"WE HUNT TO ESCAPE A PROBLEM, NOT TO DESTROY"

CULTURAL MEANINGS, SHARED KNOWLEDGE, AND CONSERVATION IMPLICATIONS OF *CAMPESINO* HUNTING IN NICARAGUA

A Dissertation

by

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Submitted to the Office of Graduate and Professional Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

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May 2020

Major Subject: Recreation, Park, and Tourism Sciences

ABSTRACT

Hunting is a vital source of income, protein, cultural traditions, knowledge, and identity for many local communities. Conservationists and policy makers must balance the competing needs of wildlife and vulnerable hunting cultures to achieve effective conservation. In Latin America, hunters mostly identify as either indigenous or *campesino*. Although both groups are marginalized and disenfranchised, indigenous hunters are often perceived as "ecologically noble savages" whose hunting cultures, traditions, and knowledge represent an innate conservation ethic. Campesinos, in contrast, are considered mere "peasants" who lack the hunting cultures, traditions, knowledge, and environmental ethics required for sustainable hunting. These perceptions have restricted conservation research and practice with campesino hunters and their cultures – the largest group of hunters in Latin America. The research is based on a literature review and 11-months of ethnographic field work in the campesino community of El Pizotero, Nicaragua to address the following questions: 1) What is the state of knowledge about campesino hunting? 2) How do perceptions and practices of hunting connect to campesino identity and culture? And 3) how does local and traditional ecological knowledge (LTK) from hunting contribute to campesino hunting culture? The review of 80 years (1937-2018) of hunting papers with campesinos revealed that it is a growing area of bilingual and interdisciplinary scholarship. Yet, this body of literature is geographically and contextually disjointed, and does not represent a cohesive area of study. In particular, scholars appear to study campesinos to understand their hunting rather than hunting to understand campesinos. Ethnographic analysis revealed that campesino culture and hunting were inseparable. Hunting emerged from survival as a worldview imbedded in a campesino identity framed around agricultural subsistence to escape the harsh realities of the *campo*, including shared experiences with poverty. Indigeneity was not a significant element of identity or hunting for most campesinos. However, campesino hunting LTK was a significant source of shared cultural knowledge for hunters and non-hunters. It was expressed and transmitted through hunting stories, beliefs, knowledge about hunted mammals, relationships with hunting dogs, and meat preparation and sharing practices. These findings have implications for conservation efforts with marginalized campesinos and their 'invisible' hunting cultures.

DEDICATION

I dedicate my dissertation to my Nicaraguan family and friends, particularly D. Miguel and Da. Elisa, José Francisco “Chico” *y família* (Carmen, Brian, and “Pando”), D. Sabino, D. Louis, D. Santo, D. Castillo, D. Carbayo, Katia, and Amilcar. My special dedication goes to two groups of people without whom this dissertation would not have been possible: the hunters who believed in me, confided in me, and trusted me with their “secrets of the hunt”; and second, to D. Juan “Pelón” and D. Miguel Meléndez, who were lost to this world and did not see the results of our work together. *Muchísimas gracias por tu apoyo, fe, y confiar en mi. Estaré siempre en deuda contigo.*

ACKNOWLEDGEMENTS

Dissertations are marathons. As with any marathon, those who support us along the way make it possible. I am indebted to several key people in my life, without whom I would have fallen before the finish line. First, my parents, John and Theresa, were guiding lights over the years. They kept me straight and motivated, serving as lighthouses in the intellectual and emotional storm while pulsing weekly reminders of what was ultimately the most important facet of my life over the last few years: my family and friends outside of research and the dissertation. To my brother, John, and sister-in-law, Lauren, who rejuvenated me through constant encouragement and many opportunities to spend time with family, including your wedding and the newest member of our family, Julian. Thank you, Julian, for coming into our lives. I hope to one day show you this so you can be one of the four people who will read it! I would write a gazillion dissertations if I knew you were at the end of each one. To my sister, Jessica, who encouraged my pursuit of higher education from the beginning. Thanks for being a catalyst in this arduous process. Finally, to my friends who have been with me before a PhD was ever on the horizon: Dan, Caleb, Jancarlo, Lauren, and Tong. You always believed that I could reach this point, even when I lost some of that belief myself.

No acknowledgment section would be worth its salt without expressing many thanks to my friends, colleagues, and mentors at Texas A&M and in BCS in general. Although there are too many of you to thank, I’ll do my best to acknowledge as many of you as I can. Without putting too much weight on the order of their mentions, special

thanks go to DJ Katu, Devi Bhuyan, Leslie Ruyle, Nick Jacobsen, Katherine Dennis, Lauren Redmore, Erin Buchholtz, Margot Wood, Emma Gómez, Audrey Joslin, Kelsey Neam, Luke Bower, Andrew Golnar, David Saenz, Liz Marchio, Ben Ghasemi, Mike Surovik, Sean Covington, Jason Martina, Tom Lacher, Rich Woodward, Jess Gilbert, Leah Menchaca, Stacey Baldwin, and Nihad Merdzo. You, and many others that I don't have space to name, made up the core of my community of scholars and friends. I am so grateful for everything you gave me.

I'm also grateful for the array of people in the Department of Recreation, Park, and Tourism Sciences. Unfailingly supportive people like Tina Vega, Debbie Barnes, Irina Shatruk, Melyssa-Ann Stricklin, and Ann Williams created a warm and welcoming space over my many years at TAMU. Thank you for everything you do. The same can be said for a large cast of RPTSers who made this experience what it was, such as Gerard Kyle, Kelly Kyle, Michael Schuett, Scott Shafer, David Scott, and Susan Scott. I still pause when I think about how lucky I am to have done my doctoral work among such an outstanding group of people. Speaking of outstanding people, an incredible amount of thanks to my doctoral committee (including one former member who retired): Drs. Amanda Stronza, Lee Fitzgerald, Forrest Fleischman, Michael Alvard, and Jim Gramann. Thanks for the thought-provoking preliminary questions and enduring support while you were on my committee, Jim. To Mike, thanks for your thoughtful and encouraging support as I wrote this up, especially during my doctoral defense. Lastly, I owe a special thanks to Amanda, Lee, and Forrest. Forrest, your belief in my abilities and ideas were instrumental in setting the path I am on today. You're a shining example

of powerful and insightful mentorship – an example I aim to carry with me throughout my career. And lastly, I would not be writing this acknowledgement today if it hadn't been for the dynamic ABS duo: Amanda and Lee. You started the ABS program that drew me to TAMU, and saw my potential for contributing to it. You also were there at a vulnerable breaking point along this path. I cannot express how much your patient understanding, kind mentorship, and steadfast encouragement have affected my life. Although you told me that this was all my work, I'm not exaggerating when I say that, in all respects, none of this was possible without you. Thank you so, so much for everything.

Additionally, thank you to my funding sources that I mention on the next page, including the ABS program, RPTS, and the TAMU Center on Conflict and Development.

As a lifelong dog lover, I couldn't write this without properly acknowledging the canines that were always in the background. To Spike and Precious, my energetic, neurotic, and unfailingly lovable dogs that passed away, I hope you're showered with lots of love, thanks, and treats wherever you are. More canines came into my life soon after, including Owando, Remi, Laika, Maggie, and Winnie. All five were playful respites and sources of indispensable canine companionship throughout the writing process. Importantly, Remi gave me a literal gift I can carry with me after this acknowledgement section is written: Mira, who was born in the middle of this writing frenzy only to become my playtime and deskside companion for this dissertation, and for the next stage of my life. It's safe to say that you kept me sane (and at times injected a little insanity) during my writing, which is why you're getting a lifetime's supply of treats, butt-rubs, and walks as soon as I type the last letter of this leviathan document.

Lastly, I am inexpressively grateful to the Nicaraguan campesinos, NGO Paso Pacífico – specifically Sarah Otterstrom, Kim Williams-Guillén, Liza González, Julie Martinez, and José Francisco "Chico" Vanegas Cortez – as well as friends and colleagues from my time at NAU, and NGO affiliates, Carol Chambers and S. Hagell. You all cultivated and highly encouraged my expanding interest in campesino hunting and local knowledge since 2008. In the end, this entire project hinged on the openness, interest, and patience of all the community members in El Pizotero, Nicaragua. You offered your time and energy to steer me in the right direction for this project, cultivated my understanding of the importance of your identities and lifelong, daily activities to who you are as human beings, and offered your forthright advice for helping me manage the many ups and downs of living in your community. None of this would be possible without you. I could thank the entire community, but please see the dedication for references to specific individuals. *¡Abrazos, zafarrancho, y dale pues! ¡Come y comamos!*

CONTRIBUTORS AND FUNDING SOURCES

Contributors

This work was supervised by a dissertation committee consisting of Professor Amanda Stronza of the Department of Recreation, Park and Tourism Sciences, Professor Lee Fitzgerald of the Department of Wildlife, Fisheries, and Ecological Sciences, Professor Michael Alvard of the Department of Anthropology, and Professor Forrest Fleischman of the Department of Forest Resources at the University of Minnesota.

All work conducted for the dissertation was completed by the student independently. Field work and permitting were instrumentally facilitated and supported by Paso Pacífico (see the acknowledgements for references to specific individuals), the student's field assistant, "Chico", and the generous hospitality of the residents of El Pizotero, Nicaragua, throughout the course of his fieldwork.

Funding Sources

Graduate study was supported by a fellowship from the Applied Biodiversity Science Program (ABS) at Texas A&M University (TAMU), graduate teaching assistantships from the TAMU Department of Recreation, Park and Tourism Science, and a graduate student mentor fellowship for the Conservation Scholars Program under the ABS program at TAMU.

This work was also made possible in part by an award from the Student Media Grant Program under the Howard G. Buffett Foundation Chair on Conflict and Development at TAMU, preliminary travel funds provided by the ABS program, and discretionary funds received from the Robert B. Ditton Endowed Scholarship for Human Dimensions of Wildlife Research. Additional support came from a Graduate Student Research Travel Award from the TAMU Office of Graduate and Professional Studies (OGAPS). Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the ABS program, Center on Conflict and Development, and OGAPS.

NOMENCLATURE

CCA	Cultural Consensus Analysis
CCT	Cultural Consensus Theory
CKS	Cultural Keystone Species
IUCN	The International Union for Conservation of Nature
K-C-P	Kosmos, Corpus, and Praxis
LTK	Local and Traditional Ecological Knowledge
NGO	Nongovernmental Organization
PA	Protected Area

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1. INTRODUCTION

In this dissertation I present the results of research on the history, trends, practices, and knowledge that comprise campesino hunting cultures in Latin America. This research is based on an interrelated set of assumptions that connect several theories and concepts in environmental anthropology, conservation science, and peasant studies to ethnically- and culturally-fueled discourse in biodiversity conservation. These theories and concepts include campesino and indigenous identity, campesino hunting culture, local and traditional ecological knowledge (LTK), the kosmos, corpus, and praxis (K-C-P complex) of ethnoecology, cultural consensus theory (CCT) as both a theory and method (cultural consensus analysis: CCA), and sustainable hunting. In particular, I use this theoretical-conceptual nexus to describe, analyze, and understand a Nicaraguan campesino hunting culture in relation to its implications for wildlife hunting as a problem and solution for biodiversity losses and people's well-being.

1.1. Problem Statement and Literature Review

1.1.1. Hunters as "Others" in Conservation

Conservation biology is a considerably novel field in the history of science. Michael Soulé and Bruce Wilcox (1980) set the stage for this pioneering discipline just 50 years ago in their pathbreaking work, *Conservation Biology: An Evolutionary-Ecological Perspective*. Five years later, Soulé (1985) positioned conservation biology as a mission- or crisis-oriented discipline that was framed by four claims about the mechanics of biological systems (i.e., functional postulates) and the values that conservationists imparted on them (i.e., normative postulates). One of Soulé's proposed values was his assertion that biodiversity has intrinsic value. I draw attention to this claim not to engage in what is unequivocally the most philosophically and functionally contentious conservation value (Batavia and Nelson 2017), but instead to highlight that the only reference to hunters and hunting in his work are found in this section. Hunters were perceived to diverge from conservationists in that they "express the same love for nature as do professional conservationist, but for many reasons, including economic ones, *honorable people may be unable to behave according to their most cherished values, or they honestly disagree on what constitutes ethical behavior*" (emphasis added, 731). Soulé's footnote should not be taken out of context; insufficient ink was spilt on most actors and threats that are known to affect biodiversity to date. Yet, it is vital to point out that, from the discipline's genesis, hunters' choices and ethics were thought to inherently deviate from conservation biology's fundamental values.

For decades, scholars have widely agreed that hunting presents one of the greatest challenges to biodiversity conservation (Redford 1992, Fa et al. 2002, Wilkie et al. 2011, Ripple et al. 2016, 2019, Benítez-López et al. 2017, Bustamante et al. 2018, Di Minin et al. 2019). Diamond (1989) pointed towards species overkill as one of the four horsemen of the ecological apocalypse, a critical precursor to extinction. Similarly, Kent Redford (1992) seminally introduced subsistence and commercial hunters as the two primary causes of direct defaunation. His work sounded the alarm about the cascading ecological effects of hunting in tropical forests while reinforcing conservationists' focus on these regions. Yet, just as archaeologists cautioned against a blanket interpretation of the reach and impact of Martin's (1984) Pleistocene overkill hypothesis (Meltzer 2015), so too did conservation scholars, including Kent Redford, carefully begin to tease apart the multilayered causes and effects of hunting for wildlife and people in the tropics (Redford and Robinson 1987, Robinson and Redford 1991). While these researchers were neither the first to highlight the human ecology of Neotropical hunting (e.g., Gross 1975) or its management implications (e.g., Koford 1957, Ojasti 1970), they were some of the first scholars to integrate hunters' complex social, economic, ecological, and political realities into international conservation discourse and practice.

1.1.2. Hunting Research and Discourse

Yet prior to the 1990s, the direction towards this nuanced discourse was set by four broadly interrelated trends in the research and discourse on hunters in tropical forests, including much research in Latin America. First, anthropologists from the schools of indigenous human ecology and cultural ecology, much of which centered on the Amazon, studied the benefits and constraints of tropical environments on protein availability, settlement size, livelihood patterns, and cultural prey preferences such as hunting taboos (Lee and DeVore 1968, Gross 1975, Ross 1978, Bailey et al. 1989). Second, scholars catalogued the contributions of hunted wildlife to often isolated rural economies that tended to be indigenous (Lathrap 1970, Nietschmann 1971, Prescott-Allen and Prescott-Allen 1982). Third, wildlife biologists and anthropologists contextualized data on cultural prey preferences with records of harvest rates, hunting patterns, and hunting techniques (Ayres and Ayres 1979, Becker 1981, Vickers 1984, Redford and Robinson 1987, Bodmer et al. 1988). Fourth, the importance of the economic contributions and protein provisions from wildlife for local peoples – often framed as subsistence-based peoples (Nietschmann 1971) – were commonly paired with information on harvest rates and hunting techniques to craft justifications for locally-based management regimes (Leopold 1959, Pierret and Dourojeanni 1967, Ojasti 1970).

However, much of these data were filtered through ethnically-fueled discourse because they were collected from indigenous societies. The perception of indigenous cultures as "ecologically noble savages" has deep roots in western thought that have reverberated through centuries of anthropological and conservation scholarship, dating back to 1609 (Hames 2007). For example, in his review of anthropological hunter-gatherer studies, Barnard (1983) recounted that participants in the conference that precipitated Lee and DeVore's (1968) agenda-setting book on hunter-gatherer studies, *Man the Hunter*, were inclined to study these groups because "We cannot avoid the suspicion that many of us were led to live and work among hunters because of a feeling that the human condition was likely to be more clearly drawn here than among other kinds of societies" (194). In other words, scholars of hunter-gatherer societies perceived indigeneity as a natural, primitive, and "more 'human'" reflection of humanity before it was tainted by modernization (Barnard 1983:194).

The ecologically noble savage myth was also reflected in, reinforced by, and challenged within a complex history of depictions in mainstream publications, indigenous movements, and conservation biology. In the late 19th and early 20th centuries, popular publications like *National Geographic* portrayed tropical forest dwellers in general, and indigenous groups and their knowledge in particular, as primitive (Nygren 2006). These depictions were reversed after the 1970s amidst popular environmental movements (e.g., the first Earth Day in 1970), which portrayed indigenous and "traditional" peoples as saviors of rapidly disappearing Amazonian forests "blessed with inherent environmental wisdom" (Nygren 2006:515). For example, the 1981 cover of *International Wildlife* invoked the noble savage in its photo of a Peruvian *campesino* gently holding a vicuña while gazing into its eyes. Yet according to Wakild (2020), this photo misrepresented *campesinos*' contentious histories with vicuñas and exclusion from

Peruvian society by fabricating a culturally inaccurate traditional relationship that parroted ethnically-fueled international conservation discourse. Many indigenous groups and their advocates, on the other hand, leveraged the myth's rhetorical strength to draw attention to their rights struggles, social movements, and places in international conservation and development (Redford and Stearman 1993, Conklin and Graham 1995, Dove 2006). For instance, *Parade* magazine featured Paulo Payakan, a Kayapó leader who blended ethnic ideas with environmentalism, on the cover of a 1992 issue with the title "A Man Who Would Save the World" (Conklin and Graham 1995). Thus, a longstanding history of popular depictions maintained this myth in broader narratives.

Importantly, the conceptual value and empirical merits of the ecologically noble savage myth were also called to task by conservation biologists and anthropologists, for whom hunters played a significant role in their arguments (Redford 1991, Alvard 1994, Stearman 1994, Krech 2005). Conservationists like Kent Redford and Allyn Stearman (Redford 1991, Redford and Stearman 1993, Stearman 1994, 2000) challenged the myth's conceptual foundations. Redford (1991) asserted that the myth was recapitulated by the widely held belief that Neotropical hunters would retain traditional hunting techniques, or were morally obligated to do so, when facing the pressures of the modern world. Similarly, Stearman (2000) argued that the potential for sustainability of Neotropical hunters should be filtered through five factors affected by modernization – sedentarism, population growth, market access, technological enhancements, and land encroachment – rather than a perceived cultural conservation ethic. Anthropologists such as Raymond Hames (1987) and Michael Alvard (1993, 1994) demonstrated that indigenous Amazonian hunters (Siona-Secoya, Yanomama, and Piro) were unlikely to be intentional conservationists. Instead, their hunting patterns, game preferences, and sustainability were likely constrained by socio-economic and environmental factors, including those reviewed by Stearman (2000). Despite these findings, the ecologically noble savage myth was welded to conservation discourse, leaving a legacy of "indigeneity" and "tradition" as de facto markers of sustainable environmental practices like hunting (Holt 2005). This legacy informs conservation practice with hunters and hunting policies in Latin America to this day (Oliva et al. 2014, Antunes et al. 2019).

1.1.3. Hunter Identities as Peasants, Campesinos and Indigenous Peoples in Latin America

Worldwide, hunters' identities are divided by, and connected through, an insurmountable array of ethnic, social, political, and occupational factors. Recent interdisciplinary work has found that 11 factors demarcate hunter identities in the literature (von Essen et al. 2019). While highly comprehensive, this review predominantly drew from North American, European, and African literature. Using von Essen et al's (2019) typology, scholars of Latin American hunting appear to differentiate hunters by a combination of their type of residence, landscape, motivation, and class. Some examples of these hunter identities include lumbermen hunters, village subsistence hunters, rural subsistence hunters, illegal commercial meat hunters, and *ribereño* hunters in the Peruvian Amazon (Bodmer et al. 1988, Bodmer 1995); urban, *caiçara*, *caboclo*, colonist, and *ribeirinho*, hunters in the Brazilian Amazon (Cullen et al. 2000, Hanazaki et al. 2009, van Vliet et al 2015); *llaneros* in the Venezualan *llanos* (Ojasti 1970), Mennonite hunters in Belize (Harvey et al. 2017), afro-descendant hunters such as *quilombolas* in Brazil and Afro-Colombians in Colombia (Prado et al. 2014, Vargas-Tovar 2012), and "peasant-hunters" and bird traders (*pajareros*) throughout Mexico (León and Montiel 2008, Oliva et al. 2014, Roldán-Clarà et al. 2017). Most of these hunter identities are not mutually exclusive because they manifest from shared histories of colonization, marginalization, economic development, and indigenous ancestry. Indeed, the challenges of consolidating hunters' identities are magnified by the presence of over 800 indigenous groups in the region (Toledo 2001), whose histories, ethnicities, and ancestries are often intermixed with many Latin American hunting groups. To distill these complexities, Latin American hunters are most often grouped as either subsistence and commercial hunters and/or indigenous and *campesino* hunters (Redford 1992, Ojasti 2000, Ortiz von Halle 2002). The latter dichotomy is informed by ethnicity and is the basis of ethnic discourse about hunters and the conceptual foundation of this dissertation – a classification that was absent from von Esssen et al.'s (2019) categorizations.

1.1.4. Campesinos as Farmers and Hunters

The word *campesino* is often translated to the reductive and theoretically-weighted term *peasant* in English. However, briefly divorcing the term from the theoretical baggage of the peasantry opens up space to explore its meanings and significance to those who identify as *campesinos.* Broadly speaking, *campesinos* embody an occupational and land-based identity that is rooted in the *campo* (Latin American countryside) (Loker 1996, Doane 2007). In this way, their livelihoods, worldviews, and lived experiences are both expressions and extensions of the land on which they live and work. Loker (1996) defines campesinos as "relatively poor, predominantly rural dwellers with strong ties to agriculture either as producers, laborers, or more frequently, both" (71). He goes on to state that "I prefer the term campesino because it applies to many rural dwellers who are increasingly involved in a variety of economic activities, including, but not limited to, farming" (Loker 1996: 71). While his definition harkens back to the economic roots of peasant definitions, he also emphasized the connection to land that percolates throughout peasant studies. Importantly, the term is preferred over the colloquial *peasant* precisely because it is the term that many rural Latin Americans use to describe themselves (Loker 1996, Müller-Schwarze 2008) and therefore is considered to not have an English analog (Edelman 2013). Given these parameters, I will use Loker's (1996) definition for the purpose of this dissertation.

Campesino also represents one of the two most commonly used categories that conservationists and wildlife managers use to define hunters in Latin America (Ojasti 2000). The history of campesinos in hunting scholarship and conservation discourse parallels aspects of its history in anthropological thought (see Section 1.1.5 below). Bennett (1959) produced one of the first cross-cultural hunting studies in Latin America, where he evaluated the cultural motivations of indigenous (Emberá formerly known as Chocó), urban, and campesino hunters. In his work, he described campesinos according to their appearance ("The physical appearance of the campesino bears testimony to Indian, Spanish, and to a small degree, Negro genes which he has inherited" (83)), their culture ("Culturally conservative, the campesino clings tenaciously to traditional ways of doing things" (83)), intellectual limits ("The campesino is often illiterate, invariably superstitious, often suspicious of attempts made to better his economic status, and looks upon his national government [as] trouble more than help" (83-84)" and occupation ("The campesino is a farmer who produces most of what he consumes and consumes most of what he produces" (84)). Similarly, Leopold (1959) noted that Mexican campesinos were stubborn, resistant to government intervention, and needed educational outreach to learn sustainable hunting practices.

Recent work in conservation also shows that pejorative or essentialist portrayals of campesinos have reverberated into the present. For example, nongovernmental organizations (NGO) and policy makers have been shown to represent campesinos as either ignoble agriculturalists or ecological saviors depending on their conservation goals (Nygren 1999, Doane

2007, Haenn 2016). Indeed, these narratives and the legacy of the ecologically noble savage color how campesinos and their hunting practices are portrayed. Ethnically fueled conservation discourse thus tends to frame campesinos as poor, uneducated, and opportunistic hunters who lack the culture and knowledge required for sustainable hunting practices (Redford and Robinson 1987, Montero 2004, Ruiz-Serna 2015).

1.1.5. The Peasantry

To understand the importance of ethnicity to hunting scholarship, the meanings and linkages among the terms *peasants*, *campesinos*, and *indigenous peoples* must be defined in order to understand their importance to conservationists, anthropologists, and policy makers. Yet, reaching a concise definition of any of these terms is a leviathan task. For example, the meanings assigned to each term commonly vary according to their use as cultural identities, scholarly analytical concepts, and legal designations (Dove 2006, Adams et al. 2009, Edelman 2013, Antunes et al. 2019). Any encompassing definition of these elusive concepts must wade through centuries of multidisciplinary debates that often emerged from deeply entrenched histories of pejorative uses from around the globe (Edelman 2013).

