Brosius, T. A. Dobson, B. C. Forbes, L. Horowitz, M. A. McKean, and N. J. Turner (2003). Conservation and the social sciences. Conservation Biology 17:649–650.
Medina, F. M., E. Bonnaud, E. Vidal, B. R. Tershy, E. S. Zavaleta, C. J. Donlan, B. S. Keitt, M. Le Corre, S. V. Horwath, and M. Nogales (2011). A global review of the impacts of invasive cats on island endangered vertebrates. Global Change Biology 17:3503–3510.
Mendenhall, C. D., D. S. Karp, C. F. J. Meyer, E. A. Hadly, and G. C. Daily (2014). Predicting biodiversity change and averting collapse in agricultural landscapes. Nature 509:213–217.
Montecino-Latorre, D., and W. San Martín (2019). Evidence supporting that human-subsidized free-ranging dogs are the main cause of animal losses in small-scale farms in Chile. Ambio 48:240–250.
Morsello, C., B. Yagüe, L. Beltreschi, N. van Vliet, C. Adams, T. Schor, M. P. Quiceno-Mesa, and D. Cruz (2015). Cultural attitudes are stronger predictors of bushmeat consumption and preference than economic factors among urban Amazonians from Brazil and Colombia. Ecology and Society 20:21.
Morzillo, A. T., K. M. De Beurs, and C. J. Martin-Mikle (2014). A conceptual framework to evaluate human–wildlife interactions within coupled human and natural systems. Ecology and Society 19:44.
Muradian, R., M. Arsel, L. Pellegrini, F. Adaman, B. Aguilar, B. Agarwal, E. Corbera, D. Ezzine de Blas, J. Farley, G. Froger, et al. (2013). Payments for ecosystem services and the fatal attraction of win–win solutions. Conservation Letters 6:274–279.
Novoa, A., R. Shackleton, S. Canavan, C. Cybele, S. J. Davies, K. Dehnen-Schmutz, J. Fried, M. Gaertner, S. Geerts, C. L. Griffiths, et al. (2018). A framework for engaging stakeholders on the management of alien species. Journal of Environmental Management 205:286–297.
Nyhus, P. J. (2016). Human–wildlife conflict and coexistence. Annual Review of Environment and Resources 41:143–171.
O'Connell, M., and R. White (2017). Academics can also be culprits of evidence complacency. Nature Ecology & Evolution 1:1589.
Olmsted, P. (2017). For love or money: Harnessing environmental values and financial incentives to promote conservation stewardship. Ph.D. dissertation, The University of British Columbia, Vancouver, BC, Canada.
Orlove, B. S. (1985). The history of the Andes: A brief overview. Mountain Research and Development 5:45–60.
Peres, C. A. (2000). Effects of subsistence hunting on vertebrate community structure in Amazonian forests. Conservation Biology 14:240–253.
Perfecto, I., and J. Vandermeer (2010). The agroecological matrix as alternative to the land-sparing/agriculture intensification model. Proceedings of the National Academy of Sciences USA 107:5786–5791.
Perfecto, I., J. H. Vandermeer, G. L. Bautista, G. I. Nuñez, R. Greenberg, P. Bichier, and S. Langridge (2004). Greater predation in shaded

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coffee farms: The role of resident Neotropical birds. Ecology 85:2677–2681.
Philpott, S. M., W. J. Arendt, I. Armbrecht, P. Bichier, T. V. Diestch, C. Gordon, R. S. Greenberg, I. Perfecto, R. Reynoso-Santos, L. Soto-Pinto, et al. (2008). Biodiversity loss in Latin American coffee landscapes: Review of the evidence on ants, birds, and trees. Conservation Biology 22:1093–1105.
Porras, I., D. N. Barton, and M. Miranda (2013). Learning from 20 years of payments for ecosystem services in Costa Rica. International Institute for Environment and Development, London, UK.
Powell, B., S. H. Thilsted, A. Ickowitz, C. Termote, T. Sunderland, and A. Herforth (2015). Improving diets with wild and cultivated biodiversity from across the landscape. Food Security 7:535–554.
Primer Juzgado Civil de Valdivia (2013). Estado - Fisco de Chile con Forestal Celco S.A. Causa por daño ambiental e indemnización de perjuicios. Revista de Derecho - Consejo de Defensa del Estado 30:159–339.