The history of anthropological literature on Latin American peasants is often dated back to Robert Redfield's and Alfonso Villa Rojas' (1934) ethnography of the village of Chan Kom, Mexico, where they described the residents as *little*, *folk*, or *peasant*. However, this history was preceded by centuries of scholarship on the European peasantry. According to Silverman (1979),

> "Long before Robert Redfield's first field trip to Mexico in 1926, peasants had been the concern for other scholars: historians of medieval Europe, jurists and political theorists,

Russian economists and 'rural statisticians' who carried out sophisticated peasant studies on a national scale, Eastern European ethnographers of folk-life, rural sociologists stimulated by [Frederic] LePlay to record family budgets, and others" (49).

Although ongoing debates continue to deconstruct, reclassify and recategorize the meanings, cultures, and implications of *peasant* livelihoods for social organization, the term traditionally refers to rural economic categories and their modes of production. This analytical frame was codified by Russian economist Alexander Chayanov in his work *The Theory of Peasant Economy* (1966 [1925]). Chayanov, like Karl Marx, perceived peasants as economic Others (Brass 2002, Müller-Schwarze 2008). However, he diverged from Marx and countered standard economic theories by assigning subjective agency to peasants' economic choices beyond the subjugation of capitalist forces; he conceptualized family economics in terms of a "labor-consumer balance between the satisfaction of family needs and drudgery (or irksomeness) of labor" (xv). As a result, "the peasant family proceeds by subjective evaluation based on the long experience in agriculture of the living generation and its predecessors" (Chayanov 1966[1925]:xvi). Bolstering the emphasis on rural production and market relations, Kroeber (1948) considered peasants to be "definitely rural–yet live in relation to market towns; they form a class segment of a larger population which usually also contains urban centers, sometimes metropolitan capitals. They constitute part-societies with part-cultures" (284). These "part-societies with part-cultures" represented an increasing focus on culture as a unit of analysis in anthropological theory (Wolf 1986). Wolf (1955) argued that *peasant* "indicates a structural relationship, not a particular culture content" (454) which can be typified as closed corporate communities that reflect “a bounded social system with clear-cut limits, in relations to both outsiders and insiders” (456).

The preceding interpretations of peasants aligned with aspects of Redfield’s view of the peasantry as “a traditional way of life” with longstanding economic, emotional, and cultural ties to the land (Redfield 1956, Silverman 1979). However, the idea of “traditional” peasants, as drawn from Redfield’s nuanced ethnographies (Redfield 1930, Redfield and Villa Rojas 1934), married Latin American anthropologists’ focus on the cultural “traditions” of indigenous groups with their predominate focus on the economic “traditions” of the peasantry (*sensu* Wolf 1955, 1986, Brass 2003). These two approaches embody the prevailing schools of thought about peasants, or what recent scholars have dubbed “peasants-as-economic-subject” and “peasants-as-cultural-subject” (Brass 2003:2). Brass (2003), in particular, notes that contemporary peasant scholarship and social movements are shifting towards a focus on peasants’ lived experiences and interactions with their environment as a source of identity, culture, agency, and empowerment either at the expense of, or as a source of, economic development. This shift is observed in Latin American peasant movements like *El Movimiento Campesino-a-Campesino* and *La Via Campesina* that merge peasants’ land-based identity and culture with human rights, autonomy, food sovereignty, and environmental sustainability goals (Holt-Giménez 2006, Claeys and Edelman 2020). This framing has allowed peasants and their advocates to codify a globally recognized definition of *peasants* in the recently adopted *United Nations Declaration on the Rights of Peasants and Other People Working in Rural Areas* (UNDROP 2018). The UNDROP defines peasants as “any person who engages or who seeks to engage, alone, or in association with others or as a community, in small-scale agricultural production for subsistence and/or for the market, and who relies significantly, though not necessarily exclusively, on family or household labour and other non-monetized ways of organizing labour, and *who has a special dependency on and attachment to the land*" (emphasis added, 5). Through this definition and proclamation, peasants are also recognized as agricultural actors and cultural agents with "traditional" rights, practices, and knowledge systems.

In theoretical terms, one critical example of this shift is Ploeg's (2008) recently proposed choreography of the peasant condition (see Fig. 2.2 in his work). According to Ploeg (2008),

> "Central to the peasant condition…is the *struggle for autonomy* that takes place in *a context characterized by dependency relations, marginalization and deprivation.* It aims at and materializes as *the creation and development of a self-controlled and self-managed resource base*, which in turn allows for *those forms of co-production of man and living nature* that *interact with the market, allow for survival and for further prospects* and *feed back into and strengthen the resource base, improve the process of co-production, enlarge autonomy* and, thus, *reduce dependency*. […] both survival and the development of one's own resource base might be *strengthened through engagement in other non-agrarian activities*. Finally, *patterns of cooperation* are present which regulate and strengthen these interrelations" (emphasis from the author, 23).

Ploeg's (2008) model emphasizes human-environment interactions in the terms of eight interrelated elements of the peasantry. First, co-production refers to the different ways that peasants interact with and transform *living* nature. Co-production can take many forms, including agriculture, horticulture, fishing, and most importantly for the purpose of this dissertation, hunting. In highlighting co-production as a central element of the peasantry that is not restricted to agriculture, this model suggests that scholars cannot fully understand peasant livelihoods without considering the multilayered dynamics of their production strategies. Second, co-production promotes and maintains a self-controlled resource base. The potential resource base can encompass an array of products and materials, such as crops and hunted wildlife. In this way, effectively harvesting crops and wildlife allows peasants to strengthen their strategies for co-production, such as learning improved cultivation techniques and enhancing their capacity to hunt a wider range of prey. Moreover, it is a path towards agency and autonomy for a social group that is commonly described by their dependence on their economic conditions. Yet, the model accounts for market relations as its third element. Market relations are an extension of co-production and a self-controlled resource base. Peasants can choose how they economically engage with the outside world in culturally appropriate terms. For example, peasants may choose to sell surplus crops and wild meat to urban markets or elect to retain these resources for insurance, bartering, or sharing with other community members. Fourth, this model stresses *survival* as a key motivation underlying peasant livelihoods. Ploeg (2008) cautions against restricting survival to subsistence because survival can manifest in many forms beyond the resources, such as social relationships, market interactions, and adjustments to environmental changes. As such, survival is a multidimensional concept that informs peasants' interactions with their immediate surroundings and the outside world. Fifth, peasants strive to reduce their dependency on outside forces through the cyclical relationship between survival and their self-sustained resource based. This promotes improved livelihoods independent of outside intervention. Sixth, peasants strive for autonomy from their challenging socio-political and ecological environments. Autonomy manifests at multiple scales from broad political action (such as peasant social movements) to one's ability to select their small-scale farming and hunting techniques. Seventh, multiple livelihood strategies, which Ploeg (2008) describes as "pluriactivity", are commonplace. While these "other activities" can encompass the diverse strategies of co-production and resource base maintenance mentioned above, they are mostly adopted to obtain extra cash and confer a broader sense of autonomy in peasant life. In short, these additional activities are primarily driven by concerns for economic survival and flexibility, which enhance autonomy from, and reduced dependency on, external actors. Eighth, cooperation is required to navigate harsh environments. For example, campesino cooperatives, communal home gardens, and group hunts all represent forms of cooperation. In turn, cooperation meets group and individual needs by uniting peasants towards a common goal: to cope with the adverse circumstances that are central to the peasant condition.

1.1.6. Local and Traditional Ecological Knowledge (LTK)

The theoretical shift towards broadly understanding peasant societies is also reflected in growing trends towards unromantic depictions of 'other' cognitive systems, including those of peasants and campesinos. These systems fall under the conceptual domain of local and traditional ecological knowledge (LTK). Similar to the varied definitions of the peasantry, *campesinos*, and hunter identities, LTK and its variants are described with many terms and conceptualized with a diversity of frameworks focused on ethnicity, residency, landscapes, and resource use strategies. Some examples from the pantheon of environmental knowledge categories include local ecological knowledge (LEK), indigenous ecological knowledge (IEK), fishers' knowledge (FK), folk ecological knowledge (FEK), professional ecological knowledge (PEK), and traditional ecological knowledge (TEK) (Antweiler 1998, Davis and Ruddle 2010, Berkes 2012, Hind 2014, Fleischman and Briske 2016). Berkes (2012) seminal definition of TEK is the most cited to describe resource users' knowledge of their environment. He defines TEK as "…a cumulative body of knowledge, practice, belief, evolving by adaptive processes and handed down through generations by cultural transmission about the relationship of living beings (including humans) with one another and with their environment" (7). Given that this definition captures nearly all dimensions of LTK in the conservation literature, it forms the conceptual foundation for LTK in this dissertation.

Despite its utility, Berkes' (2012) definition of LTK alone does not fully capture the development of LTK as a body of scholarship. The advent of LTK as a domain of anthropological inquiry is traced back to Harold Conklin's (1954) ethnobotanical study of the Hanunóo people in the Philippines. Conklin's ethnographic account catalogued what he termed 'ethnoecological factors', which united local taxonomies, classificatory systems, and environmental understandings into a cohesive exploration of this culture's human-environment relationships. His study was revolutionary in its depiction of the complexities of non-Western, indigenous cognitive systems. In turn, presenting these knowledge systems as complex countered anthropologists' tendencies to portray 'other' cultural knowledge as primitive, magical, and non-changing, setting the stage for investigations of knowledge systems that did not fit the indigenous mold.

The literature on peasant and campesino cognitive systems embody a departure away from the influence of the "ecological noble savage" on perceptions of 'other' cultures. In terms of peasant cognitive systems, Baraona (1987) proposed that campesinos' dependence on land and agricultural labor for survival warranted a deeper exploration of how their entire repertoire of environmental knowledge, perceptions, and ideas (*corpus*) mediated how their livelihood practices are enacted on the landscape. This perspective aimed to redress the ethnoscientific “tendency to regard *culture* as distinct and largely autonomous from *production*” (Toledo 1990:58). Drawing from ethnoscientific studies in anthropology, the theorized interplay of *corpus* and *praxis* represented one of the first efforts to conceptualize campesino cognitive systems and, in turn, divorce them from the imprecise and romanticized notions of “indigenous” and “traditional” cultures (Toledo 1990). Conklin’s (1954) work is widely agreed to be the foundation of ethnoecology as a novel field (Toledo 1992, Zent 2009).

Toledo (1992) then expanded on these peasant cognitive systems to propose ethnoecology as a new area of study. Building on the interplay between *corpus* and *praxis*, he proposed an ethnoecological framework that accounted for the worldview (*kosmos*) of knowledge holders in what he termed the kosmos-corpus-praxis (k-c-p) complex (Toledo 2002). The k-c-p complex is presented as a holistic approach to studying human-environment interactions. The framework allows the researcher to use multidisciplinary methods and tools to understand how diverse human societies appropriate nature. For example, ethnoecology frames have been used to explore conservation conflicts among campesinos and environmental NGOs in Mexico (Haenn 1999), perceptions of landscapes and land management among the Dene in northern Canada (Johnson 2010), and the social and ecological resilience of *caiçaras* in the Brazilian Amazon (Begossi 2006). Some scholars have even proposed a coterminous, yet theoretically distanced, ethno-ecological identity to understand campesino social movements (Healey 2009). Thus, ethnoecology presents a promising discursive tool and analytical frame for evaluating campesino hunting cultures. It is also recognized as one of many tools in the conservation social scientists toolkit (Bennett and Roth 2015).

However, the k-c-p complex is based in the trappings of an indigenous worldview. Most references to a *kosmos* are purely situated in an indigenous context. Toledo (2002) begins his description of the *kosmos* with the following: "For indigenous people, land (and nature in general) has a sacred quality which is almost absent from Western thinking" (515). His language mirrors the use of *sacred* by Berkes (2012) to qualify LTK, which idealizes it, and therefore inoculates it, from skeptical inquiry (Davis and Ruddle 2010). Moreover, this view of the *kosmos* unintentionally separates this framework from non-indigenous or non-traditional communities. For this reason, the k-c-p complex has not been applied to understanding a strictly *campesino* cognitive system.

Overall, the shift towards an expanded, subjective focus on peasant livelihoods and culture, particularly in the context of conservation discourse and practice, is the foundation of two analytical lenses for this dissertation. First, it provides a theoretical window to explore the cultural importance of hunting for Latin American *campesinos* whose broader lived experiences are often rendered invisible by a scholarly emphasis on economics and agriculture, indigenous cultures, and classificatory debates. Second, it contributes a novel analytical window to investigate what Ploeg (2008) described as the "awkward science" of peasant studies – a constellation of various disciplines converging on the peasantry with little theoretical overlap.

In this way, the K-C-P gap is critical to hunting scholarship in Latin America and conservation with campesino hunters for several reasons. First, LTK is a promising way to access and conceptualize hunting cultures in conservation (Berkes 2012). In fact, hunters are one of the main sources of information for LTK research (Brook and McLachlan 2008). Second, campesinos are the largest group of hunters in Latin America (Ojasti 2000). This gap therefore restricts conservationists' access to the diverse worldviews that inform the knowledge, practices, and beliefs of this social class. Third, it reinforces the myth of the ecologically noble savage and pejorative views of campesino hunters that accompany it. Fourth, it divorces LTK from rational skepticism and validity testing (Davis and Ruddle 2010). And fifth, it creates space for conflicts to occur based on a limited view of the contributions of hunting to campesinos' material and cultural survival.

1.2. Dissertation Format

The remainder of this dissertation is divided into three sections. I wrote the next three sections as manuscripts with the intention of submitting them to peer-reviewed journals. Section 2 is an interdisciplinary review of over 80 years of campesino hunting studies which was recently published in the journal *Conservation Biology* (Petriello and Stronza 2020). The materials are reproduced with the permission of the journal. In this review, we compile the disjointed literature on campesino hunting to paint a broad picture of this yet unformed area of research. Section 3 places an ethnographic lens on the Nicaraguan campesino community of El Pizotero, and was written in the style of the journal *Ecology and Society*. Through interviews, participant observation, and participant photography, I piece together the contours of the hidden culture of campesino hunting for this community. This culture is hidden in the sense that it is not only inseparable from other livelihood activities in the *campo*, but also occurs in the spaces between work and home. Hunting is invisible because it permeates many aspects of community life, yet remains unspoken to outsiders. The furtive nature of campesino hunting means that conservationists in the region are unfamiliar with its effects on wildlife and its significance for local culture and survival. One aspect of this significance comes from the contributions of hunting to campesino LTK, which is the focus of Section 4 written for submission to *Human Ecology*. Section 4 takes a deep dive into the content and structure of campesino hunting LTK. I apply cultural consensus analysis (CCA) to interview surveys in order to empirically assess the presence of a shared culture of hunting knowledge. These data are supported and qualified through content analysis of prominent hunting knowledge themes, which I then filtered through the k-c-p complex of ethnoecology. In turn, clearly distinguishable elements of the *kosmos*, *corpus*, and *praxis* emerged from interviews and field notes. Not only do these findings demonstrate the validity of a novel approach for framing campesino hunting cultures, but they also support this approach through qualitative and quantitative analyses. The broader conceptual implications of these results are discussed in the conclusions, including suggestions for integrating campesino hunting cultures and knowledge into mainstream conservation and human rights agendas.

2. CAMPESINO HUNTING AND CONSERVATION IN LATIN AMERICA*

2.1. Introduction

Wildlife hunting is an urgent threat to global biodiversity (Benítez-López et al. 2017, Di Minin et al. 2019, Suarez and Zapata-Ríos 2019). It is also vital to the livelihoods and worldviews of indigenous and local peoples involved in conservation across scales and contexts and with various goals (Robinson and Bennett 2000, Altrichter 2006). Conservationists' efforts to evaluate sustainable hunting or modify hunter behaviors must therefore navigate stakeholders' complex relationships with conservation, local histories, cultural survival, identities, welfare, enforcement of hunting laws, and other community members (Bennett and Robinson 2000, Boglioli 2009, Duffy et al. 2016). With awareness of these complexities, interdisciplinary conservation scholars are expanding research agendas and methods to capture the varying cultural, historical, and political contexts of hunting (Duffy et al. 2016, Jones et al. 2019, Smith et al. 2019). Although this progress demonstrates the relevance of hunting in social-ecological systems (van Vliet et al. 2015), it also highlights the importance of examining the terms ascribed to and assumptions about hunters and hunting worldwide (von Essen et al. 2014, Duffy et al. 2016).

The need to recognize cultural differences across hunters and hunting practices is widely accepted. Yet, long-held assumptions about the linkages among culture, hunters' identities, and sustainability persist. Decades of hunting research in Latin America has focused on and

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compared 2 ethnically diverse, but socially, geographically, and economically overlapping groups of rural hunters: indigenous societies and campesino communities (Ross 1978, Redford and Robinson 1987, Robinson and Redford 1991, Ojasti 2000, Silvius et al. 2004). Whereas much research emphasizes the contrasting cultural and economic contributions of hunting to these groups, most studies disproportionately drew from indigenous hunters rather than campesinos. In turn, the culture, motivations, and sustainability of campesino hunting tend to be compared with indigenous expectations (e.g., Redford and Robinson 1987), which are byproducts of the ecologically noble savage myth in conservation discourse (Hames 2007). Campesino hunting scholarship appears numerically and conceptually limited even though campesinos are the most numerous hunters in Latin America and therefore the most likely to influence conservation success (Ojasti 2000).

Despite its relevance and implications for conservation, there are no syntheses or databases to guide conservation research and practice with campesino hunters in Latin America. We reviewed 81 years (1937 to 2018) of campesino hunting scholarship to determine the state of knowledge about campesino hunting in Latin America. First, we evaluated publication trends based on geographic, demographic, and methodological patterns. Second, we compiled a list of the environmental and social drivers, constraints, and LTK underlying campesino hunting. Third, we cataloged the vertebrate and invertebrate species hunted by campesinos and synthesized campesino hunting sustainability assessments. These data allowed us to highlight gaps and opportunities for conservation.

2.1.1. Terms for Hunters

Scholarly definitions of indigenous peoples and campesinos have been topics of multidisciplinary debates for decades (Kearney 1996, Dove 2006, Ploeg 2008). Many characteristics are used to define both groups, including autonomy, history of marginalization, social resistance, and resource-appropriation strategies, such as hunting (Toledo 2001, Dove 2006, Ploeg 2008). Indigenous peoples and campesinos belong to a variety of ethnic, geopolitical, and environmental groups. Indigeneity can be defined by claiming membership in 1 of the estimated 800 indigenous groups in Latin America whose autochthonous cultures comprise distinct languages, rituals, dress, and worldviews (Toledo 2001). Campesinos also self-identify with a variety of environmental, ethnic, and geopolitical groups, including *ribereños* (riverine) and *mestizos* (mixed-ancestry) in the Peruvian Amazon (Chibnik 1991), *criollos* (pastoralists) in the Argentine Dry Chaco (Camino et al. 2018), and indigenous campesinos who combine ethnic affiliation with social class.

Despite their variable identities, campesinos broadly represent "person[s] of the *campo*" (Latin American agricultural countryside) who are "relatively poor, predominantly rural dwellers with strong ties to agriculture either as producers, laborers, or more frequently, both" (Loker 1996:70). Although translated to the contested term *peasant*, many suggest *campesino* does not have an English analog because it embodies a social class, occupational identity, and agrarian livelihood that are inseparable from the campo (Loker 1996, Doane 2007, Edelman 2013). To avoid misrepresenting campesinos, we qualify Loker's (1996) descriptions with accounts of regional identities and ethnonyms. We follow the autochthonous culture criterion to respect indigenous people's rights to autonomy and self-determination. This perspective avoids romanticized depictions of indigenous resource use that inform conservation discourse (Redford 1991).

2.1.2. Hunting Narratives and Research

Kent Redford (1991) argue that anthropological field studies tend to describe indigenous hunters as isolated "ecologically noble savages" whose conservation-friendly behaviors, beliefs, and LTK systems are rooted in generations of traditional autochthonous cultures. Yet, demographic traits such as low population densities, restricted market access, and traditional hunting tools, rather than cultural intent, may inadvertently support indigenous conservation (Alvard 1995, Hames 2007). While these exceptions stimulated debate, they also merged with the noble savage narrative such that groups that do not outwardly claim, portray, or adhere to Western conceptions of indigenous hunting are often assumed incongruous with conservation (Holt 2005).

Campesinos' varied social identities challenge or appear dissociated altogether from so-called noble dichotomies, such as rural or urban, indigenous or nonindigenous, cultured or acculturated, and good or bad (Kearney 1996). This has allowed conservation scientists, wildlife managers, anthropologists, policy makers, nongovernmental organizations (NGOs), and popular media outlets, such as *National Geographic*, to portray campesinos as either ecological saviors or ignoble agriculturalists for conservation (Nygren 1999, 2006, Doane 2007, Antunes et al. 2019). Ethnically-fueled environmental discourse therefore frames modern campesinos as poor, uneducated, and opportunistic hunters who, as mere peasants in managed agricultural landscapes, lack the autochthonous culture and LTK required for sustainable (and legal) hunting practices (Redford and Robinson 1987, Montero 2004, Ruiz-Serna 2015).

Blurry definitions and ethnically-fueled hunting discourse also adversely constrain research and engagement with campesino hunting. Conservationists appear to be mostly aware of, and interested in, campesinos to understand their hunting in relation to indigenous groups rather than hunting to understand campesinos. The most highly cited English-language comparative hunting reviews and compendiums, for instance, draw from few campesino or nonindigenous hunting studies, largely from Brazil, Mexico, and Peru (Table 2.1). Aligning with environmental narratives about campesinos, many of these studies emphasize that poverty and protein deficiencies drove campesinos toward opportunistic hunting for subsistence or income (Pierret and Dourojeanni 1967, Naranjo et al. 2004a). Hunting constraints, in contrast, are often attributed to dietary taboos, species availability, and hunting regulations (Redford and Robinson 1987). Although potentially unintended, campesino hunting narratives invoke ethnicity and poverty as proxies for its social significance and sustainability. They also constrain the cultural significance and agency of campesino hunting to dietary or regulatory restrictions. As such, they overlook other drivers and constraints besides poverty (e.g., ethics, religion, conflicts) that influence hunting (Boglioli et al. 2009, Duffy et al. 2016). This gap supports calls to sensitize, convert, or curtail campesino hunting, even without biological or social data, which has been shown to precipitate conflicts (Oliva et al. 2014).

Table 2.1 Percentage of campesino or nonindigenous hunting articles (comparative studies or compendiums) in Latin American hunting reviews published in 40 years (1978-2018).

Hunting review or compendium	Citations (21 May 2019)	No. of articles or chapters (%)[a]	Countries (no. of studies)	Total articles or book chapters	Example articles or book chapters
Robinson and Bennett 2000	623	2 (12) [25]	Peru (1); Paraguay (1)	25 [8]	Bodmer and Puertas 2000, Hill and Padwe 2000,
Redford and Robinson 1987	398	4 (18)	Brazil (2); Peru (2)	22	Pierret and Dourojeanni 1966, 1967, Smith 1976, Ayres and Ayres 1979
Ojasti 2000	395	21 (46)[b]	Brazil (5); Honduras (1); Mexico (4); Peru (5); Venezuela (6)	46[b]	Ayres and Ayres 1979, Peres 1990, Martins 1992[a]
Ross 1978	371	4 (29)[c]	Brazil (1); Peru (3)	14[c]	Pierret and Dourojeanni 1966, 1967
Robinson and Redford 1991	370	Approximately 6 (21)[d]	Argentina (1); Belize (1); Brazil (1); Costa Rica (1); Panama (1); Venezuela (1)	28	Fragoso 1991, Glanz 1991, Silva and Strahl 1991
Novaro et al. 2000	256	6 (43)	Belize (1); Brazil (2); Panama (1); Paraguay (1); Venezuela (1)	14	Fragoso 1991, Glanz 1991, Silva and Strahl 1991
Jerozolimski and Peres 2003[a]	236	4 (18)	Brazil (4)	22	Smith 1976, Martins 1992, Calouro 1995,
Koster 2009[a]	69	12 (18)	Argentina (1); Brazil (7); Mexico (2); Paraguay (1); Peru (1)	66	Smith 1976, Hill and Padwe 2000, Reyna-Hurtado 2002, Altrichter 2005
Benítez-López et al. 2017	67	14 (13) [32]	Argentina (1); Belize (1); Brazil (2); Guatemala (1); Costa Rica (1); Mexico (2); Panama (1); Paraguay (1); Peru (4)	144 [44]	Fragoso 1991, Glanz 1991, Reyna-Hurtado 2002; Altrichter 2005
Silvius et al. 2004	61	4 (16)	Mexico (1); Peru (3)	25	Bodmer et al. 2004, Naranjo et al. 2004b,

Table 2.1 Continued

Hunting review or compendium	Citations (21 May 2019)	No. of articles or chapters (%)[a]	Countries (no. of studies)	Total articles or book chapters	Example articles or book chapters
Vickers 1984	59	2 (17)	Brazil (2)	12	Smith 1976, Ayres and Ayres 1979,
Guerra et al. 2010	14	4 (31)	Guatemala (1); Mexico (3)	13	Núñez 2010[a], Reyna-Hurtado and Tanner 2010
Fernandes-Ferreira and Alves 2017	8	43 (58)	Brazil (43)	74	Unspecified
Vargas-Tovar 2012	7	9 (43)	Colombia (9)	21	Unspecified
Stafford et al. 2017	6	9 (21)[e]	Brazil (4); Mexico (2); Peru (3)	44	Smith 1976, Calouro 1995, Naranjo et al. 2004b,
Ávila-Nájera et al. 2018	0	Approximately 31 (53)[f]	Mexico (31)	59	Naranjo et al. 2004a, García-Alaniz et al. 2010

[a]Brackets refer to the percent of all articles or chapters focused on hunting in Latin America that included campesinos.
[b]Estimated from Ojasti's (2000) description of hunters' profiles (pp. 38-39).
[c]Taken from the cultural comparison of hunting kills in Tables 6 and 7 and paragraphs on pages 11-12 in Ross (1978).
[d]Several book chapters did not describe the study populations to this degree, but suggested they were nonindigenous.
[e]We counted Aquino and Calle (2003) and Saldaña and Saldaña (2001) (originally denoted as "unknown" hunters) because the study site and populations matched previous descriptions from the same regions denoting them as campesinos or mestizos
[f]This number is an estimate because several articles, book chapters, and government documents were inaccessible for review.

Yet, assumptions may persist because publication trends are unknown for this area of conservation research. Ojasti (2000) concluded that knowledge of campesinos' preferred target species, as well as sustainability assessments, is fragmented compared with information about indigenous hunters' preferences. Current literature seems to validate this assertion in that most noncomparative studies evaluate campesino hunting in the Peruvian Amazon to inform protected area (PA) management and sustainable hunting of mammals through community-level surveys, interviews, or transects (Bodmer et al. 2000, Aquino et al. 2009). Geographic, methodological, conceptual, and taxonomic uniformity risks divorcing campesino hunting from the diverse contexts, cultures, LTK, and dimensions of sustainability that inform conservation with campesinos and analogous rural groups (Bennett and Robinson 2000, Montero 2004, Altrichter 2006, Ruiz-Serna 2015). Declining campesino hunting in certain regions heightens these concerns (Gray et al. 2015, Coomes et al. 2016).

2.2. Methods

We used 210 combinations of English, Spanish, and Portuguese search terms with Boolean operators to review the literature on campesino hunting in Latin America in 5 academic databases and Google Scholar (Appendix A). Our initial search included peer-reviewed literature, book chapters, technical reports, theses, and dissertations that centered on campesino hunting or indirectly reported data on this topic within larger research goals.

We initially identified and sorted 609 sources from authors' descriptions of the hunter populations, study locations, and study design. We included studies with samples that were described as campesinos, identified as subgroups of this larger social class (Appendix A), or referred to as campesinos in previous studies. We excluded studies that did not describe hunting among nonindigenous or indigenous campesinos (definitions are given in Appendix A). Given that many Brazilian hunting studies involved rural groups (e.g., *caboclos*, *caiçaras*, and *quilombolas*) whose cultural histories, resource-use patterns, regional idiosyncrasies, and social meanings are not captured by the term *campesino* or its subcategories (see Chibnik 1991), we excluded most studies in Brazil (n = 103). However, we included Amazonian studies near Brazil or comparative studies with Brazilian rural populations. We removed studies not on terrestrial, coastal, or freshwater ecosystems. We also removed sources that analyzed secondary data, unless they were countrywide or ecoregional reviews with otherwise inaccessible data (e.g., government and NGO technical reports). Given time constraints, we excluded dissertations and theses. In total, 275 papers did not satisfy our review criteria.

We compiled data for 30 variables from the final selection of 334 papers (Appendix A). First, to assess publication trends, we catalogued each publication's year, format, language or languages, outlet format (e.g., journals, magazines), and Google Scholar citation counts as of 10 November 2017. We coded study contexts from their introductions, objectives, and discussions. We also recorded all study methods, sample sizes, sampling units (individuals, households), and ethnic composition and campesino identities of hunters. We cross-referenced study ecosystems and habitats with Dinerstein et al. (1995). For context and relevance to conservation, we documented the names, management categories (IUCN and UNEP 2018), and number of studies per PA that were part of the study designs and contexts.

Second, we documented the campesino hunting drivers and constraints reported by authors, campesinos, or other study participants (criteria are given in Appendix A). We catalogued human-wildlife and human-human conflicts as independent of these categories because they were nuanced, variable , and proximate causes and deterrents of hunting (Torres et al. 2018). Third, we compiled ranked lists of hunted vertebrates and invertebrates according to their taxonomic groupings, conservation status (IUCN 2018), and number of studies per species. We also aggregated authors' assessments of the sustainability of campesino hunting to construct a picture of how researchers and practitioners evaluate campesino hunting and its sustainability. We conducted chi-square tests, linear regressions, and post hoc analyses with Bonferroni adjustments in SPSS version 25 and Microsoft Excel (2016) to determine statistical variations in publication and conceptual trends (Veríssimo and Wan 2019). We used this approach to avoid a priori assumptions about this disarticulated body of literature.

2.3. Results

2.3.1. Campesino Hunting Publication Trends

Of the 334 reviewed papers, 94% were academic articles (266), book chapters (43), and monographs (2) published in 145 peer-reviewed journals and 27 books. The remaining 6% comprised conference proceedings (13), society bulletins or popular magazines (6), and technical reports (4). The papers were published in English (55%) and Spanish (45%). Citation rates varied significantly ($\chi^2 = 473.9$, df = 6, $n = 334$, $p < 0.001$) from 0 to 448 citations per paper (mean [SD] = 28 [52]); 70% received fewer than 25 (Appendix A). Yearly publication rates increased significantly over time ($R^2 = 0.60$, $p < 0.001$) from means of 2 (SD 1.27) per year in the first 4 decades to 10 (5.94) per year in the last 3 decades ($\chi^2 = 616.9$, df = 8, $n = 334$, $p < 0.001$) (Fig. 2.1 and Appendix A). The 25 journals and 4 books that published 45% of all papers reflected these linguistic and chronological trends; all published ≥3 papers after 1990 in English (45%), Spanish (41%) or both (14%) (Table 2.2).

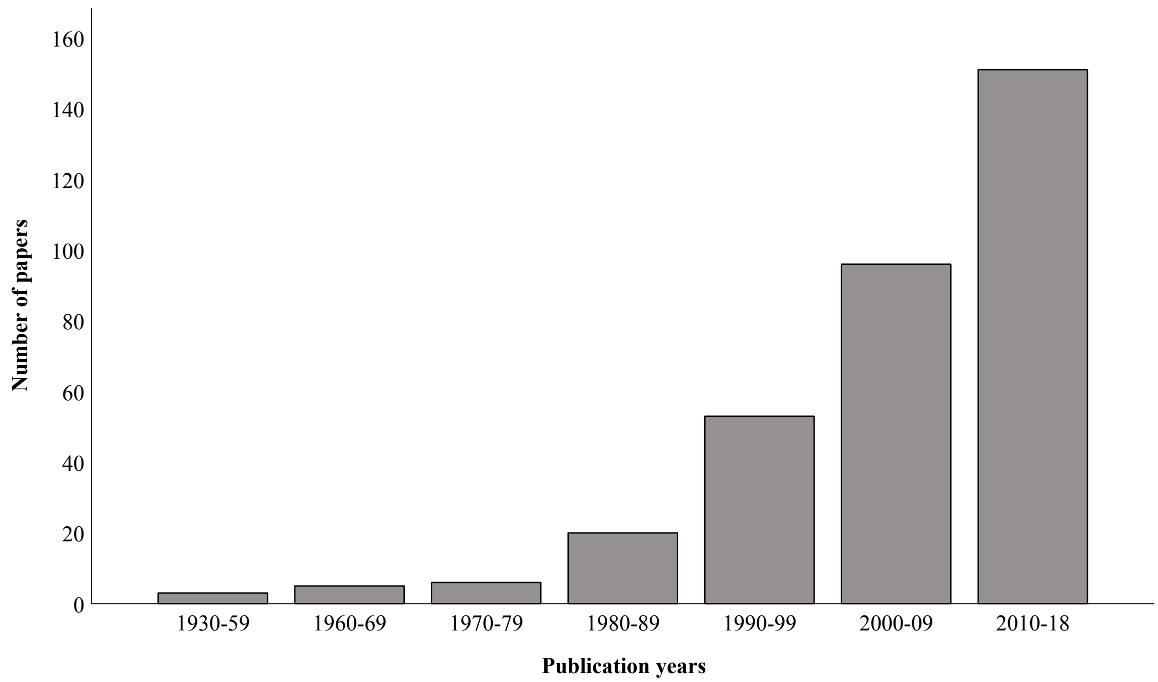


Figure 2.1 Trend in the combined number of peer-reviewed articles, book chapters, and gray-literature publications (e.g., conference proceedings, technical reports) on campesino hunting published from 1937 to 2018.

Table 2.2 Rank and publication information of peer-reviewed journals (n = 145 total) and books (n = 27 total) that published >2[a] studies of campesino hunting in Latin America (n = 334 total studies) from 1937 to 2018.

Rank	Journal or book name	Society or publisher	Society or publisher country	Language	Timeframe	Social group studied[b]	No. of articles
1	*Etnobiología*	Asociación Etnobiológica Mexicana	Mexico	Spanish	2004-2017	C I	14
2	*Biological Conservation*	Elsevier	United States	English	1987-2015	C O R	12
3	*Oryx*	Fauna & Flora International	United Kingdom	English	1995-2018	C O	11
4	*Conservation Biology*	Society for Conservation Biology	United States	English	1997-2003	C O R	7
5	*Journal of Ethnobiology and Ethnomedicine*	BioMed Central	United Kingdom	English	2012-2018	C O R	6
6	*Revista Colombiana de Ciencia Animal*	Universidad de Sucre, Colombia[c]	Colombia	Spanish	2011-2016	C	6
7	*Tropical Conservation Science*	Mongabay	United States	English	2009-2018	C I	6
8	*Ecology and Society*	Resilience Alliance	Canada	English	2005-2015	C O R	5
9	*Revista Forestal del Perú*	Universidad Nacional Agraria La Molina[d]	Peru	Spanish	1967-1976	C R	5
10	*Revista Peruana de Biología*	Universidad Nacional Mayor de San Marcos[e]	Peru	Spanish	2003-2017	C R	5
11	*Tapir Conservation*	IUCN SSC Tapir Specialist Group	Switzerland	both	2002-2015	C	5
12	*People in Nature: Wildlife Conservation in South and Central America* (Silvius et al. 2004)	Columbia University Press	United States	English	2004	C R	5

Table 2.2 Continued

Rank	Journal or book name	Society or publisher	Society or publisher country	Language	Timeframe	Social group studied[b]	No. of articles
13	*Ethnobiology and Conservation*	Universidade Federal Rural de Pernambuco	Brazil	English	2014-2017	C O	4
14	*Human Ecology*	Springer Nature	United States	English	1999-2010	C I	4
15	*Interciencia*	INTERCIENCIA Association	Venezuela	Both	1994-2010	C R	4
16	*Journal of Ethnobiology*	Society of Ethnobiology	United States	English	1988-2012	C I	4
17	*Mammalogy Notes* (*Notas Mastozoólogicas*)	Sociedad Colombiana de Mastozoología	Colombia	Spanish	2014-2017	C	4
18	*Vida Silvestre Neotropical*	World Wildlife Fund	United States	both	1989-1999	C	4
19	*Neotropical Wildlife Use and Conservation* (Robinson and Redford 1991)	University of Chicago	United States	English	1991	C	4
20	*Uso y Manejo de Fauna Silvestre en el Norte de Mesoamérica*(Guerra et al. 2010)	Secretaría de Educación de Veracruz	Mexico	Spanish	2010	C I	4
21	*Acta Zoológica Mexicana*	Instituto de Ecología, A. C.	Mexico	Spanish	1998-2010	C	3
22	*Biodiversity and Conservation*	Kluwer Academic Publishers	Netherlands	English	1999-2007	C R	3
23	*Biota Colombiana*	IAVH[f]	Colombia	Spanish	2013	C	3
24	*Human Organization*	Society for Applied Anthropology	United States	English	1990-2005	C O	3
25	*Revista Luna Azul*	Universidad de Caldas	Colombia	Spanish	2013-2016	C	3
26	*Quehacer Científico en Chiapas*	Universidad Autónoma de Chiapas	Mexico	Spanish	2014-2016	C	3

Table 2.2 Continued

Rank	Journal or book name	Society or publisher	Society or publisher country	Language	Timeframe	Social group studied[b]	No. of articles
27	*Ra Ximhai*	Universidad Autónoma Indígena de México	Mexico	Spanish	2011-2014	C	3
28	*Revista de Biología Tropical*	Universidad de Costa Rica	Costa Rica	both	2008-2012	C	3
29	*Fauna Socializada: Tendencias en el Manejo de la Fauna en América Latina* (Campos-Rozo and Ulloa 2003)	Fundación Natura and Instituto Colombiano de Antropología e Historia	Colombia	Spanish	2003	C R	3
							146[g]

[a]Eighteen peer-reviewed journals had 2 publications each, and 102 had one each. Gray-literature publications (n = 23) are excluded (13 conference proceedings, 6 magazine or bulletin articles, and 4 technical reports).
[b]C = Mestizo or Criollo or nonindigenous campesinos or "peasants"; I = Indigenous campesinos; O = Nonindigenous colonists; R = Ribereños.
[c]School of Agricultural Sciences
[d]School of Forestry
[e]School of Biological Sciences
[f]Instituto de Investigaciónes de Recursos Biológicos Alexander von Humboldt
[g]Comprising 44% of the 334 publications included in this review, 44% (n = 120) of the 268 peer-reviewed publications, and 37% (n = 16) of the 43 book chapters.

Campesino hunting studies were documented in 17 Latin American countries but not in Uruguay, Suriname, French Guiana, and Guyana (Fig. 2.2). All but 11 studies represented 1 country each and were unevenly distributed across these countries (χ^2 = 707.58, df = 17, n = 334, p < 0.001); 69% were in Mexico (n = 105), Peru (n = 91), and Colombia (n = 35), whereas 13% (n = 44, mean [SD] = 6 [3.32]) were in the 7 Central American countries combined (Appendix A).

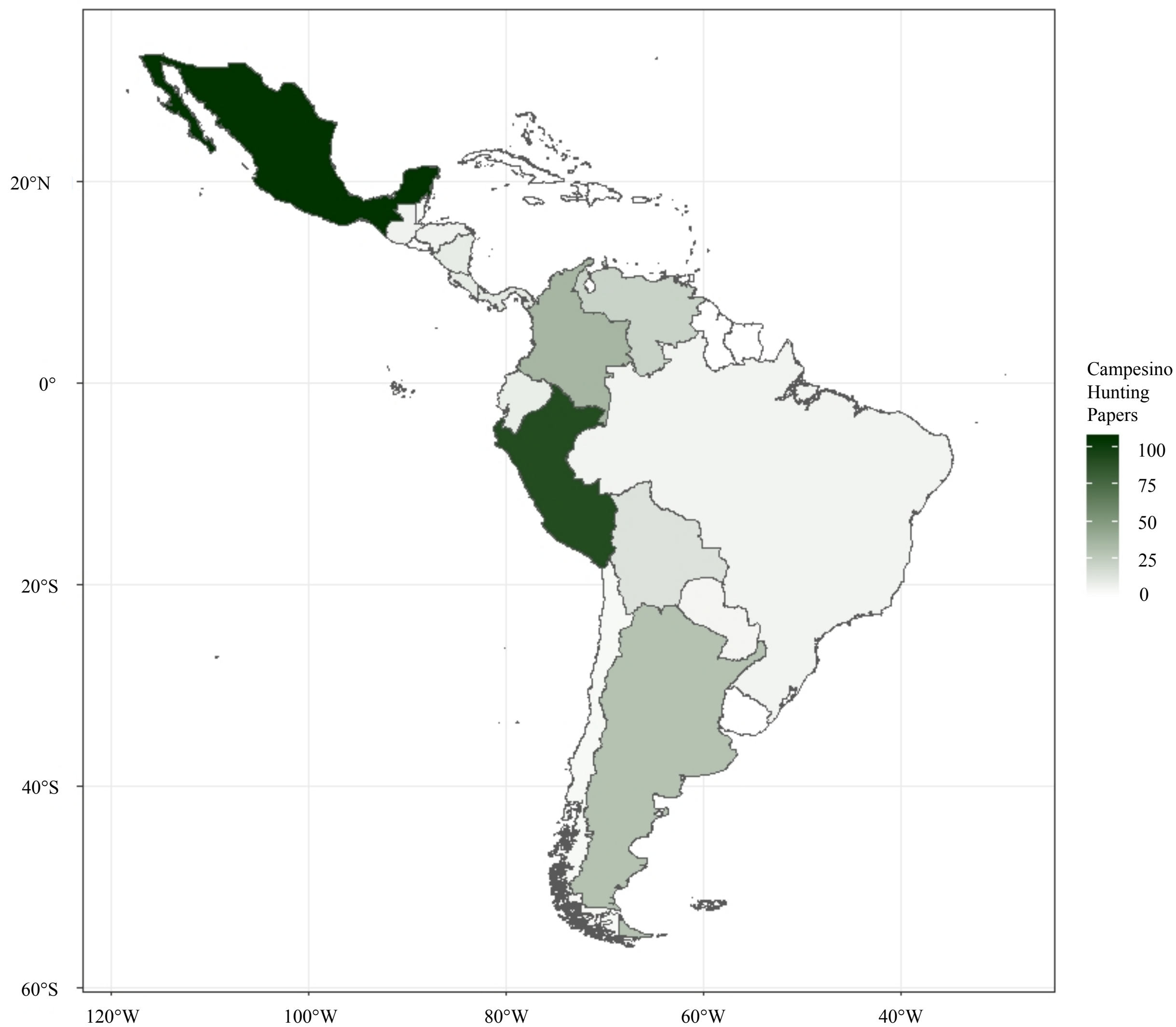


Figure 2.2 Geographic distribution of 334 peer-reviewed articles *(n* = 266), book chapters (*n* = 43), gray-literature publications (*n* = 23, e.g., conference proceedings), and monographs (*n* = 2) on campesino hunting in Latin America published from 1937 to 2018.

We found studies representing all major ecosystem types (METs) and major habitat types (MHTs) in Latin America and the Caribbean (Table 2.3). Although the number of METs was a strong predictor of MHTs per study ($R^2 = 0.80$, $p < 0.001$), most studies were restricted to 1 MET (*n* = 245) and MHT (*n* = 209); 141 (42%) were exclusively located in tropical moist broadleaf forests and 44 (13%) were exclusively situated in more critically endangered tropical dry broadleaf forests. Only 4 studies (1%) took place in highly threatened xeric habitats, such as Mediterranean scrub and restingas (Table 2.3). Approximately 8% of authors did not include sufficient detail to identify METS or MHTs.

Table 2.3 Rank of major ecosystem types (METs) and major habitat types (MHTs) in 334 studies of campesino hunting published from 1937 to 2018.

Rank	MET, other category	MHT, other category	No. of studies[a] per MHT	Studies with ≥2 MHTs per MET	Total studies per MET[a]
1	tropical broadleaf forest	tropical moist broadleaf forest,	215	46	272
		tropical dry broadleaf forest	103		
2	grasslands, savannas, shrublands	grasslands, savannas, and shrublands	53	13	69
		flooded grasslands	19		
		montane grasslands	15		
3	Undetermined or urban[b]	agricultural	8	3	52
		Amazon	4		
		forest	3		
		mountain	5		
		urban	34		
		Yucatán	1		
4	freshwater[b]	lakes or lagoons	24	4	45
		rivers	19		
		marshes	5		
5	conifer ortemperate broadleaf forest	tropical and subtropical coniferous forests	20	0	22
		temperate forests	2		
6	mangroves	mangroves	12	0	12
7	xeric formations	mediterranean scrub	1	0	7
		desert and xeric shrublands	3		
		restingas	3		

[a]Values are total number of studies that took place in each MET adjusted to count those with >1 vegetation type per ecosystem only once.
[b]Not included in Dinerstein et al.'s (1995) assessment (undetermined studies lacked sufficient detail to identify the ecosystem or vegetation cover beyond general assumptions).

We identified 30 study contexts. The number of studies per context varied statistically ($\chi^2 = 507.98$, df = 29, $n = 334$, $p < 0.001$); 42% of studies centered on the conservation and management of specific taxonomic groups or species (20%), PA management and conservation (13%), or human-wildlife relationships (9%) (Appendix A). All remaining contexts individually comprised <6% of studies each. In 38% of publications, study areas spanned 156 PAs in 14 countries – mostly Peru (42%) and Mexico (25%) (Appendix A) – that represented 5 IUCN PA management categories and 20 international, national, and local designations across 23 research contexts. The PAs were more likely to be undesignated ($\chi^2 = 507.98$, df = 29, $n = 334$, $p < 0.001$) than designated (Appendix A). Studies in or near 142 PAs (91%) comprised 1-2 contexts per PA, mainly conservation program assessments or conservation and management of PAs or specific taxonomic groups ($\chi^2 = 479.33$, df = 22, $n = 199$, $p < 0.001$) (Appendix A).

Overall, nonindigenous campesinos were the target populations for more studies (88%) than indigenous campesinos (7%). One-third of studies ($n = 110$) incorporated other social groups such as government officials, noncampesino immigrants, and 75 indigenous groups (Appendix A). With respect to data collection, authors used 12 methods – 1-5 per paper (mean [SD] = 2 [0.84]) – to gather data from or about these groups (Appendix A). Four types of interviews ($n = 257$) and 3 types of surveys or questionnaires ($n = 111$) were the most common. However, the interviews and survey types were unspecified in 53% and 37% of cases (Appendix A). Methods such as participatory mapping (4%), focus groups (3%), and photography (e.g., camera traps) (2%) were significantly less common ($\chi^2 = 853.4$, df = 11, $n = 526$, $p < 0.001$) but more clearly defined. Sample sizes and units across studies ranged from 1 to 2919 individuals (mean [SD] = 150 [314]) and 1 to 806 households (140 [172]). Five study samples were presented as ranges of values and were excluded from analysis.

2.3.2. Campesino Hunting Drivers, Constraints, Conflicts, and Knowledge

Authors, campesinos, and other social groups in 307 studies (92%) identified 18 drivers and 14 constraints on campesino hunting (Table 2.4). They were more likely to only identify hunting drivers (89%) rather than both (31%) or constraints (3%) ($\chi^2 = 258.14$, df = 3, $n = 334$, $p < 0.001$) (Appendix A). Subsistence and income were the 2 most common drivers, whereas constraints primarily originated from state and PA hunting regulations, communal rules, and individual disinterest, disapproval, and desires to protect wildlife (Table 2.4). However, these constraints rarely triggered the 10 types of hunting conflict reported in 115 studies (34%), which mainly comprised conflicts with crop or livestock predators (68%) (Appendix A).

Table 2.4 Drivers and constraints of campesino hunting from 307 studies published from 1945 to 2018.