Redpath, S. M., S. Bhatia, and J. Young (2015). Tilting at wildlife: Reconsidering human–wildlife conflict. Oryx 49:222–225.
Rode, J., E. Gómez-Baggethun, and K. Torsten (2015). Motivation crowding by economic incentives in conservation policy: A review of the empirical evidence. Ecological Economics 117:270–282.
Rodriguez, E. N., G. Tiscornia, and M. E. Tobin (2004). Bird depredations in Uruguayan vineyards. In Proceedings of the 21st Vertebrate Pest Conference (R. M. Timm and W. P. Gorenzel, Editors). University of California Press, Berkeley, CA, USA. pp. 136–139.
Rosa, H., S. Kandel, and L. Dimas (2004). Compensation for environmental services and rural communities: Lessons from the Americas. International Forestry Review 6:187–194.
Ruiz-Izaguirre, E., and C. H. A. M. Eilers (2012). Perceptions of village dogs by villagers and tourists in the coastal region of rural Oaxaca, Mexico. Anthrozoös 25:75–91.
Salafsky, N., D. Salzer, A. J. Stattersfield, C. Hilton-Taylor, R. Neugarten, S. H. Butchart, B. Collen, N. Cox, L. L. Master, S. O'Connor, and D. Wilkie (2008). A standard lexicon for biodiversity conservation: Unified classifications of threats and actions. Conservation Biology 22:897–911.
Sánchez-Mercado, A., M. Asmüssen, K. M. Rodríguez-Clark, J. P. Rodríguez, and W. Jedrzejewski (2016). Using spatial patterns in illegal wildlife uses to reveal connections between subsistence hunting and trade. Conservation Biology 30:1222–1232.
Sánchez, R., S. A. Ballari, E. H. Bucher, and J. F. Masello (2016). Foraging by burrowing parrots has little impact on agricultural crops in northeastern Patagonia, Argentina. International Journal of Pest Management 62:326–335.
Schultz, P. W. (2011). Conservation means behavior. Conservation Biology 25:1080–1083.
Schüttler, E., R. Rozzi, and K. Jax (2011). Towards a societal discourse on invasive species management: A case study of public perceptions of mink and beavers in Cape Horn. Journal for Nature Conservation 19:175–184.
Schüttler, E., L. Saavedra-Aracena, and J. E. Jiménez (2018). Domestic carnivore interactions with wildlife in the Cape Horn Biosphere Reserve, Chile: Husbandry and perceptions of impact from a community perspective. PeerJ 6:e4124.
Şekercioğlu, C. H., G. C. Daily, and P. R. Ehrlich (2004). Ecosystem consequences of bird declines. Proceedings of the National Academy of Sciences USA 101:18042–18047.
Sepúlveda, C. (2016). Swans, ecological struggles and ontological fractures: A posthumanist account of the Río Cruces Disaster in Valdivia, Chile. Ph.D. dissertation, The University of British Columbia, Vancouver, BC, Canada.
Sepúlveda, C., and P. Villarroel (2012). Swans, conflicts, and resonance: Local movements and the reform of Chilean environmental institutions. Latin American Perspectives 39:181–200.
Sepúlveda-Luque, C., M. Lara-Sutulov, S. Pérez, S., F. Guerra, C. Rodríguez, and A. Pino (2018). De la invisibilidad a la multiplicidad: Movilizaciones, ontologías e imaginarios urbanos en torno a la defensa de los humedales de Valdivia. Revista Austral de Ciencias Sociales 35:5–28.
Shackleton, R. T., D. M. Richardson, C. M. Shackleton, B. Bennett, S. L. Crowley, K. Dehnen-Schmutz, R. A. Estévez, A. Fischer, C. Kueffer, C. A. Kull et al. (2019). Explaining people's perceptions of invasive alien species: A conceptual framework. Journal of Environmental Management 229:10–26.
Silva Regueira, R. F., and E. Bernard (2012). Wildlife sinks: Quantifying the impact of illegal bird trade in street markets in Brazil. Biological Conservation 149:16–22.