Hunting drivers and constraints	No. of studies
Drivers	
internally generated	
subsistence, dietary, taste, or nutritional preference	218
income (e.g., wildlife product sales, pet trade)	173
protect crops, livestock, and people	74
medicinal and veterinary purposes	63
obtain or feed household pets	54
household items (e.g., hides for chairs, cooking oil, trophies)	50
Entertainment, recreation, sport, or to resolve boredom	33
cultural celebrations, myths, and rituals	29
enact and reaffirm social bonds and roles	11
opportunistic or incidental hunting (e.g., hunting dogs pursue prey unprompted, animal found while working in fields)	7
assert hunting or land rights	2
lack of awareness of the effects of hunting	2
wildlife ranching and breeding	2
reduce competition with predators for hunted prey	1
externally generated	
outside market forces	5
limited infrastructure (e.g., employment, transportation)	4

Table 2.4 Continued

Hunting drivers and constraints	No. of studies
Drivers (continued)	
internally generated (continued)	
low enforcement	2
avoid guerrilla fighter presence by hunting	1
Constraints	
internally imposed	
individual disapproval of hunting, pride in local wildlife, or desire to protect wildlife	31
promote species reproduction or low wildlife abundance	24
lack of hunting tools (e.g., guns, ammunition, dogs) or means to preserve meat	15
limited time or labor	8
avoid physical or spiritual danger	4
lack of knowledge or experience with hunting or hunted species	4
fear of losing future financial benefits from wildlife (e.g., tourism revenue)	4
externally imposed	
local, national, or regional environmental regulations (e.g., protected area policies)	35
sociocultural or communal norms, beliefs, stigmas or prohibitions	33
Geographic or environmental barriers (e.g., travel distance, topography)	7
low or shifting market demands	6
avoid military or guerrilla fighter presence	4
species evasiveness or elusiveness	4
conservation programs	1

There were numerous references to and inferences drawn from LTK, whether or not they were recognized as such, to frame these drivers, constraints, and conflicts. Although just 9 studies were conducted in the context of LTK, 178 (53%) recorded or collected data through 10 identified themes of hunting LTK (Appendix A). Knowledge of wildlife population trends (38%) and their medicinal uses (35%) were the most referenced and solicited ($\chi^2 = 148.68$, df = 9, $n = 178$, $p < 0.001$) compared with fine-scale LTK such as species feeding ecology (10%) and reproductive potential (5%) (Appendix A). Most LTK themes focused on species-specific knowledge rather than the social and cultural contexts of campesino hunting.

2.3.3. Target Species and Hunting Sustainability

In total, 288 studies (86%) documented 799 species (53% birds) hunted by campesinos (Appendix A). Although the overall number of hunted taxonomic groups did not significantly vary across studies ($\chi^2 = 151.01$, df = 2, $n = 286$, $p = 1$), more studies exclusively ($n = 133$) documented hunted mammals than combinations of all other taxa ($\chi^2 = 875.95$, df = 14, $n = 288$, $p < 0.001$). Insects ($n = 59$ in 14 studies) and amphibians ($n = 14$ in 11 studies) were the least documented species. Nine studies did not report hunted animals to the species level. Most species (70%) were ranked as least concern ($n = 557$). Of the remainder, 13 were lower risk, 50 near threatened, 47 vulnerable, 24 endangered, 7 critically endangered, and 100 were unassessed (Appendix A). These taxonomic and status trends are reflected in the 25 most documented hunted species (Fig. 2.3).

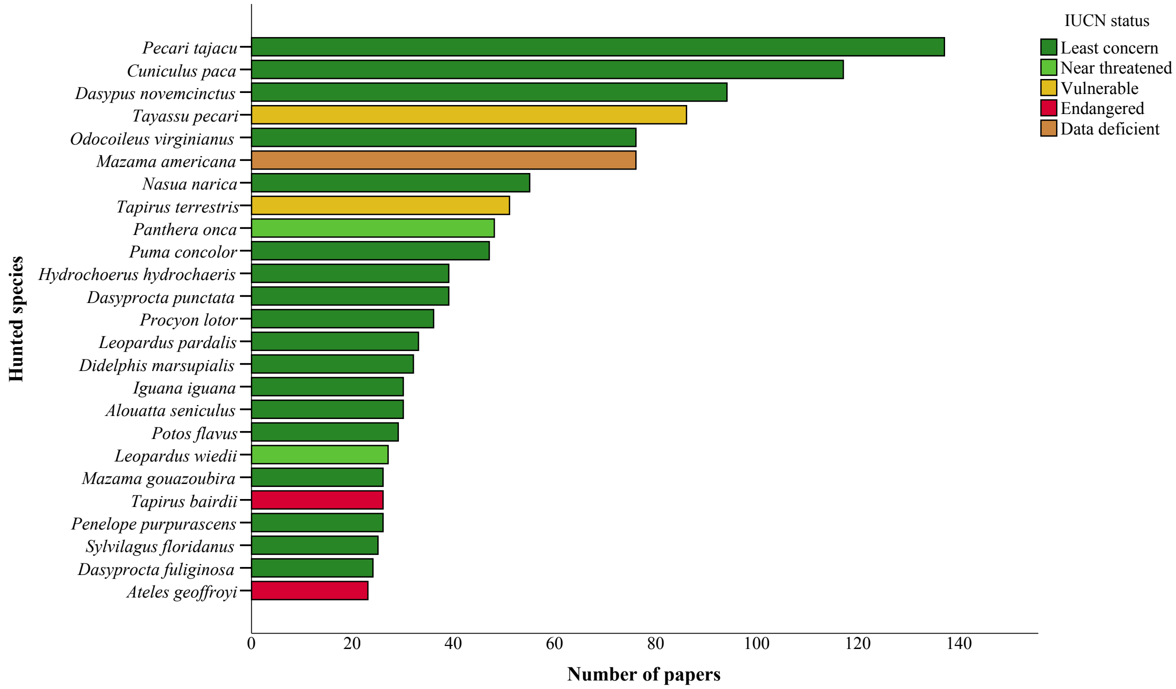


Figure 2.3 The 25 animals most reported as targets of campesino hunters in Latin America based on 334 peer-reviewed articles (*n* = 266), book chapters (*n* = 43), gray-literature publications (*n* = 23, e.g., conference proceedings), and monographs (*n* = 2) published from 1945 to 2017 and the species' 2018 International Union for Conservation of Nature (IUCN) status.

Only 51 studies (15%) reported campesino hunting as sustainable (*n* = 13), unsustainable (*n* = 18), or mixed, depending on the target species (*n* = 20). Twenty-six of these studies qualitatively inferred campesino hunting as mostly unsustainable (62%) or sustainable (31%). Conversely, 25 (8% of all studies) used quantitative sustainability assessments, such as population trend models, surplus production models, market indices, harvest rates over time, and cross-site comparisons. Eighteen quantitative assessments (90%) reported mixed results. Authors reported unsustainable hunting primarily with large-bodied, *k*-selected mammals with low reproductive rates, such as tapirs (*Tapirus* spp.) and primates (*Lagothrix* spp.). Conversely, small- to medium-sized *r*-selected species, including agoutis (*Dasyprocta* spp.) and pacas

(*Cuniculus paca*), were mostly hunted sustainably. Yet, results varied when authors tested different methods to assess sustainability within the same datasets or taxonomic families (e.g., *Cracidae*, *Psittacidae*, and *Tayassuidae*).

2.4. Discussion

In contrast with past overviews (Table 2.1), our review indicates campesino hunting scholarship is a diverse and relevant body of literature for conservation in Latin America. Nearly a century of literature spans multiple conservation contexts across 17 countries for multilingual scholars and audiences who are invested in conservation initiatives that affect the livelihoods of campesino and indigenous hunters alike. Despite these trends, citation rates are low, geographic scopes and methodological approaches are limited, research contexts are constrained, and sustainability assessments are few. We suggest several explanations for the patterns and gaps.

2.4.1. Campesino Hunting Publication Trends

Our database suggests that the salience and importance of campesino hunting research appear to be increasing. Most available nonindigenous hunting scholarship originated from Spanish- and Portuguese-language literature in Mexico and South America. In particular, research on wildlife management, trade, and conservation in the Peruvian and Brazilian Amazon inserted nonindigenous hunters (i.e., ribereños, mestizos, and caboclos) in the conservation discourse (Pierret and Dourojeanni 1967, Ayres and Ayres 1979), which contrasts with the emergence of the noble savage in international environmental discourse (Nygren 2006). The few campesino hunting sources available from this period provided the foundation for comparative Amazonian hunting reviews in the 1970s and 1980s within anthropology and conservation science (Ross 1978, Vickers 1984, Redford and Robinson 1987). These efforts paralleled novel research on the subsistence and cultural roles of hunting in campesino livelihoods (Torres et al. 1985, Mellink et al. 1986) and their implications for the management of specific taxonomic groups preferred by campesinos (Bodmer et al. 1988). Increasing publication and citation rates in the last 3 decades coincided with seminal interdisciplinary works on wildlife hunting and management from 1990 onward (Robinson and Redford 1991, Robinson and Bennett 2000, Silvius et al. 2004) – many of which were published in English-language books and journals, notably *Biological Conservation* and *Conservation Biology*. English-language studies appeared to have the largest scholarly impact, even though they accounted for a slim majority of campesino hunting publications. However, the interdisciplinarity of campesino hunting research is counterbalanced by restricted scopes, demographics, contexts, and methodologies – all of which likely explain the low citation rates.

Our findings are similar to other reviews and compendiums on Latin American hunting and ethnobiology in that most studies occurred in Mexico and Peru (Table 2.1) (Albuquerque et al. 2013). Several interrelated reasons and limitations clarify this trend. First, the current distribution of campesino hunting research reflected its scholarly roots and traditions in these countries (Pierret and Dourojeanni 1967, Mellink et al. 1986). Second, the predominance of literature in Mexican and Peruvian tropical moist broadleaf forests paralleled the interwoven demographic histories in these landscapes. The high number of Mayan studies came from use of the term *campesino* by Mayan and mestizo communities in Mexican rainforests coupled with an established body of ethnobiological literature comparing these groups (Naranjo et al. 2004a). Similarly, ribereño and Cocama-Cocamilla peoples in the Peruvian Amazon share the same forests, wildlife, and, increasingly, the same cultural and economic practices (Chibnik 1991).

Third, our selection criteria excluded 103 hunting studies in Brazilian ecoregions (e.g., cerrado and caatinga), where the word *campesino* was not applied to the study samples. With respect to Brazil, the uncertainties and contradictions of Brazilian hunting legislation likely restricted the availability of research; rural hunters are legally vulnerable and may be unwilling to contribute to research (Antunes et al. 2019). In contrast, Peruvian campesinos are afforded clearer legal hunting protections, which may promote engagement with researchers (Shanee 2012). Therefore, these limitations are also findings in that our broad search criteria found 2-4 times as many Brazilian rural hunting studies than past reviewers (Albuquerque et al. 2013, Fernandes-Ferreira and Alves 2017), meaning that wider inclusion criteria and cross-sectoral collaborations could provide more comprehensive geographic and chronological pictures of campesino hunting in Latin America.

The emphasis on these countries and ecosystems, however, has disproportionately minimized campesino hunting research in rare and underprotected ecoregions. Xeric formations are some of the rarest and most endangered habitats in Latin America and are therefore highly susceptible to hunting pressures (Dinerstein et al. 1995). Altrichter (2006) found that campesino hunting contributes to local livelihoods and increases pressures on the endangered Argentine Chaco, which led to work on indigenous and campesino hunting cultures (Camino et al. 2018). Thus, the urgency of campesino hunting pressure advanced new culturally rooted research and conservation implications in a priority ecoregion. Hunting pressures are also mediated by sociopolitical contexts. For example, the Mesoamerican biodiversity hotspot has a long history of civil conflicts that affected the contexts and efficacy of conservation with campesino hunters. Nicaraguan campesinos stopped hunting during the Sandinista Revolution and Contra Conflict to avoid being mistaken as enemy combatants, which is presumed to have promoted the recovery of overhunted wildlife (Nietschmann 1990). These examples show how research in these understudied ecoregions, however scant, yielded insights about campesino hunting dynamics.

Furthermore, regional biases may have restricted research contexts and methodologies. Mexico and Peru are megadiversity countries with high linguistic endemism, expansive regulatory structures, and exemplary PA networks governing 2-3 biodiversity hotspots each (Toledo 2001). In these regions, PAs thus have the high potential to address problems affecting some of the most vulnerable demographics, species, and ecosystems in Latin America with which campesinos intersect. However, multiple stressors act together to magnify the urgency of effective hunting research and management in Latin American PAs, including population growth, habitat loss, unchecked hunting inside park boundaries, and inadequate PA coverage in highly threatened regions combined with weak enforcement and funding (Benítez-López et al. 2017, Di Minin et al. 2019, Suarez and Zapata-Ríos 2019). In turn, PA research in these countries presented ways to counterbalance these trends and examine environmental discourse about campesinos (Doane 2007) through the creation and expansion of PA designations and management tools for and by campesinos (Shanee et al. 2015 Oliva and Montiel 2016). Although <40% of papers included PAs, our review supports this trend in that most studies within the top 3 research contexts were relevant to or took place in or near at least 1 of 156 mostly undesignated PAs primarily in these countries.

In turn, the presence or absence of designations may have influenced the social and political complexities of PA management and therefore the type of research conducted with campesinos. For example, Bodmer et al. (2000) used hunting registries and transects to assess spatial, seasonal, and taxonomic variations in sustainable hunting to inform conservation in the designated Pacaya-Samiria National Reserve in northeastern Peru. In the same region, ethnographic methods (key-informant interviews and participant observation) revealed that campesinos enacted communal rules in undesignated conservation concessions and private PAs to control hunting (Shanee et al. 2015), which aligned with Bodmer et al.'s (2000) recommendation for Pacaya-Samiria. This example signals the value of the use of diverse methods to access campesino hunting across contexts and settings, even in the same region of the same country.

Methodological diversity alone does not infer diverse objectives or hunters' transparency. Whereas conservation biologists often combined interviews with linear transects and hunting records, conservation social scientists largely coupled interviews with focus groups, participant observation, and other participatory methods (Appendix A). Although both approaches provided geographic, historical, and sociocultural insights about hunting for the study populations (Montero 2004), most study contexts motivated researchers to gather individual and household-level insights about species or taxonomic groups, habitat differences, game preferences, sustainability, or livelihood choices. Moreover, researchers often collected legally sensitive hunting data that emerged from larger objectives, such as assessing campesinos' livelihood profiles (Loaiza et al. 2015). The scales, objectives, and institutional contexts of data collection may therefore explain variations in reported hunting frequencies (2-83%) and household income (0.04-7%) from hunting (Altrichter 2006, Gray et al. 2015, Loaiza et al. 2015, Coomes et al. 2016), particularly depending on campesinos' perceptions of researchers' intent. From this standpoint, expanded interdisciplinary methods, objectives, and human-subject protections could strengthen participation to reveal context-dependent dynamics of campesino hunting at multiple scales (e.g., Jones et al. 2019).

2.4.2. Campesino Hunting Drivers, Constraints, Conflicts, and Knowledge

We found that most campesino hunting drivers, constraints, and conflicts were broadly ascribed to subsistence or income. Given that both strategies were adopted to maintain quality livelihoods, the lines between these categories were as blurry as the hunters' identities (Ojasti 2000). Context-specific meanings and motivations attached to hunting further complicate this dichotomy. Thus, simply characterizing hunting as subsistence- or income-based overlooks important details about their underlying motivations, constraints, and knowledge.

The third most cited motivation for campesino hunters was protecting crops, livestock, and people. Yet, this driver was informed by contextual concerns and cultural expectations associated with subsistence, income, personal safety, and human-wildlife conflicts. For example, Peruvian ribereños and Mexican campesinos noted they preemptively hunted felids to avoid or retaliate for losses of livestock, poultry, and human life (Naughton-Treves 2002, Garcia-Alaniz et al. 2010). Additional social and cultural expectations for hunting these species accompanied this discourse, including communal aims to exterminate predators (Camino et al. 2018). Many of these same studies recorded that campesinos secondarily sold predator pelts to supplement lost incomes or used them for household ornaments (Garcia-Alaniz et al. 2010). Therefore, while crop and livestock protection was a generalized driver and conflict for campesino hunters, it was mediated by a multilayered and entangled spectrum of underlying motivations to hunt.

Our review similarly revealed a smaller yet equally complex web of constraints on campesino hunters. Unlike most reported hunting drivers, reported constraints were both internally and externally imposed by the sociopolitical and environmental circumstances of hunting. Of note are the large number of studies that documented campesinos' reported disinterest and opposition to hunting on ethical, religious, or ecological grounds (Shanee 2013).

Conversely, others identified constraints from military conflicts, communal norms, and state hunting regulations occurring independent of, adjacent to, and within PAs (Ruiz-Serna 2003). Although these constraints may seem disparate, the study communities were all associated with conservation initiatives in the forms of an environmental NGO presence, multiple types of PAs, or active enforcement of environmental policies. This recurring theme indicates that decades of conservation discourse and enforcement are potentially shifting campesino communities away from hunting, which is reinforced as campesinos cast hunting aside to pursue other livelihood alternatives, such as agriculture (Gray et al. 2015, Coomes et al. 2016).

Despite the many reported campesino hunting drivers, conflicts, and constraints, all 3 were interlinked by LTK. Although helpful for assessing the status of wildlife populations, LTK also captured campesinos' hunting experiences, knowledge, and cultural norms. Understanding medicinal LTK from campesinos was a way to include local communities in management considerations for San Guillermo Biosphere Reserve, Argentina (Hernandez et al. 2015). Cosmological beliefs guide campesino hunters' targets and strategies in La Macarena National Natural Park in Colombia, such as putting crosses on weapons and ammunition for protection against enchanted animals (Ruiz-Serna 2015). Although most authors drew from some form of campesino hunting LTK to inform their results, many did not recognize this information as LTK or set out to document it. Several included claims that campesinos lack environmental knowledge and ethics. In turn, research trends suggest that the invisibility of the many social drivers of hunting, their entanglement with hunting conflicts, observed livelihood and perceptual shifts away from hunting, and the targeted elicitation of LTK on wildlife population trends are likely occurring at the expense or loss of broader campesino hunting LTK.

2.4.3. Target Species and Hunting Sustainability

Unacknowledged or lost campesino LTK is a concern for campesino communities and conservation programs and denies conservationists insights into the targets and sustainability of campesino hunting. We found that campesinos hunt a wider diversity of species than documented in previous studies (Redford and Robinson 1987, Ojasti 2000, Stafford et al. 2017). Campesinos mostly preferred mammals, birds, and reptiles of least conservation concern, a finding that is consistent with other hunting or human-wildlife conflict reviews in the Neotropics that included campesino populations (Table 2.1) (Torres et al. 2018). Importantly, quantified sustainability assessments have not kept pace with this diversity, which highlights an urgent concern for conservation.

Sustainable hunting is complex because its bridges biological, social, economic, political, cultural, and institutional domains (Bennett and Robinson 2000); the first domain alone is subject to >20 sustainability indicators (Weinbaum et al. 2013). We believe the unmeasured claims of unsustainable campesino hunting were founded, amidst this complexity, on conservation's precautionary principle. Indeed, several authors also highlighted the challenges of obtaining reproduction data on remote wildlife and harvest rates from marginalized campesinos as potential barriers to accurate sustainability assessments within this group (Moure 2003). Authors often drew from years, if not decades, of experience with communities to make these claims. This experience is crucial to accurate sustainability assessments whether in the absence of verifiable data on reproductive, spatial, or age distributions of hunted species or hunting patterns and techniques, knowledge, frequencies, and sociocultural roles. However, quantified sustainability indices are valuable tools for tailoring conservation and management strategies to individual species that depend on input and participation from hunters. They can also support efforts to address hunting among individual communities. Our results suggest that research and management with campesino hunters would benefit from increased application of sustainability indices. In particular, such indices and other forms of harvest data, even with their respective limitations (Weinbaum et al. 2013), can help researchers and campesinos themselves avert assumptions and conflicts about campesinos hunting through communal norms and regulations (Oliva et al. 2014, Shanee et al. 2015).

2.4.4. Moving Forward

Our review of campesino hunting scholarship showed it is a widespread topic that runs throughout Latin American conservation, even when these practices are invisible to conservationists' gaze. Although this suggests campesinos are conservation gatekeepers across threatened ecoregions, it also seems that many conservationists studied campesinos to understand hunting rather than hunting to understand campesinos. This indicates that conservationists of all disciplines could expand campesino hunting scholarship beyond these predetermined boundaries by shifting this perspective. Such a shift requires in-depth interactions with campesino hunters who are directly and indirectly connected with conservation. It also demands new strategies for understanding illegal hunting and its sustainability built on reformulated narratives about the drivers, identities, and descriptions of campesino hunting. Although this trend is changing, most interpretations of campesino hunting culture were published in Spanish-language journals, such as *Etnobiología*, and therefore are potentially inaccessible to an English-speaking audience.

We suggest campesino hunting represents a transboundary and interdisciplinary field that is relevant across Latin America, and we recommend scholars use collaborative methods to situate their work within campesino hunting contexts and cultures. Participatory methods, such as community mapping and participant photography, offer otherwise inaccessible contextual details about the motivations, techniques, habitat preferences, and targets of campesino hunters. Both methods also present tools for accessing potentially unrecognized and eroding LTK tied to campesino hunting. In these ways, collaborative approaches act as bridges between conservation biologists, social scientists, and campesinos. Moreover, such collaborations could expand funding, foster research networks, and pool resources to assess, rather than infer, sustainability trends. We suggest scholars use evidence rather than expectations to characterize campesino hunters and their sustainability. Our aim is not to redirect over half a century of progress towards indigenous hunting rights and inclusion in natural resource decision making. Rather, we recommend greater consideration of other marginalized and disenfranchised groups and their relevance to conservation.

3. CULTURAL MEANINGS AND SHARED KNOWLEDGE FROM CAMPESINO HUNTING IN NICARAGUA

3.1. Introduction

Over the past 60 years, biologists and wildlife managers have documented a diversity of effects from hunting by indigenous and nonindigenous groups in Latin America (Leopold 1959, Pierret and Dourojeanni 1966, Vickers 1984, 1988, Silvius et al. 2004, Bodmer et al. 2018). Through a biological lens, factors such as harvest rates, relative abundance, harvested biomass, and intrinsic rate of increase (r_{max}) largely guide researchers' and natural resource managers' hunting assessments (Robinson and Redford 1991, Bodmer 1995, Robinson and Bennett 2000, Weinbaum et al. 2013). Although such metrics have inherent limitations, they have extensive, replicable, and verifiable merit for evaluating the sustainability of hunting (Robinson and Redford 1991, Weinbaum et al. 2013, van Vliet et al. 2015). Yet real world applications of these measures, largely through community-based conservation initiatives, protected areas management, and behavioral interventions, are often inadequate and incomplete without an understanding of the social and cultural meanings, motivations, and roles of hunting (van Vliet et al. 2015, Chausson et al. 2019, Dobson et al. 2019).

Through a social lens, results from decades of research have indicated that "culture" (e.g., shared values, beliefs, rituals, and worldviews) shapes why indigenous and nonindigenous groups hunt, how they hunt, and their prey preferences (Bennett 1959, Redford and Robinson 1987, Koster 2009, Ruiz-Serna 2015). While scholars often ascribe these cultural differences to hunters' ethnicities as either indigenous (e.g., Kayapó, Maya, Siona-Secoya, Waoroni) or nonindigenous (e.g., mestizo/mestiço, ribereño/ribeirinho, caboclo, caiçara), a growing number of authors have found that ethnicity or indigenous affiliation does not alone explain the preferences or sustainability of hunting patterns among these groups (Jerozolimski and Peres 2010, Morsello et al. 2015). Indeed, the indigenous and nonindigenous distinction often overlooks the important reality that both groups commonly belong to the *campesino* social class (Sexton 1985, Boyer 2003, Müller-Schwarze 2015), and therefore comprise the largest users of wildlife in Latin America (Ojasti 1996, 2000). Campesino hunters have therefore been of growing importance to conservation for decades (Ojasti 1996, 2000, Petriello and Stronza 2020). Yet we still know relatively little about what hunting means to campesinos and how or why hunting is part of their cultural identity beyond the indigenous-nonindigenous divide.

Three persistent research trends appear to impede scholarly understanding of campesino hunting cultures. First, conservation scholars often overlook the cultural significance and meanings of *campesino* hunting precisely because "culture" is often associated with indigenous beliefs and traditions rather than hunters' shared livelihoods and identities as campesinos (Montero 2004, Ruiz-Serna 2015). Second, studies with campesinos and similar rural hunters tend to comprise <25% of studies that inform most comparative hunting reviews and compendiums by biologists and anthropologists alike (see Table 1 in Petriello and Stronza 2020). Third, many authors appear to study campesino hunting to assess its implications in regions of conservation concern rather than study campesino hunting to understand its cultural meanings across Latin America (Petriello and Stronza 2020). Indeed, most of our understanding of the social, economic, and cultural roles of hunting in campesino livelihoods center on regions with either large indigenous populations, endangered ecosystems, or protected areas, such as river-dwelling Peruvian *ribereños* in the Amazon and Mayan and mestizo campesinos in Mexico (Bodmer et al. 1997, Naranjo et al. 2004a, Toledo et al. 2008, Coomes et al. 2016). These trends indicate that scholars aim to redress decades of discrimination against indigenous peoples, account for indigenous rights to autonomy and self-determination, and emphasize priority conservation regions. Nonetheless, they also privilege select components of campesinos' cultural identities and geographies, which risks separating the conservation implications of campesino hunting from its broader cultural and regional importance. In turn, biologists and anthropologists have called for increased multidisciplinary and geographic engagement with campesino hunting cultures to address these concerns (Montiel Ortega 1999, Altrichter 2006, Ruiz-Serna 2015, Petriello and Stronza 2020).

We aimed to advance this area of research by focusing an ethnographic lens on a Nicaraguan campesino community to understand what hunting means to campesinos and the conservationists that work with them. First, we present a synopsis of campesino identity, its conflicted relationship with conservation, and campesino hunting in Nicaragua . Second, we provide a brief review of the evolution of campesino hunting studies, and the reported indigenous *and* nonindigenous cultural roles of hunting among Latin American campesino communities, to set the stage for the study findings. Third, we present results from 11-months of ethnographic fieldwork in a Nicaraguan campesino community to answer the following questions: 1) How do perceptions and practices of hunting connect to campesino identity and culture? 2) What does hunting and being a hunter mean to campesinos and the NGO workers with whom they interact? And 3) How are these meanings and motivations conflicting and complementary?

3.1.1. Campesinos and Conservation

Campesinos are considered "person[s] of the *campo* [Latin American agricultural countryside]" (Loker 1996:70) whose cultures and resource uses are the products of their relationships with the environment, agriculture, markets, and politics (Wolf 1955, Brass 2003, Ploeg 2009). However, the term "peasant" is often used reductively to label ethnically diverse rural peoples who live and work in the *campo* (Loker 1996, Kearney 1996). Campesino is not an ethnic identity; "a *campesino* could be white, mestizo, Indian, or even a foreign immigrant" (Becker 2014). Instead, it serves as a distinct cultural and nationalistic identifier tending to be constructed from a variety of state politics, local economic struggles, and environmental relations (Boyer 2003, Brass 2003, Lederach 2017). For example, riverine campesinos in Peru and pastoral campesinos in Argentina identify as *ribereños* and *criollos*, respectively (Chibnik 1991, Camino et al. 2018). Despite these distinctions, campesino identities across Latin America are place-based in that they are united by their shared agrarian livelihoods in the c*ampo*.

Many factors shape how campesino identity and culture are perceived and used by rural residents, policymakers, and NGOs in conservation. Campesinos have leveraged their historically marginalized identities for political power and group autonomy in protected areas management and community-based conservation (Simonian 1995, Haenn 1999, 2016, Shanee 2013). However, those identities tend to be filtered through conservation actors with more social and political power. For example, NGOs and media outlets such as *National Geographic* have selectively portrayed campesinos as ecological saviors or ignoble agriculturalists to align with environmental narratives or secure institutional and financial support (Nygren 2006, Doane 2007, Haenn 2016). Mesoamerican scholars have observed that policymakers, urbanites, and scholars have characterized campesinos as poor "uneducated forest destroyers" (Nygren 2000a:

24) who are “short-sighted abusers of biological resources” (Loker 1996:76) “with no respect for the law” (Nygren 2000b:145). Therefore, campesino identities, cultures, and resource use practices in conservation are often products of conservation discourse rather than campesinos lived experiences.

Perceptions and interactions with campesinos in conservation are important because campesinos are likely the largest group of rural residents in Latin America (Loker 1996). As such, conservationists, researchers, and decision-makers are by far more likely to overlap or collaborate with locals who identify as members of this social class. For example, lands in Mexico, Bolivia, Peru, and other countries are granted protective statuses of the community identifies as campesino (Simonian 1995, Orlove 2002). Campesino rights movements like Campesino-a-Campesino and La Vía Campesina are promoting community rights and sovereignty for healthy air, water, and food in environments of conservation concern (Hawkesworth and Pérez 2003, Claeys 2015). Moreover, campesinos are subject to consistent conservation attention – an arena where even the meanings of *being* campesino are often contested (Haenn 2016) – given their ties with agricultural landscapes. Many of these efforts also tend to overlap with or draw from the knowledge and experiences of campesino participants, many of whom are likely to be hunters given that campesinos are the most numerous hunters in Latin America (Ojasti 1996, 2000).

3.1.2. Campesino Hunting Scholarship in the Margins of Conservation

The cultures and identities of campesinos and other nonindigenous rural hunters, including illegal hunters, have been relatively ignored in anthropological research in conservation (Nygren 1999, Boglioli 2000, 2009, Duffy et al. 2016). There are several reasons and implications for this pattern. First, the terms “culture”, “sustainability”, and “conservation” are often equated with indigenous beliefs because of the ecologically noble savage myth (Redford 1991, Hames 2007). This perspective pushed studies of *campesino* hunting culture to the fringes of hunting and conservation scholarship – a trend that continues to date. Second, detailed ethnographic accounts of campesino hunting cultures have mostly been published in Spanish language journals and technical reports (but see Ruiz-Serna 2015). Although such Spanish language studies are indispensable for conservation in Latin America, they are potentially unknown or inaccessible to scholars outside of the region. In turn, their contributions to work with campesinos and similar rural populations may be limited, such as challenging assumptions with campesino hunters in conservation discourse and planning (e.g., Montero 2004, Ruiz-Serna 2015). For example, Naidoo and Ricketts (2006), in the absence of campesino hunting data, cited Hill et al. (2003) to base part of their ecosystem services model on the “speculation that poaching by campesinos is…resulting in the depletion of certain species” (2156). Third, others have found that minimal data about campesino hunting and its culture promote conflicts in conservation (Oliva et al. 2014), particularly for a population that is often narrowly perceived as cultureless, uneducated, and poverty-driven environmental destroyers (Montero 2004).

In sum, the cumulative longstanding effects of the “ecologically noble savage” legacy, restricted intellectual and regional interest in campesino hunting culture, stereotypes about campesino livelihoods and hunting, and conflicts emerging from such assumptions about this social group have pushed campesinos to the margins of hunting scholarship. To overcome potential biases and avert hunting conflicts, scholars can turn to imperceptible cultural and cognitive components of hunting to demonstrate their roles in economically, ethnically, regionally, and religiously diverse campesino communities.

3.1.3. Campesinos and Hunting in Nicaragua

Hunting scholarship with Nicaraguan campesinos is rare; only 9 of 334 campesino hunting studies (3%) from 1937 to 2018 took place in Nicaragua (Petriello and Stronza 2020). Of those 9 studies, only 1 took place in the critically endangered tropical dry forests on Nicaragua's pacific slope (Otterstrom 2001). Through ethnographic interviews and participant observation, she found that campesino hunting in the Río Escalante-Chacocente Wildlife Refuge was culturally a gendered activity (mostly men and boys hunted). Hunters used fires, machetes, slingshots, firearms, and dogs to hunt a variety of species. Based on these trends, and the high presence of hunting dogs (84% of homes had dogs), Otterstrom (2001) estimated that hunting occurred in 50% of households. Moreover, hunting was culturally motivated by "historical precedence and the current market forces that place a cash value on wildlife, dead or alive" (Otterstrom 2001: 23). Conservationists, ecotourism operators, and service industry employees in the Rivas Department rank hunting and the pet trade as the most prominent threats to biodiversity (Hunt 2009).

We chose to conduct fieldwork in El Pizotero (a pseudonym to maintain community members' and hunters' anonymity) – a small community located in Cárdenas municipality in the Rivas Department of Nicaragua. The Rivas Department (Fig. 3.1) is a 2,161.82 km^2 stretch of land between Lake Nicaragua and the Pacific Ocean that borders Costa Rica (INIDE 2011). Most of Nicaragua's Paso del Istmo Biological Corridor, a core conservation region in Central America, is in Rivas (Paso Pacífico 2006). The landscape is a mix of agricultural areas, cattle pastures, urban centers, and ecotourism destinations in Central America's critically endangered tropical dry forest fragments (Dinerstein et al. 1995). It holds the highest concentration of rural residents (51%) in the Pacific region (INIDE 2011). Most residents are campesino farmers, pastoralists, and artisanal fishermen. Fewer than 10% belong to twelve indigenous groups, mostly the Nahoa-Nicaroa.

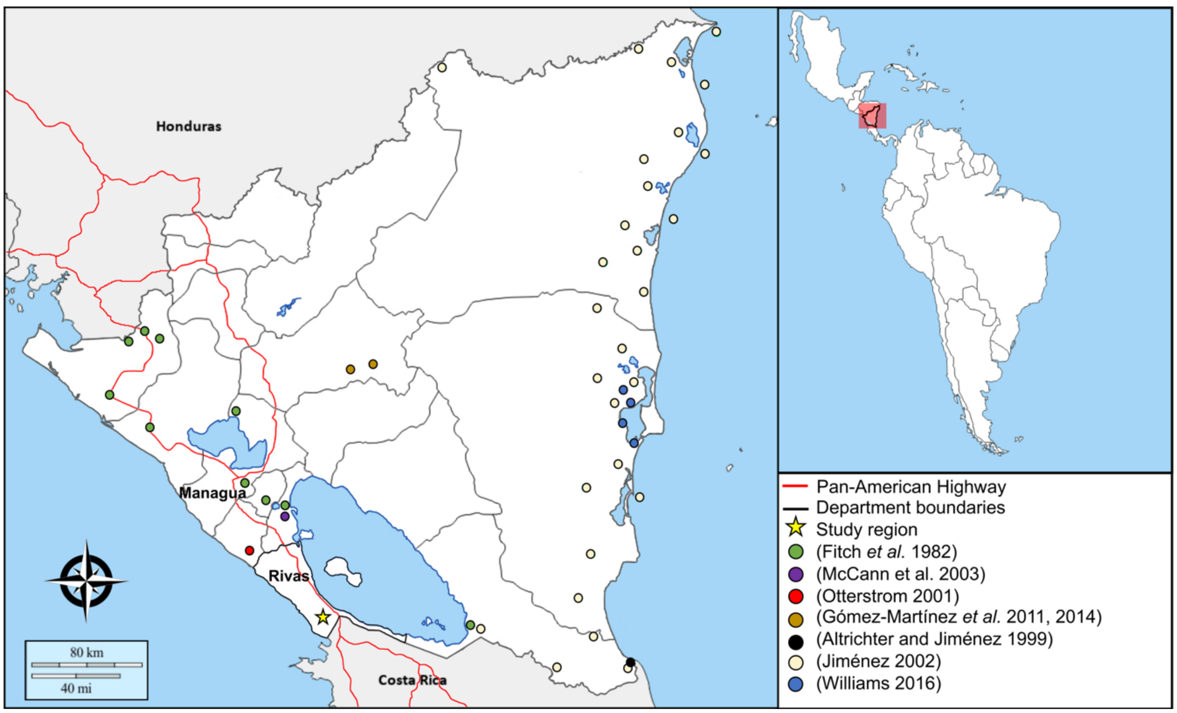


Figure 3.1 Study site location in southwestern Nicaragua compared to the locations from 8 campesino hunting studies (1982-2016) demarcated by departments (black lines) in Nicaragua.
*Source maps from https://d-maps.com/carte.php?num_car=27016&lang=en and https://d-maps.com/pays.php?num_pay=299&lang=en).

In this region, conservation programs directly and indirectly restrict hunting at multiple scales. For example, the administration of President Daniel Ortega Saavedra actively works with El Pizotero campesinos through their Citizen Power Councils (*Consejo de Poder Ciudadano*, CPC) – local branches of the Ortega government that are run by community members "to allow the Nicaraguan people of the different social sectors of the country to exercise Participatory and Direct Democracy" (Bay-Meyer 2013:403) – that promote an array of environmental projects such as trash cleanups, water reclamation projects, and other infrastructural improvements (MAP, *personal observation*). In addition, climate mitigation and reforestation projects aim to reduce hunting in "Private Protected Areas" and in participating campesinos' lands (Otterstrom et al. 2007). The programs focus on landscape-level conservation to minimize hunting across the isthmus, expand environmental awareness, and foster alternative livelihood strategies in place of hunting. They also add to a number of regional environmental education programs that seek to "raise hunters' awareness" about the threats of their actions (Fundación Cocibolca 2010).

Regionally, El Pizotero is less than 50 km from four protected areas in any direction, including Chacocente Wildlife Refuge to the north, Guanacaste National Park to the south, and La Flor Wildlife Refuge to the west. The closest of the four is the recently established 120-acre Mono Bayo Wildlife Reserve (MBWR) to the east. In 2017, Paso Pacífico, a regional NGO, established MBWR nearly 2 km from El Pizotero (Paso Pacífico 2017) where hunting is strongly discouraged through signage and park guards (Fig. 3.2a). As of 2016, NGO employees began to monitor the property's periphery for hunting activity. Within the community, three largescale farms actively restrict hunting through signs and caretakers (Fig. 3.2b, c). Some residents perceive National Guard troops, who patrol main roads for undocumented immigrants, and NGO workers as hunting deterrents or signs of government corruption, such as illegal hunting by park and military personnel (e.g., Weaver et al. 2003). This is because unlicensed hunting and hunting inside Nicaragua's 76 protected areas are prohibited yet common (Decreto 9-96 1996, Weaver et al. 2003), holding a penalty of 100 days to eight years in prison (Manzanarez 2012). Many local campesinos empathize with hunters given their share experiences of need and poverty, and shared memories of conflict with the conservation community. These issues serve to rally mixed opinions for local hunting, even among non-hunters.

(a) Local protected area sign that reads "The yellow-naped parrot (*Amazona auropalliata*) is in danger of disappearing. You can save it. Report hunters".

(b) "No hunting" sign on a private farm with a machete hole on the top left.

(c) "No hunting" sign posted on the lead researcher's cabin inside a private farm.

Figure 3.2 "No hunting" signs on protected area and farm property in southwestern Nicaragua.

3.2. Campesino Hunting and Its Culture in Latin America

Delete Campesino hunting culture has not been a targeted area of inquiry for conservationists in general. To date, scholarly understanding of campesino hunting cultures is based on a limited and disparate body of literature that often incidentally references the topic through an array of disciplinarily and chronologically distinct lenses. Indeed, nearly all of the available reviews of different facets of campesino hunting – including those that compare it to indigenous hunting practices - focus on its biological sustainability and wildlife management implications (Leopold 1959, Ojasti 1996, 2000). Although the idea that culture is infused into and expressed from campesino hunting practices is not new (Robinson and Redford 1987, Ruiz-

Serna 2015), there are no targeted reviews of the cultural meanings underlying campesino hunting across Latin America. Here, we present a brief chronological overview of research on the culture of campesino hunting.

Hunting has been shown to be a key component of campesino culture since the first ethnography of a Latin American peasant community (Redfield and Villa Rojas 1934). In this seminal study, the authors do not use the term campesino to describe the Mayan residents of Chan Kom; instead, they label the town a “peasant village” that is “like peasant villages everywhere, rather than like the truly primitive community of tribesman” (67). Sprinkled throughout their detailed description of Chan Kom are accounts of the economic, social, and cosmological roles hunting played in this community. Redfield and Villa Rojas (1934) payed detailed attention to the social importance of hunting in various forms ranging from the importance of group hunting to maintaining social bonds, the medicinal or curative uses of animals (e.g., bones from agouti heads in amulets), and the spiritual and cosmological beliefs underlying hunting (e.g., offerings to saints and prayers to forest spirits to protect and provide deer to hunt). Other scholars in this time period identified hunting as a point of confusion for conceptualizing mestizo Gaucho identity in the Argentine pampas (Nichols 1937). Although these works were not exclusively focused on campesino hunting or situated in a structured theoretical framework, they informed a foundation for scholarly inquiry on this topic in anthropology and conservation. In particular, Redfield and Villa Rojas (1934) contributed to a growing and longstanding body of literature about hunting among the Maya in Mexico (Jorgenson 1995, Ramírez-Barajas and Calmé 2015).

The geographer Camilo Branchi (1945) wrote a description of his experience with hunting in southern Mexico, which began from an encounter with an individual on a train to

Chiapas who told him “Don’t be afraid – We have a puma on the train” (143). From there, he outlined his reunion with mestizo hunters in Chiapas that invited him on a jaguar (*Panthera onca*) hunting trip. His description highlighted the hunters’ uses of a cage and dogs, accompanied with their local knowledge and beliefs about jaguars and pumas (*Puma concolor*), such as the belief that pumas prefer to consume the flesh of indigenous people. Similar to Redfield and Villa Rojas (1934), Branchi (1945) situated the social importance of campesino (mestizo) hunting in the cultural practices and historical legacies of the indigenous Maya. These studies echoed the trend to associate ‘culture’ with ‘indigeneity’ in anthropology and conservation, which later developed into the ecologically noble savage hypothesis (Redford 1991, Alvard 1993, Hames 2007).

Expanding this perspective, geographer Charles Bennett (1959), in what appears to be one of the first cross-cultural hunting studies available for Latin America, compared the cultural motivations of campesino hunting to those of the Emberá (formerly known as Chocó) indigenous people and Panama City urbanites. He documented that subsistence hunting by campesinos and Emberá was a cultural trait for both groups, but the cultural significance diverged on many levels (e.g., hunting strategies, hunted species) structured on its recreational value to campesinos and its consumptive value to the Emberá. Bennett (1959) further recognized that these cultures and their environmental effects on biodiversity were deeply complex, balancing his predictions of potential future declines in the abundance of hunted animals with suggestions for more research to deduce concrete causal relationships among culture, hunting, and ecology.

In the 1960s, several authors began to focus on the conservation and management wildlife hunted by campesinos. Tamayo (1961) based many of his descriptions of mammals in the Venezuelan llanos on the behavioral and morphological characteristics, as well as local folk taxonomies, reported by campesino hunters. Pierret and Dourojeanni (1966, 1967) moved beyond descriptive records to record the hunting frequencies, strategies, species, and numbers of animals consumed by Peruvian riverine campesinos (*ribereños*). Wild meat was the most important source of protein for these communities. From this they concluded: "Thus, [the results] show the particular social importance of the wildlife in the zone and the consequent importance of its rational management" (Pierret and Dourojeanni 1966:277). Dourojeanni et al. (1968) further cited campesino hunters' target waterfowl to promote an aquatic bird refuge, which is today a national reserve, in Lake Junín, Peru. Thus, details about the "social importance" of wildlife and hunting to campesinos were primarily relegated to the subsistence and economic values of wild meat and the utility of said values for wildlife conservation rather than the contributions of campesino culture to the importance of hunting.

Studies from the following two decades largely emphasized the conservation implications of hunting by campesinos and mestizos rather than its links to campesino culture (Ríos et al. 1973, Castro et al. 1976, Vickers 1984, Redford and Robinson 1987, Bodmer 1988). In particular, Ross (1978), Vickers (1984), and Redford and Robinson (1987) compared wildlife uses among campesinos/mestizos and multiple indigenous groups, such as the Achuara, Siona-Secoya, and Waorani. Their reviews consistently noted that campesinos mostly hunted the same species as indigenous groups, including agoutis (*Dasyprocta* spp.), pacas (*Cuniculus* spp.), nine-banded armadillos (*Dasypus novemcinctus*), white-lipped and collared peccaries (*Tayassu pecari*, *Pecari tajacu*), deer (*Odocoileus* spp., *Mazama* spp.), capybara (*Hydrochoerus hydrochaeris*), and tapirs (*Tapirus* spp.), yet less frequently with fewer catches. Ross (1978), along with other studies of analogous Brazilian 'peasant' groups such as caboclos (Smith 1976), advanced the study of hunting taboos among these populations. In particular, they framed taboos as adaptational responses to the environment from the theoretical perspective of cultural ecology. Although these authors were among the first to emphasize the cultural attributes assigned to campesino hunting in the context of natural resource management and conservation, they drew from the previous decade's studies to strengthen the tradition of using indigenous hunting cultures as comparative cultural baselines for understanding campesino hunters rather than viewing campesino hunting culture as its own area of scholarly inquiry. As a result, assumptions about campesinos as a social group were often invoked to describe challenges and strategies for addressing campesino resource use. Examples included, "Stopping the campesinos from destroying the forests is very difficult, and there is currently a campaign of education for them" (Pfeiffer 1986:139) and "Country people [campesinos] existing on a subsistence level will not willingly relinquish their rights to capture and eat the lizards [*Iguana iguana, Ctenosaura similis*] at every opportunity" (Fitch et al. 1982:413).

Yet a small number of geographers and anthropologists began to reveal the nuanced social worlds of campesino hunting and hunters in the mid- to late-1980s. Torres et al. (1985) documented a variety of medicinal, symbolic, and subsistence values ascribed to wildlife hunted by Argentine campesinos, including the consumption of puma and rhea (*Rhea* spp.) meat to reduce or prevent smallpox, fevers, and rheumatism. Despite these findings, the authors claimed that hunting was a subsistence and economic activity with little to no cultural significance. Others such as Mellink et al. (1986, 1988), Hiraoka (1985, 1989), and Torres et al. (1985) expanded their focus beyond wildlife use to document the social, cultural, and environmental forces shaping campesino hunting. They found that Mexican, Peruvian, and Argentine campesino hunters not only attached varying levels of significance to specific game (e.g., medicinal properties for certain recipes, Torres et al. 1985), but also hunted in response to broader environmental and social pressures such as seasonal flood patterns, game presence in *purmas* (fallowed fields), the exchange of meat for labor, low agricultural yields, restricted market access or employment opportunities, and lack of documentation to immigrate to the US. In short, hunting embodied a broad spectrum of social roles and significance for campesino communities from the values of individual species to responses to geopolitical forces. Yet these studies were rare in that most research tended to draw from biological inventories of hunted species gained from hunters' self-reported kills, interviews, and observations. In turn, these numbers were converted into management prescriptions, built on the differences between indigenous and nonindigenous hunters which were distilled to discrete biological and cultural factors such as taboos, technological constraints, and market access (Redford and Robinson 1987).

The influence of these studies, however, was seen in a renewed interdisciplinary interest in the many social facets and broader implications of campesino hunting in the 1990s both in academic literature and popular outlets. Campesino hunters and hunting strategies were shown or follow and adapt to ammunition prices (Silva and Strahl 1991), gendered roles (Hiraoka 1995), recreational preferences (Bolkovic 1999), and national-level civil unrest (Nietschmann 1990). Many of these findings emerged when a growing body of researchers started to explore campesino wildlife trafficking and trade (Barbarán 1999), the economic contributions of hunting to campesino livelihoods (Rabinovich et al. 1991, Coomes 1996, Barham et al. 1999), and LTK gained from hunting (Mandujano and Rico-Gray 1991, Hellier et al. 1999). Others brought campesino cognitive systems to the forefront of research about campesino appropriation of the environment through various strategies like agriculture and hunting (Toledo 1993). He suggested that researchers employ an ethnoecological approach to unite culture with production. Although these combined advances established a fulcrum to balance "the anthropologists' wonder at indigenous knowledge with the technocrats' bias that peasant farmers are ignorant and superstitious" (Bentley 1992:112), much of the literature was not united under the shared banner of campesino hunting scholarship. This disarticulation left space for the complex social realities of campesino hunting and its associated cultural elements to remain hidden. For example, authors continued to levy unsupported claims about campesino hunters, such as "Considering the demand for these parrots and the poverty and desperation of the Guatemalan campesino (native), it is easy to see why Yellow-naped Amazons [*Amazona auropalliata*] are still disappearing from their native habitats and reappearing in living rooms around the world" (Acedo 1993:16). Yet these studies also made it increasingly clear to researchers that, "…more important consequences, related to the culture of [campesinos], are more complex…" (Rabinovich et al. 1991:357), illustrating that "Campesino hunting, by its sociocultural and ecological nature, requires an interdisciplinary approach for its evaluation and management" (Montiel et al. 1999:49). The study of campesino hunting culture was reaching a turning point.