Silva-Rodríguez, E. A., and K. E. Sieving (2011). Influence of care of domestic carnivores on their predation on vertebrates. Conservation Biology 25:808–815.
Silva-Rodríguez, E. A., G. Acosta-Jamett, F. Villatoro, P. Stowhas, O. Ohrens and L. Naughton-Treves (2019). Conflictos en el manejo de la fauna silvestre en Chile: daños causados por animales silvestres, conductas hacia la fauna y conflictos humano-humano. In Naturaleza En Sociedad: Una Mirada A La Dimensión Humana De La Conservación De La Biodiversidad (C. Cerda, E. A. Silva-Rodríguez, and C. Briceño, Editors). Editorial Ocho Libros, Santiago, Chile. pp. 241–277.
Simeone, A., and M. Bernal (2000). Effects of habitat modification on breeding seabirds: A case study in central Chile. Waterbirds 23:449–456.
Steiner São Bernardo, C., A. J. J. Desbiez, F. Olmos, and N. J. Collar (2011). Reintroducing the Red-billed Curassow in Brazil: Population viability analysis points to potential success. Natureza & Conservação 12:53–58.
Stotz, D. E., J. W. Fitzpatrick, T. A. Parker III, and D. K. Moskovits (1996). Neotropical Birds: Ecology and Conservation. The University of Chicago Press, Chicago, IL, USA.
Sutherland, W. J., and C. F. Wordley (2017). Evidence complacency hampers conservation. Nature Ecology & Evolution 1:1215.
Swindale, A., and P. Bilinsky (2006). Household dietary diversity score (HDDS) for measurement of household food access: Indicator guide. USAID, Food and Nutrition Technical Assistance III Project (FANTA), Washington, DC, USA. https://www.fantaproject.org/monitoring-and-evaluation/household-dietary-diversity-score
Tingley, M. W., J. B. C. Harris, F. Hua, D. S. Wilcove, and D. L. Yong (2017). The pet trade's role in defaunation. Science 356:916.
Tironi, M., B. Undurraga, P. Di Giminiani, D. Rossello, C. Schaeffer, and C. Sepúlveda (2017). Borders, affects and effects: Doing animal studies in Chile. Society and Animals 25:533–552.
Trivedi, M. R., F. H. Cornejo, and A. R. Watkinson (2004). Seed predation on Brazil nuts (*Bertholletia excelsa*) by macaws (Psittacidae) in Madre de Dios, Peru. Biotropica 36:118–122.
United Nations (2015). The 2015 Revision of World Population Prospectus. https://esa.un.org/unpd/wpp/
Villatoro, F. J., L. Naughton-Treves, M. A. Sepúlveda, P. Stowhas, F. O. Mardones, and E. A. Silva-Rodríguez (2019). When free-ranging dogs threaten wildlife: Public attitudes

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toward management strategies in southern Chile. Journal of Environmental Management 229:67–75.
Wald, D. M., S. K. Jacobson, and J. K. Levy (2013). Outdoor cats: Identifying differences between stakeholder beliefs, perceived impacts, risk and management. Biological Conservation 167:414–424.
Wald, D. M., K. A. Nelson, A. M. Gawel, and H. S. Rogers (2019). The role of trust in public attitudes toward invasive species management on Guam: A case study. Journal of Environmental Management 229:133–144.
Wiedenfeld, D. A., and G. Jiménez-Uzcátegui (2008). Critical problems for bird conservation in the Galápagos Islands. Cotinga 29:22–27.
Williams, K. J., M. A. Weston, S. Henry, and G. S. Maguire (2009). Birds and beaches, dogs and leashes: Dog owners' sense of obligation to leash dogs on beaches in Victoria, Australia. Human Dimensions of Wildlife 14:89–101.
Wunder, S. (2007). The efficiency of payments for environmental services in tropical conservation. Conservation Biology 21:48–58.
Wunder, S., and M. T. Vargas (2005). Beyond "markets": Why terminology matters. Editorial, The Ecosystem Marketplace, Katoomba Group 22 March 2005. https://vtechworks.lib.vt.edu/handle/10919/66872
Zbinden, S., and D. R. Lee (2005). Paying for environmental services: An analysis of participation in Costa Rica's PSA program. World Development 33:255–272.

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