The implications of these studies produced an outgrowth of interdisciplinary work on the cultures of campesino hunting from the 2000s onward. Gender, for example, has been found to be a key factor guiding hunting locations and levels of participation, with women occupying the cultural margins of hunting spheres as caretakers for children and hunting dogs, bushmeat cooks, and mediators of meat retention or sales (Montero 2004, Espinosa 2010, Tamburini and Cáceres 2017). Mestizo women in Belize were also more likely to say they would kill wild felids if they threatened livestock or crossed their paths while hunting (Harvey et al. 2017). Others have shown that the cultural value of meat consumption in campesino communities outweighs its economic value (Rodríguez-Ríos and García-Páez 2018).

Moreover due to the growing recognition of the importance of local knowledge to conservation and natural resource management (Berkes 2008), anthropologists and conservationists have shown a revived interest in hunting LTK from these communities (Smith-Cavros et al. 2012, Garcia et al. 2012, Lavariega Nolasco et al. 2016). While Smith-Cavros et al. (2012) recorded indigenous campesino LTK to show that past manatee hunting has led to a shared culture of 'environmental regret', making campesino hunting culture the primary intellectual interest, most campesino LTK work has been applied towards creating culturally appropriate hunting or PA management programs, particularly in regions where campesino and indigenous communities live side by side (Hernández-Tapia et al. 2018). Yet a small number of scholars have found that the cultural meanings underlying nonindigenous campesino hunting and identity extend to belief systems thought to be largely exclusive to indigenous hunters. Ruiz-Serna (2015) reported that Colombian campesinos imbued animistic agency into forests and select prey species to describe the nuanced human-wildlife relationships underlying their hunting practices. Despite these findings, most studies do not connect hunting to *being* campesino, meaning that the cultural meanings intersecting campesino identity and hunting are not the primary interest of most research (Altrichter 2006). Furthermore, of the few studies that highlight the culture within campesino hunting, many center on the cultural values of individual species or the utility of campesino LTK for protected area management rather than the meaning of hunting and being a hunter (Petriello and Stronza 2020). Lastly, differences between the perception and reality of campesino hunting culture are conflicted, with nonmembers of campesino cultures (e.g., NGO workers, foreign researchers) attaching meanings and motives to campesino hunting based on outward characteristics like poverty and agricultural livelihoods. Therefore, research is needed to understand the cultural meanings ascribe to hunting and *being* a campesino hunter, and how campesinos' and conservationists' perceptions of the two differ or converge. Such an approach would center campesinos' lived experiences with hunting as the focus of intellectual interest rather than their potential negative effects on species and ecosystems of conservation interest.

3.3. Methods

3.3.1. Sampling Frame and Data Collection

We collected qualitative data on campesino culture and hunting across three field visits spanning 11-months from March 2016 to August 2016, February 2017 to March 2017, and June 2017 to August 2017. We identified prospective participants by drawing on the lead author's previous field work and experience in El Pizotero in 2008 and 2014, the assistance of a local guide from the community who was employed with a local conservation NGO at the time, and through snowball sampling (Bernard 2013). The lead author's rapport with the community cultivated a baseline of trust and openness that was essential for exploring the legally and culturally sensitive topic of hunting. The local guide acted as a cultural broker by mediating household introductions while clarifying and situating questions from community members about the research in local idioms and education levels. We devoted the first month of field work to introductions, pilot testing the interview script to refine our questions, and participant observation.

The lead author conducted 33 semistructured interviews and 11 photo-elicitation interviews with 36 residents (Table 3.1) in and near the campesino community of El Pizotero, Nicaragua. All interviews were in Spanish and lasted an average of 103 minutes across a range of 21 to 171 minutes. We divided the semistructured interviews into six sections as part of a larger study: 1) indigenous and campesino meanings and identities; 2) environmental knowledge; 3) hunting knowledge, significance, and experience; 4) perceptions of the sustainability of hunting; and 5) hunting institutions; and 6) cultural consensus of hunting knowledge (Appendix A). Demographic information was also collected at the end of each interview. We placed questions about campesino and indigenous identity at the beginning of the interview to promote residents to situate their responses in the context of their identities and livelihoods. Data for this study are mainly drawn from sections 1, 3, and 5. However, full transcriptions allowed us to select excerpts from other sections that aligned with interview themes (see Data analysis below). In addition, we draw from the lead author's field notes from 11-months of participant-observation, including participating in three hunting events, bushmeat preparation, shared meals, daily conversations, and a constellation of other activities.

Table 3.1 Demographic information about informants (*n* = 36).

Median age (years)		49
Percent campesino/a		97%
Percent female		28%
Percent El Pizotero residents		88%
Median community residency (years)		16
Percent with children in household		89%
NGO employees		8%
Citizen Power Council officials		8%
Hunters	Current	14%
	Past	39%
Self-reported indigenous identity	"Indigenous campesino"	6%
	From community affiliation	8%
	From campesino cooperative affiliation	11%
	As a Nicaraguan	3%
	No affiliation/no response	27%
Veterans	Sandinista Revolution	17%
	Contra War	14%
	Both	8%
Self-reported job	Agriculture/livestock	61%
	Housekeeping	25%
	Park guard	5%
	Field worker	3%
	Biologist	3%
	University student	3%
Education	No formal education	22%
	Some primary education	42%
	Primary education	6%
	Some secondary education	14%
	Some college	17%

A total of 11 campesinos contributed to the photo-elicitation component of this study during the third field season. Photo elicitation is categorized as a form of participant photography that was originally developed in anthropology and sociology, but is increasingly deployed in the context of conservation and natural resource management (Belcher and Roberts 2012, Masterson et al. 2018). First, the lead author presented a digital camera (PowerLead PCam PDC001) to each prospective participant based on a predetermined list of 14 hunters and non-hunters from the semistructured interviews. Second, the lead author demonstrated the camera functions in 30 minute personalized individual workshops for each participant photographer. During the workshops, the photographers then received a visual camera guide and a list of three questions to direct their photography: 1) What do hunting and being a hunter mean to you, your community, and your culture?; 2) What, why, and how do you learn or have you learned about hunting?; and 3) Why is hunting good or bad for the environment? Photographers were asked to capture photographs as answers to the questions, with each question representing a potential path for generating meaning from hunting. Third, semistructured interviews with each photographer elicited the purposes, meanings, and connections of each photo to the guiding questions and their relationships to *being* campesino (see Appendix B for the photo-elicitation interview script). This approach varies from previous work where several researchers have used camera traps to document prey species, their relative abundance, and the effects of campesino hunting on wildlife (Monroy-Vilchis et al. 2008, Lavariega Nolasco et al. 2016, Harvey et al. 2017) or employed similar participatory photography methods to explore campesino and non-campesino social processes and resource management (Shepherd and Scarf 2006, Gotschi et al. 2009). Only one study to our knowledge employed visual techniques to turn the lens towards campesinos themselves and capture elements of campesino hunting and hunters' experiences (Ruiz-Serna 2015). We are therefore unaware of any studies of campesino hunting that employed any form or variation of a participant photography technique.

3.3.2. Data Analysis

All three data sources – interview transcriptions, photographs, and field notes – were analyzed using qualitative content analysis. Broadly speaking, content analysis can be either quantitative or qualitative. According to Hsieh and Shannon (2005) and Schreier (2012), qualitative content analysis (herein QCA) is used to derive the subjective interpretations and meaning of a corpus of data in various forms – although they are most commonly text data – through codes, patterns, and themes. There are no standardized approaches for conducting QCA (Elo et al. 2014), as demonstrated by its many applications as an inductive, deductive, conventional, directed, or summative method (Hsieh and Shannon 2005, Elo and Kyngäs 2008). This flexibility separates QCA from grounded theory through its ability to generate both surface content and the meanings underlying that content (latent content) to create and explore categories rather than highlight their relationships or build theory (Cho and Lee 2014). We elected to use inductive content analysis because our research questions centered on extracting the meaning of hunting to campesinos and prior knowledge on this topic does not represent a comprehensive body of knowledge or theory that would be used to generate codes in deductive content analysis. Others have broadly described this approach as conventional content analysis (Hsieh and Shannon 2005).

Despite a lack of standardized criteria for carrying out QCA, authors have segmented the QCA process into three phases: 1) preparation; 2) organization; and 3) reporting (Elo and Kyngäs 2008). The preparation phase included selecting the unit of analysis and making sense of the data. In turn, we selected full interview transcripts, field notes, and photographs as the units of analysis. Prior to coding, all data sources were reviewed to deeply familiarize the authors with the data. The organization phase comprised the two-step process of open coding followed by focused coding (Ryan and Bernard 2003; Bernard 2013; Saldaña 2013). First, we randomly selected 6 interview transcripts, yielding three from 2016 and 2017, using a random number generator. The lead author then open coded the 6 transcripts by identifying words and sentences that captured as many elements of the campesino hunting system and research questions as possible. During this process, the lead author also recorded thoughts, memos, and theoretical ideas about the phenomena in question. This process, broadly described as word-by word or line-by-line coding, allowed the researchers to capture a diversity of relevant themes that may have been otherwise inaccessible if the coding process was guided by theory or as concise body of knowledge. This process yielded 66 open codes. Second, we refined and condensed open codes into larger categories called focused codes. These codes allowed us to more concisely target our data collection and analysis through an iterative process designed to fully refine our code list. In total, we identified 14 focused codes, 8 of which pertained to the objectives of this study (Table 3.2). The following results and discussion capture the reporting phase of the inductive QCA process, compiling and summarizing the manifest and latent meanings underlying the data. We carried out opened and focused coding in NVivo 12.3 (QSR International).

Table 3.2 Focused codes derived from qualitative content analysis of the meanings of campesino hunting.

Focused codes	Participants*	References	Description
Hunting social and cultural meanings and significance	41	204	Direct descriptions of the ways hunting intersects with campesino society and culture, such as reaffirming social bonds, providing intergenerational narratives, and how *being* campesino shapes perceptions and participation in hunting.
Hunting motivations	38	168	The internal and external drivers of participating in hunting such as providing for one's family, family tradition, and recreational preference.
Hunting opposition and restraints	35	258	The internal and external constraints on hunting participation such as morals and ethics, regulations and restrictions, and religious convictions.
Campesino identity	35	200	Explanations or details pertaining to the elements participants assigned to what it means to be campesino, including education levels, labor, poverty, and comparisons with other social groups.
Indigenous identity	22	48	How participants explained their relationship to an indigenous culture, including group affiliation, knowledge of an indigenous language, and ties to an indigenous heritage.

Table 3.2 Continued

Focused codes	Participants*	References	Description
Hunters' community presence	21	43	References to the presence or absence of hunters, including the number of hunters, ways of discerning who is and is not a hunter, and the benefits or costs of hunters to the community.
Campesino-environment relationships	14	29	The ways in which being campesino shaped how participants interacted with and perceived the natural environment and wild animals.
Conservation presence	9	31	References to how community members perceived or interacted with foreign or domestic conservation researchers.

*The number of interviews that contained each theme with their corresponding frequencies (i.e., references) from 33 semistructured interviews and 11 photo-elicitation interviews (n = 44 total).

3.4. Results

3.4.1. Being Indigenous or Campesino

To understand the relationship between campesino identity, livelihoods, and hunting, we had to first understand the meaning of "campesino" for the community members. Therefore, we asked participants to first describe and elaborate on whether they considered themselves to be indigenous and campesino and what it meant for them to belong to one or both of these groups. In doing so, we situated the overall context of our project in campesino and indigenous livelihoods rather than the socially and legally sensitive issue of hunting.

3.4.1.1. *Indigenous Ambiguity*

Despite 55% of participants identifying as indigenous, the term carried a varying level of ambiguity and affiliations (Table 3.1). While nearly one-third of participants did not know the meaning of the word (e.g., "*I don't know what indigenous is*"), others substituted it with the words Indian (*indio*), native (*nativo*), or primitive (*primitivo*).

> 017: *I think that at this moment I could say I'm not indigenous, because belonging to an indigenous group would mean that I belong to the* primitivo *origins of those who were in Nicaragua. Now I wouldn't be 100% sure, because there's already a mixture of nationalities that isn't like being original. But I still feel that we do have some indigenous identity, because our origins depend on it.*

This semantic ambiguity was largely couched in the historical influence of indigenous peoples – often unnamed – on Nicaragua's lineage and campesinos regardless of whether a participant identified as indigenous.

> 022: [Mestizo] *is indigenous in the first place because we can say it is a combination of races between the indigenous and Spanish that birthed a new indigenous race. It's also called indigenous because it is local. We can say it is part of Nicaragua. That new race was created in Nicaragua. For that reason we say 'indigenous', because it is from our country.*

> 014: *Of course we are indigenous because we are from* campesino *people, as if we were indigenous. What happened is that we are not pure* nativos*. We have no descendants from an indigenous family, but we are* campesinos*. They fight like us in the same way we fight to survive. But they have other ways to survive.*

In other words, ethnic miscegenation blurred the lines between indigeneity and *mestizaje* (mixed-ancestry). Yet, multiple participants drew from their identity as *Nicaraguan* campesinos and mestizos to support their claims to indigenous ancestry. For example, most interchangeably adopted the Nicaraguan colloquial term *pinolero* as a synonym for campesino because, "*the campesino lives off of pinol* [a mix of toasted and ground corn with sweet spices, which is tied to indigenous origins]*, they live eating tortillas. That's why many people say that the campesino is a pinolero, because we mostly live off of that, the campo, corn, rice*" (018). Therefore, diverse forms of nationality and livelihoods anchored and bridged El Pizotero residents' indigenous past with their campesino identity.

3.4.1.2. *Campesino Identity*

Nearly all participants identified as campesinos (Table 3.1). However, according to participants, campesino culture was distinguished from other social groups, including indigenous peoples and urbanites, by a complex web of overlapping social, economic, and historical dimensions. These included inheritance, poverty, pride, education, physicality, clothing, and ethnicity – all of which converged on shared struggles, ancestry, and knowledge maintained through agriculture in the *campo*.

> 028: *Campesinos have their characteristics that distinguish them in distinct ways. The campesino is sometimes identified by how they dress, sometimes by the color of their skin, by what is rural, and their actions. Another thing, each time the campesino leaves for the villages he leaves through the campo, the mountains, and a person who lives in a city is not going to walk around the mountains, it's very difficult. The campesino is identified by that, by laborious hands, by a machete, by working to survive. All the work of the campo*

that develops the campesino is known through his skin, sometimes by well-beaten and mistreated hands.

The last theme of agricultural livelihoods *in the campo*, however, was the primary dimension that nearly all participants mentioned as the prerequisite for claiming a campesino identity, even more than shared beliefs, values, and labor strategies. Many participants were proud to live in the campo, even defining the land as the livelihood activities enacted on it – "*the campo means living off the campo…farming to harvest in the campo*" (12) – and therefore identified as campesino because their livelihoods were seen as paths out of poverty.

022: *We, the campesinos alone, live from the campo. If the campo didn't exist, we would be dead. If you're not in the campo, you're stuck with the misery of not eating. From the campo, we more or less live coming out of poverty.*

Yet, for others, being campesino solely rested on the land they called home rather than the shared ideals or labor strategies of other campesinos. This conceptual divide was expressed in the prevailing tension between campesinos either doing what they needed to survive or being cognizant environmental stewards – a point which was filtered through how some campesinos perceived the role of poverty in shaping survival strategies As explained by two participants, the first a campesina who was unable to participate in agricultural activities given her physical limitations, the second a campesino and NGO employee at MBWR, being campesino did not require or could be used as an excuse to overexploit the campo based on one's identity:

017: *I identify myself as a campesina because of the environment where I live, not because of the ideals that campesinos have. I see it from another point of view. Other campesinos see campesino identity from the way they can take advantage of everything and without limits, and I do not, I see it from another type. I see that I can enjoy the wild, I can have contact with it, but without abusing, without exceeding those limits to damage what I so much appreciate.*

023: *Yes, the people want to survive. And whatever way they do it, they cannot conserve the environment, they affect it. When there's no one to tell you things, there's a word: "innocent, innocently". Without knowing that you're hurting yourself, you do things. It's serious.*

Thus, shared livelihood practices (e.g., agriculture, cattle ranching, hunting, and fishing) that were perceived as exploitative by some were also secondary to, and inseparable from, the shared landscape that defined campesino identity in El Pizotero. Despite these tensions, campesino identity for all participants was a way of life that required "*living in the campo. Living from your crops. And living away from the city*" (004).

3.4.2. How Do Perceptions and Practices of Hunting Connect to Campesino Identity and Culture?

3.4.2.1. *The Agriculture-Hunting Nexus*

Local perceptions, practices, and meanings ascribed to hunting were similarly entangled with, and extended from, the purpose, meanings, and challenges of using agricultural practices to cope with the economic and social struggles of life in the *campo.* Like most campesino communities throughout Latin America, community members practiced mixed livelihood strategies that mostly revolved around agriculture and livestock to manage the uncertainty of campo life while ensuring their family's survival. The most common crops were rice, beans, corn, squash, and yuca. Family home gardens (*huertos familiares*) with numerous species of peppers, mangos, and avocados were also common. Cattle (e.g., Brahman-Holstein mixes), horses, and domestic pigs were interspersed between these spaces. Agriculture and cattle ranching required certain tools and skillsets, such as machetes to clear paths and cut wood, pickaxes and shovels to dig holes and dislodge roots, firearms and dogs to chase away crop predators and protect livestock (Fig. 3.3) – all of which demanded knowledge of the most efficient ways to employ these tools. According to an 82-year old community elder, there is a system of the area (*sistema de la zona*) wherein older campesinos form friendships with newcomers to help them adjust to the area by accruing those multiple skillsets and knowledge bases:

> 009: "*It is a system of installing an idea for a job, because without that, if you don't think, you don't do anything. Even to speak you must think of what you're going to say. So that is the campesino system, when you already have someone to talk with. The old campesino is instructing the new one, so that when he wants to move away, he already manages the system of the area".*

This system of generational knowledge transfer about campesino skillsets was also a vital component of what it meant to be campesino. For example, when reflecting on the skills and knowledge sets that allow them to persist in the campo, many invoked their knowledge of agricultural tools: "*I'm in debt to my grandparents, they raised me in the campo. They put me to work, showing me how to use a machete, a macana, an ax. I learned and did it well*" (016). For this reason, agricultural knowledge and tools was also the first theme that connected campesino culture and hunting (Fig. 3.3).

"*That's a machete. That's the fundamental tool because if I don't carry that, it's better that I don't go out because that's how I clean where I pass. I go around clearing my path and it serves me for everything. I cut what I'm going to cut; I kill if I get my catch with that; I dig if there are caves* [animal burrows]. *I do everything with that tool, everything that is the hunt*" (08C).

(a) Machetes, the fundamental campesino tool

"*There are people that don't like to go out to hunt. I've always liked to go out hunting in the forest, the mountains. And so I learned to hunt animals in different ways. But the way that's easiest is the rifle. You don't work much. Just one shot. Sometimes I use other tools, but it's a rarity. This is for the fast animals because it's the fastest* [weapon] *there is.* [But] *if the animal is in a hurry, if it's fast and it's not hit well – and you don't aim well – then the animal will get away. Because you just get one shot and then it's gone*" (08C).

(b) The family .22 rifle

"*As you can see, there's a machete, shovel, and I think everything up to the pickaxe. These are the three appropriate tools for hunting in the campo. Those are the authentic tools. I took this photo for one reason: as something you can show your other compañeros. So you can explain to them, 'Look, these are the tools that the campesinos use where I was.' You can tell them, 'These are the authentic tools to help your dog's and your own survival. It's of great importance because when you come to take a picture of these it's like a great memory for us to show your colleagues, your friends*" (06C).

(c) The machete, pickaxe (*piocha*) and shovel (*pala*)

"*This only reflects one thing: what a dog is. All the campesinos here, in the area where we are, have dogs. What's the main objective of keeping a dog in the farm, inside the houses? One: to take care of the house. Two: hunting. There are dogs that specialize in hunting armadillo, paca, racoon, coati, agouti, and deer. There are deer dogs* (perros venaderos) *inside this community. This is a coati dog* (perro pizotero). *The agouti dog* (perro guardero) *is another that isn't here because lots of dogs are timid in the water. And an agouti dog has to go into caves where there's water. That's not for all dogs*" (04C).

(d) Coati (*Nasua narica*) hunting dog (*perro pizotero*)

Figure 3.3 Dual purpose agricultural tools used by Nicaraguan campesinos to farm and hunt.

Agriculture and hunting are synergistic activities. They inhabit two sides of the same coin that is campesino livelihoods. For example, the practicing hunter in El Pizotero was always on the lookout for animal signs while working the fields. Farming was therefore a multipurpose activity that permitted aspiring and current hunters to gain or refine their knowledge of the environment and their skills with hunting tools. As such, farming tools were hunting tools. While machetes were used to ‘clean’ fields and chop trees, they were also used to ‘clean’ meat (i.e., dress) and kill prey. Pickaxes and shovels allowed campesinos to dig out roots and create holes for seeds. They similarly allowed them to dig prey out of burrows, providing them and their dogs easier access to another meal. Shovels served the same purpose. Dogs were simultaneously field companions that warn tired workers about approaching crop predators or potentially dangerous animals (e.g., wild cats) while alerting them to the locations or signs of potential prey (e.g., trails, prints, burrows). In the words of another hunter and participant photographer, “*As we are with the idea of talking about hunting I thought that this photo* [Fig. 3.3c] *comes to practically represent the hunter*.” (07C).

3.4.2.2. *Machetes*

Of all of these tools, the machete and hunting dog are the core of the campesino hunters’ repertoire (Fig. 3.3). Without these multipurpose ‘tools’, hunting in the campo would be significantly more difficult, if not impossible. The machete is the indispensable symbol of the campesino. It is often the first and last tool handled during the day. Waking up to the sound of a family member sharpening their machete was common. Children tended to receive their first machete when they were 5-years old, making it a symbolic and literal extension of campesino life – a rite of passage. Even children involved with the NGO’s youth conservation program mentioned machetes as the first tool needed to be a park guard, which demonstrated how campesino life is inseparable from their perceptions of the environment and conservation (field notes, 15 July 2016). In fact, the community members mentioned machetes at least once during most interviews (61%), and were considered more numerous than people by multiple community members. For these reasons, many campesinos remarked that of all the reasons MAP was unlikely to become campesino (e.g., history, nationality, and unfamiliarity), his lack of a machete was the first.

The first step to any hunting trip was sharpening your machete, which was supported by field notes.

> "*Due to the fact that I lack hunting tools, my Nicaraguan family loaned me a machete. I arrived at his house at 7:10am. Although I felt prepared, he appeared to have forgotten our little event. He only wore jeans and a red Crocodile polo shirt. When he saw me, he started to prepare his things: sharpening his machete methodically, putting on his boots, gathering the dogs, finding a collar for the wandering dog*" (29 May 2016).

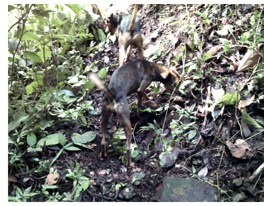
Similarly, two participant photographers and avid hunters merged their dependence on the machete as a campesino with their dependence on it as a hunter (Fig. 3.3a, c). Therefore, one required a machete to be both campesino and a hunter.

3.4.2.3. *Hunting Dogs*

While machetes are the universal symbols for campesino identity and labor, dogs are the universal symbol for hunting in El Pizotero. Hunting dogs are the vehicles between the world of the hunter and the non-hunter. They are the closest many non-hunters will come to hunting (e.g., Fig. 3.4a, b) in that nearly all campesinos will live with them or recognize them as the first sign of hunting: "*Where the dogs walk, the owners walk because they're hunting. You hear them [barking] when they're hunting with their dogs*" (003).

(a) Hunting dog resting at the photographer's home

"*I chose her first because she's my pet, and also because she is an essential part of what hunting is. A person always has to support themselves with dogs whenever they go out for that activity, it's normal. They serve as an ally. This is a very exact representation of hunting*" (01C).



(b) Hunting dogs following armadillos

"*They're my dogs, my hunting companions. They help me hunt animals in the bush. They're my guardians. I walk with them here in the bush, from my house to the campo. That's why I chose them.* " (06C).

(c) Lead hunting dog guarding the photographer's uncle's house

"*She's the leader. She doesn't need anyone to bring her here…she just arrived [at the house] and the others followed her, to the point that now the other dog lost out* [Fig. 3a]. *She took the dogs out and when they returned, they came with bloody remains. They were full. They had hunted and eaten*" (01C).

(d) Hunting dog exploring an armadillo burrow network

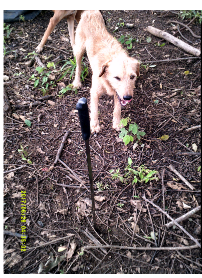
"*This is Tarzan investigating a cave. When you want to go hunting they get so joyful. When you grab your pickaxe, shovel, machete, they get so excited because they also love to go catch an animal.* " (06C).

(e) The photographer's deer hunting dog

"*Yeah, deer hunter. My daughters see him that way. We've killed one female and two male deer. One day we brought out the female dog and he followed her choice of [deer]. We bring back both [deer and armadillo]. But they know how to understand what we want to hunt.*" (02C).

(f) A hunting group excavating an agouti burrow with their dog

"*This photo is very important because I've hunted since childhood. I started to hunt with my brother. We hunted armadillos, agoutis. We we're like that since we were little, learning to hunt. The dog is from here, the house. We went looking to hunt and they found an agouti*" (09C).



(g) Armadillo and agouti hunter

"*I took this in the home garden when I was walking between the corn. It's my dog and my machete. I carry the machete where I go out to the bush, to look for armadillo, that, and paca. I use the machete to break the trail and the dog goes looking for the animal there. And wherever he goes, I start looking with my machete*" (03C).

(h) Hunting dogs digging for pacas

"*Here, he's trying to hunt a paca. He's scratching the burrow, he senses the paca in there. He feels it. But it's really difficult for us to hunt it. What we did last was pull the dogs and call them to leave the animal there*" (10C).

(i) Hunting dog crawling under a tree trunk in search of a paca

"*I took this to show where the dog was, in the paca cave. There's a ramp of pebbles where [the dog] is, in the cave. It's digging there to get in. Here we're taking the paca. The dog is stuck and we take it out. And then someone digs there. You have to dig inside and the dog fights with the paca inside the cave. It bit the dog. The dog got angry and pulled it out* " (03C).

(j) Two hunters assisting their dog as it explores a paca burrow

"*I go around repairing fences with the man you see [on the left]. He's there because it's easier to dig up the animal's hole with a broomstick. The dog scared up a paca, followed it, and caved it there. We always get there through the dogs. The lead us to the animal. We help each other hunt.*" (10C).

Figure 3.4 The uses and meanings of hunting dogs for Nicaraguan campesinos.

As essential partners in campo activities, including hunting, they are considered to be as much a campesino as their human handlers and are often referred to as campesino dogs (*perros campesinos*) or mestizo dogs (*perros mestizos*). In this community, campesino hunting dogs were imbued with agency and autonomy to pursue their own forms of subsistence as proper campesinos. They chose their preferred prey, hunted on their own, and directed the hunt with their humans. In turn, knowledge of the types of hunting dogs in the community was integrated into campesino culture in El Pizotero: (Fig. 3.3d, Fig. 3.4). For example, while interviewing the only female hunter in the community, she and her children demonstrated their dogs' preference for armadillos (*Dasypus novemcinctus*).

> "*The armadillo excited the children because they knew a lot about this animal that was the focus of this adult conversation. The mom and her daughters kept validating and verifying each person and their knowledge.* "The meat is delicious!" "We know how to find them!" "The dogs love to hunt them!". *At this point, there were 2-3 kids around the table, 2 more dogs and the interview. "Can you show me?" She said, "Of course.". Immediately, the daughters went to get the armadillo shell from the kitchen following their mom's command. The tension and expectations rose. Finally, they found it. Outside, with us, the dogs didn't just play. They nearly attacked the shell with the intent to destroy it. One of the daughters exclaimed,* "Those are hunting dogs!". *I've seen hunting dogs. They were solid (but very malnourished), brave, and loyal. These dogs, on the other hand, are small, seem weak, and yet, pretty and well fed*" (18 May 2016)

By extension, community members and hunters viewed hunting dogs as companions and family members more than tools. As one hunter expressed, "*I clearly love them a lot. They're my friends. They're my companions. And here, they're the only ones that will always accompany you in the campo. Without dogs, you're worth nothing here*" (031). Given these relationships, hunting dogs will fight to defend their owners' crops and lives. Multiple campesinos shared stories about their dogs fighting and losing their lives to coatis (*Nasua narica*), mountain lions (*Puma concolor*), and collared peccaries (*Pecari tajacu*). These losses travelled through the community, getting a nod from the most stoic and weathered farmers. One hunter, for instance, lost his armadillo hunting dog (*perro cusuquero*) between the 2016 and 2017 field seasons. His first request of MAP at the beginning of the 2017 field season was to see photographs and videos of his 'best' dog (and the subject of the previous armadillo dog vignette). These photographs and videos stimulated the first mixed public conversation (i.e., outside of a family household) about hunting during the course of this study (field notes, 22 June 2017). Similarly, the following story about the moment when a former campesino hunter fainted during a struggle with a collared peccary embodied the widely held relationships between campesinos and canines in El Pizotero:

> 023: "*One time, my three dogs started to follow a* sajino *(collared peccary) at 5am and it was 4pm and they didn't stop it and it didn't stop. My plan was to stop at a crossroads at 5pm because it had been all day. At another crossing, the other two dogs had already ran into each other. So I said I would wait there with them until the* sajino *passes When I heard the third dog come down a hill barking, I went to a ditch and put myself there with the dogs. After a little while the* sajino *came and the other dogs ran after it fast and stopped it. When I arrived, the dogs looked at me and got more into it. I told them not to*

go because they were going to kill it. That's when the animal slipped on some large stones and grabbed a dog out of frustration. I saw that she jumped and fell, but I saw that she was hurt and bleeding out. 'It killed her', I said. And those dogs were my companions. What was I going to do?

The other dog went to attack the sajino *because it saw that it bit his companion. It just stayed there, waiting. I was telling it 'Don't go in! don't go in!'. I followed it and fell on a rock too, seated. Exactly where I was seated, the dog was thrown over the* sajino*, fighting with the* sajino *right where I was sitting. 'I'm going to kill it, grab the dog, and put it away like that with the machete', I tell myself. Then I started to give it to him. I hit him in the head. But then the dog hit him and grabbed close to my feet. I fell and I fainted. I fainted and the dog grabbed the animal from behind its butt, and didn't let it get to me. When I came through the other dog was almost dying too. I killed the animal at 5:30pm. It was going to be nighttime, and I was really far from my house. 'What do I do now?' I carried the* sajino *200 varas (~168 meters) and left it. Then I went back and carried my dog over my shoulder and left it. I did this until I arrived at my house. Both dogs survived, but the first one was sick for a month.*

This story not only illustrated the interrelated dependence on machetes and dogs for hunting, but also signified the effort many campesinos will expel to cope with the pervasive poverty, food scarcity, and general lack of amenities that are often used to define this social class. Hunting, in essence, is therefore a mechanism to manage the challenges of campesino life. In particular, the drivers of hunting (Table 3.3) are similar to those that fuel campesino persistence in the face of such difficult circumstances.

Table 3.3 The internal and external hunting drivers reported by El Pizotero campesinos.

Hunting motivations	Participants*	References	Example quotes
Subsistence and consumption	32	80	"Campesino hunting is the sustenance, the necessity of the campesino to have meat. The campesino carries food to his house without needing to dress a pig or steer. It gives him a little more life to save. Save a little more and preserve what there is to hunt, look for something in the bush for food. To feed him and his family."
Income	29	49	
Unspecified sales	14	26	"It's that the people sometimes go and grab those *cusucos* [nine-banded armadillo (*Dasypus novemcinctus*)] and sell them. That was what they [the government] banned. If you grab an armadillo, it's to eat it, not to sell it."
Restaurant sales	10	15	"They sell it. When they find a big boa [Central American boa (*Boa imperator*)], they go out of town to sell it to the [highway] restaurant."
Inter- and intra-community sales	4	7	"It's that there are people that, even here bought bushmeat because there are times that some say "Oh! I want armadillo," and they already appear. "I caught an armadillo, give me so much". I say, okay, because a girl told me she bought one for C$300 (~$9 US)."
Pet trade sales	1	1	"What I've observed more than anything is [the sale] of birds, the parrots and parakeets (e.g., *Amazona auropalliata*, *A. albifrons*). I don't think there are sales of other types of animals because there aren't any; they already ran out of them."
Sport, recreation, and enjoyment	17	34	"While hunting, on the one hand, you have fun. It feels, like, cheerful walking around the bush in the hunt. On the other hand, it feels good when you kill an animal, you feel happy despite the circumstances around you [i.e., poverty and war]."
Household pets/protectors	8	14	"On one hand they ate them and the other they wasted them. With these animals [spider monkeys (*Ateles geoffroyi*)] in those previous years, perhaps some 30 years related to the *campesino*, he used it for two goals. The first goal that the campesino took on was that they chained up the animal in a little cage. Like a caretaker or guard, it warned when people came. This animal also related to the campesino in a domestic way. It even ate all types of food, they fed it everything."

Table 3.3 Continued

Hunting motivations	Participants*	References	Example quotes
Distraction from daily life/boredom	8	9	"Hunting is important. It distracts you. Walking around the campo looking for animals distracts you a lot and clears your head."
Protect people, livestock, and domestic animals	6	7	"I can hunt a possum (*Didelphis virginiana*), kill it because it comes to my house to kill my chickens, to hunt a hen with her eggs. So, I get to kill it. I sic the dog on it."
Incidental or opportunistic hunts by people and/or dogs	4	5	"Here, one catches his little animal by chance, because as he has his dogs where he's working, the dogs come and they find it. And if it's favorable, they take it and bring it back to eat it."
Medicine	3	3	"Campesinos here use iguana eggs (*Iguana iguana, Ctenosaura similis*) in the summertime, to make a soup, which is a tradition, a culture the campesino has come from, many years ago from the ancestors…even for medicine because he who eats iguana says they have tremendous vision."
Trophy or professional hunting	3	4	"That's [white-tailed] deer horns (*Odocoileus virginianus*). Above that are armadillo shells, and hung on the other side are the testicles from deer that we killed. We hunted three deer. It's like to have them, to have the head, to be looking at them".
Artisanal uses (e.g., deer hide saddles)	2	5	"The armadillo is artisanal and at the same time food. Snakes (e.g., *B. imperator,* Middle American rattlesnakes [*Crotalus simus*]) are the same. Toads also have value. They stuff them for their artisanal value."
Pelts	2	2	"Here, only when I don't have anything, [I only hunt] maybe some armadillo. It's the most tame. Well, only armadillo or some possum, only for the fur."
Official or unofficial tourism	2	2	"There are people that like to see animals in the city. I had four domestic agoutis that all had names. They would come when I called them and my nephew that lives here said to me 'Uncle, tell me, they tell me you have an agouti?' 'Yeah, they obey me." I started to whistle and call them. I gave them some ripe bananas. Then came all the bad folks because they knew the owner, but others showed up to take photos."

Table 3.3 Continued

Hunting motivations	Participants*	References	Example quotes
Social bonds/support	2	2	"I come to help hunt. Both of you who are hunting are helping what is going to happen [meat]; they support each other."
Practice hunting	1	1	"Because in order to learn to hunt you need to practice it."

3.4.2.4. *Hunting as a Social Mediator*

Whether for subsistence, income, entertainment, or distraction from boredom, hunting functions as a mediator and unifier for this resource poor community. Bushmeat is a salve for restricted diets, providing a vital substitute for diets comprised mostly of unfortified rice and beans. Bushmeat is often shared with family and friends (Fig. 3.5). When local campesinos share this hard-won meat, they also relay hunting stories that maintain community bonds, regardless of community members' support for, or opposition against, hunting.

(a) Armadillo meat (*Dasypus novemcinctus*) given to the lead researcher as a farewell (*despedida*) at the end of the 2016 field season.

(b) Paca meat (*Cuniculus paca*) preparation during the 2017 field season.

(c) A hunter showing off his venison (*Odocoileus virginianus*) from a recent hunt in 2017.

(d) Venison stew prepared with the meat from Fig. 5c that was shared with the lead researcher during a 2017 interview.

Figure 3.5 Examples of bushmeat and meat sharing in El Pizotero, Nicaragua.

Furthermore, bushmeat is an alternative source of income for those who are willing to ignore social norms. For instance, while most participants acknowledged and respected the need for fellow campesinos to hunt for subsistence, they also opposed commercial hunting (Table 3.4). Hunting for local campesinos is tolerated as a necessity to feed oneself and one's family, not to line one's purse strings. Moreover, hunting stories from the 1970s and 1980s served as allegories that warned against the destructive potential of commercial hunting: "*There was a time that it wasn't correct to live off of wild animals to survive. They caught the meat and went to sell it to restaurants. And it was getting worse because lots of hunters lived from that. And since they lived off of that, they would each catch up to 6, 8, 10 armadillos to sell to restaurants*" (013).

Table 3.4 The internal and external hunting constraints reported by El Pizotero campesinos.

Hunting opposition and constraints	Participants*	References	Example quotes
Laws and regulations	26	77	"I agree with the law that says "Environmental business is prohibited". I agree with that aspect. What I don't agree with is that if they run into me with an armadillo, they would take it from me and throw me in prison because I took it for my consumption."
Conservation presence and mindset	20	48	"Hunting is already old. It's prohibited because you can no longer go around hunting lots of animals. The people from [the local NGO] take care of the animals, they protect them. That's why the people here rarely go out hunting."
Avoid overhunting/species dispersal	18	31	"It's that there already aren't any animals. Before they hunted *guardas* [lowland pacas (*Cuniculus paca*)]. There were these animals that they called *pavones* [great curassows (*Crax rubra*)], they were like big turkeys. Now there aren't any."
Commercial hunting opposition	16	24	"Many people catch armadillos and pacas to sell them. I am completely against that because I don't agree with how they're damaging the environment simply to extract money from the animals. It's one thing to kill an animal to feed yourself, you need them for your family. It's another thing to want to do business. I do not agree. That would be in my case."
Animal rights and ethics	13	24	"For me, hunting has to stop. Because if not, we're going to lose all the animals. They exist like us human beings, they have the right to live too, like us."
Risks of hunting on private property	11	17	"We're workers there [on the farm]. If the boss sees that we killed an animal, they take away our job at once. They don't pay for the job to kill animals."
Shame and personal aversion	10	13	"My dad never let us hunt. I remember one time when we were in school, my brother killed a little bird. He brought it home and showed us. My mom scolded him. He punished him, told him it couldn't be done, and that it was the same [as hunting]. I'm the same with my son."
Military presence	9	13	"Hunters don't walk around with their weapons because it's prohibited. There's an army right there when you want your turn [to go hunting]. The hunters are afraid now, there's an army."

Table 3.4 Continued

Hunting opposition and constraints	Participants*	References	Example quotes
Religious convictions	9	12	“Those times have passed. Now walking in the bush and holding a rifle make me lazy. I don’t do that. When I was from the world that didn’t recognize the Bible, we had not known that there was a God. We did what we wanted. Not today. Today we respect everything.”
Enjoying animals	7	10	“I don’t agree with hunting. For me, I like that the animals increase so that they are there, pretty, I like to see the animals. I don’t like that they kill them. They look pretty.”
Protect wildlife for future generations	5	7	“I have children and grandchildren. By the time I finish [the animals] they will no longer know what a paca is, nor an agouti. Why? ” Because we already killed them, that is, we have finished them ourselves.”
Fear and effort	4	6	“I barely like to go hunting because that’s difficult. Have you seen when the people go out hunting? You see that they’re running around, doing marathons. I can’t walk far.”
Alternatives to hunting	4	6	“Why am I going to go hunting when it’s better to go shopping in the market? There’s meat if I want”.
Hunting taboos	3	6	“Rodrigo says ‘I couldn’t kill a spider monkey.’ I tell him ‘What a sin to kill that because it seems like a person, its face’.”
Time or age constraints	3	5	“Some people have quit practicing hunting because of their age, because you have to have dexterity. You must have agility and sometimes age doesn’t allow them to hunt.”
Lack of hunting dogs	3	3	“Losing the dog killed me. We didn’t find it until the hunt was over. We’ve found dogs, but no, both of my dogs have been killed by *terciopelos* [fer-de-lance (*Bothrops asper*)].”
Economic barriers or shifts	2	2	“I quit hunting. It did help me through difficult times. But, I didn’t continue after I started to work. I had corn that started to grow and my luck with it. I started to change my way of life.”
Time of day	2	2	“I don’t hunt pacas because they only come out at night.”

Yet, the rewards of complying with the social norm of subsistence hunting rather than commercial hunting extend beyond meat. Private landowners and farm hands are occasionally willing to let poor campesinos hunt on their land in exchange for bushmeat. The benefits of this relationship were reported to partly mediate the cultural importance of hunting in El Pizotero: "*Hunting is important. That's why it's good when there's a flexible [farm] administrator, that isn't as closed as the law to give more space for the campesino. The administration [on this farm] is working well. They're not closed. There's a good relationship. For example, Egberto eats bushmeat daily. He's poor and they let him on private property*" (005). Others employed sayings such as "*Come y comamos*" (You eat and we eat) as shorthand for the implicit agreements between landowners and landless campesino hunters, as well as bushmeat sharing among campesinos themselves. However, many applied it to different facets of hunting in campesino life. One young hunter described it as, "*Telling the boss that we're going to eat. There are bosses here that are understandable. If the boss agrees, they tell you, 'I'm going to give you a pass'. But God help you if you give them nothing*" (002). Another former hunter and NGO worker explained it as "*sharing*" at multiple social scales, ranging from the "*relationship between both the hunters and the farm managers that's the rule for almost the majority of the farms*" to "*the other rule that's a command that relates to the hunter or community member and their colleagues*" (005). However, the broader meaning of this saying unites campesinos through their common struggles as, "*An experience, for the life I lived and suffered. If I suffered it means that I lived, right? Because if not, I had nothing to talk about. But I'm talking about it, I lived it that way*" (009). In turn, hunting and its products (i.e., bushmeat, stories, and saying) are not only distractions from, and rewards for, the boredom and exhaustion of repetitive labor and lack of entertainment in the campo, but are also mediators of social relationships among campesinos.

3.4.2.5. ***The Campesino* Montero *and Urban* Cazador**

Social relationships among El Pizotero campesinos are not only applied to internal community dynamics. Rather, they are also expressions of their shared landscape, the campo, and how it differentiates campesinos from other social classes. In particular, campo traditions separate campesinos from the urbanite. Many campesinos were proud of their autonomy and independence from harsh city life. In addition to *come y comamos*, El Pizotero campesinos had other saying that stemmed from the campo and their relationships with wildlife that would be misunderstood by the average urbanite. These included phrases like "*Cada lora a su guanacaste*" (Every parrot to bed) and "*Es la hora que el mono mama*" (It's time to eat). Wildlife were also perceived to be members of the broader campesino community. They were therefore closer to campesinos than urbanites because they too knew how to fend for themselves in the campo. In contrast, the urbanites' perceived inability to live, work, and hunt in the campo instilled local campesinos with a sense of agency and identity, particularly in the face of the urbanite's perceived prejudice against campesinos. Moreover, urbanites relied on campesinos to grow their crops and relied on external support to hunt. Whereas city dwellers need to join hunting clubs or be professional hunters (*cazadores*), campesinos are subsistence hunters (*monteros*). "*Hunters* (cazadores) *don't exist here. Here they call them* monteros. *The* montero *is someone who goes out to the mountain, finds an animal, and brings it back to eat*" (013). Campesino hunters are thus monteros who are self-sufficient, hunt to eat (not to sell), and hunt to survive, or as one campesino reported he was told by an elder, "*You're not going to go around killing animals for pure pleasure. You're going to kill an animal to escape a problem, not to destroy*" (031). However, the meanings attached to being a campesino hunter (*montero* or *cazador*) were varied.

3.4.3. The Meanings and Motivations of Hunting and Being a Hunter from Campesinos, NGO Workers, and Local Government Officials

3.4.3.1. *Campesino Hunting and the Campesino Hunter*

In southwestern Nicaragua, campesino hunting and being a campesino hunter were interconnected yet separate. Whereas one was required to hunt in order to be considered a hunter, participation in hunting did not imply one was a hunter. This distinction generated different types of hunters, varied reasons for hunting (Table 3.3), and diverse constraints placed on hunters and hunting (Table 3.4) such that the meanings and motivations ascribed to campesino hunting were culturally rooted yet socially distinct.

When first asked to explain what hunting meant to them and other campesinos, many participants reported that the act of hunting and identifying as a hunter were intertwined. In addition, most accompanied their explanations of the meanings of hunting and hunters' identities with meat consumption and subsistence (Table 3.3, Fig. 3.6): "*Being a hunter* [means] *hunting animals: catching them, killing them, and consuming them*" (003). However, the perception of subsistence as the primary driver of hunting was often presented as a consequence of campesino life; hunting was simply another way to manage the unpredictability and tedium of dietary, infrastructural, and resource scarcity. In turn, some campesinos expected that most other community members likely hunted because "*It gave them a little more life to save. That's the idea of the campesino. Save a little more and preserve what you have from hunting. Hunt and search for something in the mountains for food, for you and your family*" (024). Others used their life experience in El Pizotero to suggest that "*the majority here have practiced hunting some time in their lives. It could be around 100% of the people who are originally from here*" (017).

(a) Hunter displaying his iguana (*Iguana iguana*) catch.

Subsistence and consumption: "*Because maybe my family has a desire to eat a little meat. That is why hunting is so important to me, because it's very valuable for my family that I bring meat*" (10C).

(b) Example of a white-fronted parrot (*Amazona albifrons*) as a pet.

Household pets and protectors: "*Even in the beginning people kept them as pets, according to the [older residents]. They use them as pets, as ornaments. That's what the campesino is. The people keep both parrots and parakeets of all species in the house. Almost the majority of the campesinos keep parakeets as pets.* (04C).

(c) Hunter plugging a paca (*Cuniculus paca*) burrow to prevent its escape

Income: "*If I want, for example, to have a little pet in the house, I trap it alive without hurting it. I can put it in a net. Others do it to sell them [pacas]. Because some buy them with the same idea that they're beautiful. It's to have them. Since they don't harm them, they don't get sick. They eat corn. They eat nancite* (Byrsonima crassifolia)" (11C).

(d) Hunter's image of an adult white-tailed deer skull (*Odocoileus virginianus*)

Sport, recreation, and enjoyment/distraction from daily life and boredom:"*The sport here is going to hunt, because there's no entertainment here. There's nothing here to distract your mind*" (02C).

(e) One hunter's white-tailed deer (*Odocoileus virginianus*) and nine-banded armadillo *(Dasypus novemcinctus*) trophies.

Trophy or professional hunting: "*That's a deer antler, above the armadillo shell. And hung on the other side are the little bags, the balls of the deer that we killed. We hunted three deer. We keep them to see all of what we did before the law prohibited it"* (02C).

(f) Boa (*Boa imperator*) removed from house

Protect people, livestock, and domestic animals: "*We live with dangerous animals and learn how to have or make our own safety so to speak. They eat the hens. The hens and chickens are animals that produce for the well-being of the family*" (01C).

(g) Watering hole and hunting site for El Pizotero campesinos

Subsistence and consumption: "*We're seeing a water hole where the animals come to drink. The hunters hide here to see what time the animals come to trap, eat, or sell them for business. The majority here kill animals for consumption*" (07C).

(h) Nine-banded armadillo *(Dasypus novemcinctus*) killed by hunting dogs.

Incidental or opportunistic hunts: "*The dogs caught and killed it. It was already hurt. My son came and said 'It's going to die and it's going to lose". I brought it and we're going to eat it. But it's just one, it's not like we're going to grab four or five. We took one that we'll eat. But that's a little fluke that those bandits [dogs] found it there, because they don't take them if the find it difficult*". (05C).

Figure 3.6 Photographs from Nicaraguan campesinos used to depict the meanings of hunting.

While the previous quote highlighted that hunting was potentially widespread, others drew from their life histories and their perceptions of hunting constraints, environmental conditions, and the history of hunting in El Pizotero to indicate that hunting participation, and its cultural importance, had declined or disappeared. According to one non-hunter, hunting is not culturally important, "*because seeing that they killed so much, and went to sell it, that's not good. And as it is, there are no more mountains*" (019). From this perspective, the cultural significance of hunting rested on the intent of hunting and surrounding environmental conditions. As such, the effect of hunting on recovering wildlife populations also indicated that hunting was not cultural significant for some:

> "*It's not culturally important because of the animal abuse. And also because of the increase in animals. Because hunting kills and kills and then finishes all the animals. Don't you see? And also because hunting is already gone. Now the animals are reproducing. There was little animal production before because of hunting. Now there's more production*" (001).

In addition, others emphasized that hunting would only have cultural value for campesinos if it stopped:

> "*Yes, there's an intersection [between campesino life and hunting] because hunting should not continue. As campesinos, we need to look for how to cut it, because if we don't take care if this environment, who will? We are what we foresee: caring for the animals*

while hunting does not exist. The animals increase, reproduce, because if the shortage continues, there'll be a time we don't see them anymore" (028).

These views created tension with individual- and community-level implications. While hunting was recognized as an environmental threat, it was also perceived to have a deeper cultural importance beyond those conditions.

> *"Yes, it has its importance because it's natural campesino knowledge, a person from outside is not going to be able to do what they do here, never. On that side it's important, because they can transmit what they know and how hunting is going to be maintained from generation to generation. However, I think they should have a little control, more control of how they use hunting, but I think it's important and that it should be maintained. It's part of what it is to be campesino, it's part of the culture of the community. But there should be people who guide you on how to hunt in a balanced way so that they can continue practicing for many years and the animals stay. Because if they exterminate them, they're not going to have to hunt"* (017).

Self-identified hunters also recognized this dilemma and often pointed out the internal struggle they had with maintaining their practices despite the decreases in animal populations. "*On one side hunting is beautiful, because the campesino get his little bit of meat. But on the other side, it's already harmful to the animal because it doesn't have the opportunity to live anymore. That's why it would be important to stop that, but not much*" (014). These observation of environmental conditions and declining participation were also reported by one hunter who had lived in El Pizotero for 17 years. He stated, "*The people loved to go out hunting before, as there were more animals. The people got excited and went. Now the people have lost a little of the tradition to hunt. Not completely though because there are some who have their dogs that are hunting. It's not completely lost, no*" (012). Another hunter noted, "*Yes, years back, there were more people that liked to go out to the bush more. But now, no, that's the way it is, they don't go out a lot*" (006).

Overall, the cultural importance of campesino hunting is conflicting in that declining hunting participation and environmental conditions contrast with the perceived importance of maintaining subsistence hunting as a source of shared tradition and knowledge. Yet, this tension alone did not fully indicate or define the meaning of being a hunter among campesinos.

The distinction between hunting and being a hunter is important because few campesinos identified as hunters even though they had practiced it in the past. According to one community elder, "*I didn't consider myself a hunter* (cazador) *before because I wasn't professional. It was out of necessity. I worked and the dogs worked, it wasn't like we were on the hunt* [laugh]" (009). In other words, casual subsistence hunting does not alone make one a hunter. In addition, "*Going to the mountain does not mean you're a hunter* (cazador). *A hunter is someone who has a vice, or not a vice, but it's a love for walking around the mountain. And maybe he doesn't eat meat or like meat, but he likes the bush. That is a hunter, he who likes the walk around hunting in the campo*" (013). In this sense, hunters are those who choose to hunt as a profession or tradition out of enjoyment (e.g., "*Me, I'm not a hunter. [I hunted] very little. I haven't had that tradition. I'm not going to hunt animals. I haven't had that tradition of going out hunting. I didn't like it. But I liked that [the option to hunt] was there*" (012)). Yet according to El Pizotero campesinos, "*they like the word* [montero] *here in the campo, they say 'I like to go to hunting* [montear]'" (023). In fact, the phrase "I like to go hunting" (*A mi me gusta montear*) aligned with many monteros' descriptions of their motivations to hunt:

> "*I like to walk around the bush but I don't leave much, as I keep working, but I like to walk in the bush entertaining myself. Sometimes I'll go around when I feel like looking for an animal. I'll go look for it to see if I find it to eat*" (006)

> "*Sometimes, the only time* [during this research period] *I went was that day with the dog to the bush, and I caught an animal. Yes, sometimes I go there and catch myself in the mountains. I like to walk around, look, get to know those animals*" (010).

Yet, the preference for the word *montero* over *cazador* also stemmed from local campesino identity and the boundaries it placed around hunting. For example, one former hunter (*montero*) and government official distinguished his past hunting from professional hunting by saying, "*During the time I was a* montero*, I liked it too. I never hunted for business; I hunted for consumption. One time I killed two deer. I killed them out of fear. When I had the one I had killed, another one came directly to where I was. I only had one shot and it fell right on top of the other one. That was the only time I killed two deer*" (036). These sentiments were echoed by another hunter: "*I don't agree with hunting in that way, in that they catch animals to do business. I just sometimes feel great eating a piece of armadillo meat. It feels great."* (023). In other words, these campesinos emphasized that as monteros, they were careful to hunt for sustenance while not violating local hunting norms and hunt (or overhunt) like professional or commercial hunters.

Moreover, most campesinos are unable to afford hunting or gun licenses, meaning that the montero often hunts illegally. Yet, the lack of licenses is a point of pride for some because it reaffirms the agency and self-sufficiency that are markers of campesino life. The following hunter's response to the question "Do you consider yourself a hunter (*cazador*)?" embodied this distinction:

> "*For me it would be better to be a* montero*, a small hunter*. *A montero, because the* cazadores *carry their licenses to hunt. In this country, he who is a* cazador *has to carry his own hunting and fishing license. Rather, we are* monteros. *As* monteros *we hunt some animal out of necessity and also hide from the law because we'll also get in trouble*" (031).

Therefore, being a campesino hunter in El Pizotero means more than being a hunter (*cazador*). It means being a *montero* who clandestinely sustains their hunting traditions for subsistence and enjoyment by following hunting social norms (e.g., no commercial hunting) and balancing the potential legal and environmental consequences of their actions.

3.4.3.2. *NGO Workers and the Citizen Power Council (CPC)*

3.4.3.2.1. Complementary Meanings of Campesino Hunting

All but 2 of the 6 CPC officials and NGO workers were El Pizotero natives. Four out of 6 had some form of higher education, such as field technician certifications or university experience. Although these traits diverged from El Pizoter's demographics, governmental and nongovernmental representatives all identified as Nicaraguan campesinos. In turn, they recognized similar underlying motivations for hunting to those identified by community members.

For example, governmental and non-governmental awareness of the drivers and meanings of campesino hunting often came from their own intergenerational hunting experiences as campesinos. In particular, all NGO workers and CPC officials perceived poverty at multiple scales as the primary driver of campesino hunting. In the words of one NGO worker, community member, and former hunter: "*Why is hunting important? Because there's poverty. For food for the family. Because going to buy meat is extremely expensive. A pound of me costs you a day of work. That's C$100, almost $4 for a pound of beef"* (005). Similar to this view, a second NGO worker expanded this perspective: "*Working in [conservation] in our country is very complicated because of the economic situation. In general, money doesn't move very easily through our country or in the campesino regions. In general, campesinos have to hunt. Some do it for food. Food for the family. In my case, I say it's good because it's for food. Others do it for sport*" (022). In addition, NGO and CPC members' past experiences not only allowed them to identify poverty as a hunting driver, but also allowed them to carefully assess the role of poverty in campesino hunting. For example, 1of the 2 MBWR workers also used his knowledge of campesino hunting techniques to qualify his answer the cultural consensus statement: "We cannot hunt here because we do not have the money." He stated, "*I'd like to first say that, in general, when campesinos are going to hunt, they don't go if they just have a rifle. They go to hunt with a machete and a dog. It also depends if the people come from money or say 'I'm not going to hunt because we can't buy shots'. The truth is that they're going to hunt if there's no money*" (022). In this vein, machetes and dogs represented campesino hunters' ability to hunt in spite of their economic circumstances.

Moreover, current members of the CPC equally identified poverty, enjoyment, and consumption as drivers of their past hunting. One 18-year resident and CPC member reported that, "*I considered myself a hunter, yes. It was some time ago because I even had my dog who led the charge. I took it on as a sport, but also for my consumption*" (036). Despite his time away from hunting and identifying as a past hunter, another CPC member adopted the language of the regional hunting norms to reflect on why he had recently participated in a group hunt for white-tailed deer: "*We didn't kill anything that day. But when we kill, we dress it and divide it among the five that go out, each one of us gets our part and we're happy because it's food. Although to some extent we know they're becoming extinct, but as a food, we can't stop hunting them*" (034). Another CPC member justified his past hunting from a parallel perspective. When asked to describe the difference between someone who hunts in a controlled way and someone who hunts indiscriminately, he suggested that his hunting was different from socially sanctioned commercial hunting:

> "*Clearly there's a big difference. At least if I like to hunt or see an animal. I go and look for an armadillo for myself, and if I find it, I catch it to eat it. The other is going out to catch what there is. If there are 4, 5, they kill them. There's a big difference. At that point, it's no longer for consumption, it's for something else; it's for business, to make money. It not the same as what I left. I would catch one and eat it. Here, someone who's going to kill 3, 4 isn't doing it to eat them, but to sell. There's a difference*" (036).

Furthermore, the practice of controlled hunting for subsistence, meat sharing, and release from boredom magnified the importance of hunting as a tradition (e.g., "*It's like a custom, like an addiction*") in the view of one NGO worker:

> "*For the most part, the traditional campesino has always had the tradition of eating food from hunting. It's a family food, or more than anything, a collective food, because hunters always organize themselves. If they caught a deer, they carried it in 4 parts. That's 4 families that benefitted. Let's say something like 5, 6 hunters took a door. That's 6 families that benefitted. That deer is divided into 6 parts and it's the same for any other animal*" (005).

To magnify these views, another CPC member linked campesinos to indigenous peoples through the shared dependence on hunting, and the use of hunting dogs, when explaining the cultural significance of campesino hunting:

> "*Yes, well, the indigenous are special hunters, and we as campesinos, are not as bold at hunting as them. But, we do have certain skills that we put into practice when we hunt an animal. For example, I can talk to you about how to hunt a deer. We first use guns like shotguns, .22s, or AK-47s. We use hunting dogs that we campesinos call* "Orejones"*, they have big ears. That is the relationship that we can say we have with the indigenous. Campesinos and hunting are in relation. Just like campesinos hunt animals, the indigenous hunt. And that also relates the indigenous with the campesinos. We produce our own food. That's the relationship for me*" (034).

The quotes from the NGO workers (005 and 022) and two CPC members (034 and 036) suggested that, despite their official positions, each created a space to reflect on his past hunting that situated it in the economic realities and hunting norms of the community.

3.4.3.2.2. Conflicting Meanings of Campesino Hunting

However, residency in El Pizotero and past hunting experience did not infer absolute agreement with hunting for several reasons. First, the implications of poverty-driven hunting were conflicted for CPC members and NGO workers who were and were not community members. The NGO worker cited above (005) noted that there was a cultural "contradiction" between the NGO's youth conservation efforts and the local importance of bushmeat while describing his photograph (Fig. 3.7a) during his photo-elicitation interview. "*The campesino gets more vitality from eating that quality of meat [bushmeat], more life, more strength for work. Bushmeat soup is amazing! And yeah there is a contradiction [for the youth], but they'll realize it later. Right now, no, because the culture is that way. The culture is that one as an adult has to teach. The kids are going to learn what they are teaching because the culture isn't lost. They have to revive it*" (04C).

(a) Participants in the local NGO's youth training program, including the children of several hunters

Conservation presence and mindset: "*Sometimes, what the NGO does to stop a little hunting, is exchange [children's] slingshots for binoculars, notebooks, and pencils to get them to quit hunting those animals that have declined. The slingshots have decreased. They're scarce more than anything. Since the hunters are inside the children's' families, you have to lower, reduce hunting there. Why? Because the children are their family, their kid, their cousin, or their grandchild. [But] not all the parents agree with [the anti-hunting messages they receive from their children]. Some dedicate themselves to hunting, but in a lower percentage. We're talking about some 80% previously, and right now it's lowered to some 30%. That's going to keep lowering more, but it's just beginning to work*" (04C).

(b) One hunter's brother with their family .22 rifle

Overhunting and species dispersal: *"I feel nice when I see this photo, because it's important. We're talking about hunting. Coati hunting, deer hunting, peccary hunting. A comparison: If I tell you 'I'm going to see if there's a deer' or 'I want to eat some venison, I'm going to go look for a deer', I go, and if I find it, I hunt it with the .22 there. That's beautiful. But there are few. It's worse if I find a pregnant female. I'm killing the big one, and worse, maybe two little ones are already in her belly. Instead of reproducing, I killed three for one, preventing an increase. Rather, it disappeared because I killed all three. [So] on one hand, it's beautiful. But on the other, I just don't know*" (09C).

(c) Cattle as symbol for other sources of meat and animal products that are not hunted

Alternatives to hunting: "*In the last interview, I talked to you about my ideology, something about how God made two types [of meat], because hunting is practically all related to meat. For me, there's what can be consumed regularly within every day and what not. For example, animals that have to be preserved, not caught as I told you, until they're finished. Those are the domestic animals. The ones that continue the sequence of production. And there's no danger you're going to finish them all. Even their young serve some roll in subsistence. I wish they would establish an ideology here that it's not necessary to get rid of all the forest animals. There are other resources that can equally provide you with food without affecting nature so profoundly* (01C).

(d) Rescued howler monkey (*Alouatta palliata*)

Animal rights and ethics: "*I chose this photo because it was an accident. He [the howler monkey] fell from a* cenicero *tree* (Samanea saman) *and the dogs were killing him. I went, pulled them off, and I climbed it up into a tree. He had a bite below his throat. Other people let their dogs get them. He is an innocent animal. He doesn't hurt anyone. What would I let them kill him for? It's better that he keeps living. He has the right to live too. Like how we have the right to live, they too have the right to live*" (05C).

(e) Hunter's aged deer skull (*Odocoileus virginianus*)

Laws and regulations: "*Now the law will throw you in prison. You can't walk around publicly, walk widely. Because if I go deer hunting, we go with three to four of us. 'We're going to hunt, man. Let's get together at such and such place'. There we have a point. We get together and hunt among ourselves. Because if I take along some thief that already has friction with the law, they're going to burn us, throw us to them*" (02C)

Figure 3.7 Photographs depicting the hunting constraints identified by El Pizotero campesinos.

Yet, one of the 2 NGO workers and nonmembers of El Pizotero modified this cultural contradiction in comparison with past indigenous hunters to suggest that modern campesino hunting was unlikely to be controlled or stopped:

> "*Lots of people do it as a sport and other people do it more out of necessity because they need to eat. But if you see that, that's remained since the ancients; hunting is not from right now. Therefore, I think they will never want to stop it. Why? Because if you see it, that was from the indigenous, because they used spears. If you look at the stories about them, they used spears and arrows to hunt. I'm no longer looking at those same people today. It's another type of faster hunting. For me, few are going to want to control it"* (021).

Second, when asked whether he had hunted in his life, one NGO worker responded:

> "*That's a great question. Yes, I can say that I did in my past because of the same ideas that our parents instilled in us, that we also had to walk in the campo with them and sometimes our parents hunted or other times, in my case, I did it out of necessity, for a lack of food or going to find something to eat that we could take. Things changed after my studies. I can say that my economic situation improved. I'm no longer instilled in hunting. I no longer hold that ideal*" (022).

Improved economic conditions and education were, in this sense, means for overcoming the need to hunt. There are two explanations for this view. First, the conservation implications of hunting appeared to take priority over the local cultural significance of hunting for non-resident

NGO workers. For example, in response to the cultural consensus statement "Campesino hunters are an important part of Nicaraguan history", the same NGO worker explained that: "*We can say yes. Important in the way – not important in the way that it's outstanding, very important, very cultural. Important in the way that it stands out for being excessive: very large and not very controlled. I can say yes in that way*" (022). Second, NGO workers in MBWR were responsible for enforcing the private protected area's rules (e.g., Fig. 3.2a) through patrols and interactions with hunters:

> "*Inside of the farm [MBWF], what we try to do is avoid burning, tree cutting, and hunting, which is what try to talk with the many people that I've sometimes found inside, that it's forbidden to enter the farm to hunt. I've asked many people what they're doing. Some say 'We're hunting for fish,' others say, 'We're looking for animals to eat,' and I've told them, 'That's absolutely prohibited, not just here, but in all the area because the animals are the ones that adorn nature. Didn't you know that the Lord sends water for them? Didn't you know we're surviving because of them? Don't go killing the animals? Do it for yourself and do it for me, to not have problems with you or my boss either. Because if she comes to realize that you entered here, She's going to say things to me, not to you all. To avoid a problem, don't walk inside the farm. What I would advise is not hunting the animals like that.' People come to tell me, 'It's okay,' and won't come back in. They learned their lesson. As I say that to them, I say, 'Notice there are signs inside the farm where it says that hunting is prohibited. To put that in their head, I say, 'What the sign says is a message that will make you take a good path, and will make us survive more'*" (021).

While such interactions often led to productive dialogue between conservationists and campesino hunters, they also placed campesino hunters at risk:

> "*I haven't reported anyone yet given the fact that I haven't found anyone with anything in their hands, but I'll tell the authorities when I find them with something. I also tell [hunters] to avoid me with that because I'm not going to like that you're imprisoned either, for the simple fact of having hunted an animal. The hunters are a little apprehensive when I tell them that. You know that someone has to know how to talk to people so that they can understand. Just don't talk to them very strongly, try to tell them things so that they don't want to return strong words to me either, with the simple fact that you should not enter the farm with dogs. Because I know some people enter the farm for a fish that may be in the river. But if they're with dogs, I tell them 'Don't enter. Don't walk into the farm with dogs because hunting is prohibited here. What happens? They want the dog to instruct them, so that when they hear barking, it's a sign that there's some wild animal. That's the human's way of communicating with their dog and finding out where to hunt an animal. They won't hunt without a dog"* (21).

In this way, the NGO workers' used their knowledge of, and experience with, campesino hunting strategies to enforce conservation goals. Hunting and hunters challenged the PA's conservation paradigm wherein "*Conservation means protecting the forests and wildlife. It would also mean not cutting trees, not killing animals, not extracting materials from the river, [and] leaving free areas that are only available for animals. Where the objective would be to enter that area without going hunting, to observe what types of animals, trees, insects, plants we* *have in the area. That means conservation, protecting an area*" (022). This perspective was also echoed by campesino hunters and non-hunters alike (Table 3.4, Fig. 3.7), including anti-wildlife trade posters in hunters' homes (Fig. 3.8). However, most of the campesinos (75%) that referenced conservation presence as a hunting deterrent also cited the local NGO as the primary source of concern. One non-hunter, for instance, recounted a hunter's surprise to the widely held perspective that the NGO prohibited hunting: "*Lots of people say that hunting is prohibited here, like [the NGO], they prohibit it., Adonis said, 'What insanity! I'm not going to stop hunting. Because if I catch an animal one time, not 2 times or 3 times; I'm just taking one animal'. So what did Adonis do? He said, 'I'm going to go hide out, grab my little animal, and come back.' It's prohibited because it's prohibited, but the people don't hold back*" (18).

(a) Poster in a hunter's home that reads "Don't be a trafficker. Don't buy parrot, macaw, or parakeet adults or chicks", with dialogue that reads "If you buy wild parrots, you're part of the illegal trade" and "Me?".

(b) Poster in a non-hunter's home that reads "Our heritage. Yellow-naped parrot. Endangered. You can save it. Don't buy parrot, macaw, or parakeet adults or chicks".

Figure 3.8 Conservation messaging in the campesino community of El Pizotero, Nicaragua.

Conservation enforcement was therefore seen as a barrier to maintaining hunting practices. And NGO workers were aware of this motivation and its inseparability from intergenerational campesino livelihood practices.

> "*In general, campesinos learn about hunting because it arises just like agriculture [knowledge]. It is from generation to generation. The grandparents of the grandparents have been teaching them about hunting or how to sustain themselves from hunting. In our case [as conservationists], it would be like cutting that generation, as if instilling in our children to avoid what our parents do. It could be that from generations back they came to teach us how to hunt. Now, from here on, from this generation forward, we can teach them to avoid those types of hunts. They can be given new ideas so that they take on other more important ideas instead of hunting*" (022).

The same NGO worker then provided alternatives to take the place of hunting for campesinos.

> *What we do during my job is make rounds in the farm in case someone enters. We explain that the area is a protected area, that they don't have to enter, that hunting is prohibited, and we give them explanations. Well not explanations, but the reason why we do our job, why we protect the animals. Because sometimes they happen to be campesinos, they're going to think, 'They're protecting for us.' No, our objective is to protect the animals and bring tourist at the same time. It has always been one of our mentalities, that is to say, the idea that animals come to this place, that it is a tourist area, and the same*

campesinos will go from hunters to tour guides. That they themselves present what they have in their community, saying, 'I quit instead of going hunting. Maybe a tourist comes, pays me $10 or $20 to be a tour guide. We'll see a great curassow and we'll take photos.' The tourist is happy because we're looking at an animal rather than hunting it. And it will be like a constant routine, but attract more tourists, and you have more employment, more money" (022).

Through a conservationist lens, campesino hunting and hunters signified threats and opportunities for conservation. On one hand, campesino hunting was a practice that could be cut from its roots to open up space for more conservation-friendly behaviors. On the other hand, it could be leveraged to benefit conservation through economic incentives that preserve wildlife, protect endangered habitat, and account for local needs. However, the need to recognize of the importance of hunting to campesinos was outweighed by the urgency of declining wildlife populations for people and conservation alike.

3.5. Discussion

Overall, our results demonstrate that campesino hunting is a complex phenomenon that is inseparable from campesino identity and livelihood strategies, economic realities, social relationships, environmental awareness, and conservation ethics. Given the diverse elements of campesino hunting that we documented, our findings align with those of various studies that were directly and indirectly focused on campesino hunting across Latin America. For example, the direct linkages among campesino identity and the land (campo) on which they live and work is widely accepted as the mediating factors between campesinos and their interactions with political, social, economic, and environmental sectors of society (Sexton 1985, Loker 1996, Boyer 2003, Müller-Schwarze 2015, Lederach 2017). In addition, our findings align with recent work that has shown that subsistence and income are the predominant drivers of campesino hunting across Latin America (Altrichter 2006, Petriello and Stronza 2020). However, most research tends to emphasize these and other individual components of campesino livelihoods to explain hunting practices and their environmental effects, such as local support for hunting, opposition to hunting, and individual and communal preferences for hunted species (Altrichter 2006, Shanee 2013). To the best of our knowledge, this study is one of the first English language investigations to construct a multidimensional snapshot of the meanings and motivations of campesino hunting through a combination of these components.

By combining diverse elements of campesino life to understand the cultural meanings of hunting, we found that these meanings and motivations may be imperceptible to nonmembers of El Pizotero and some community members as well. There are several explanations of this observation. First, the cultural significance of hunting was embedded in everyday objects (e.g., machetes, pickaxes) and companions (i.e., dogs). On the surface, the use of these two components of campesino life for hunting appeared to extend out of necessity or poverty. However, campesinos' claims that machetes and dogs were the markers of campesino hunters suggested that these 'tools' provided a form of cultural membership. In particular, hunting dogs offered a unique window into hunting culture. They were vehicles for that culture and constant reminders of its presence. In addition, they offered an emotional experience that prompted hunters to go to great lengths to protect them. Although the emotional value of hunting dogs in the Neotropics is hard to quantify (Koster 2009), our results indicate that this emotional bond helped sustain campesino hunting culture in this community, and likely in southwestern

Nicaragua. The campesino-canine relationship, coupled with the agency and freedom campesinos gave their dogs, maintained hunting awareness among households that was outside the boundaries of conservation messaging. Moreover, it was a direct reflection of how campesinos saw themselves: as agents who are maneuvering the campo to survive despite its inherent difficulties. From this perspective, our research adds to the growing body of literature documenting the importance of hunting dogs to Neotropical societies (Koster 2009). Yet, the cultural importance of hunting dogs is an underdeveloped area of research for nonindigenous hunting groups with broad implications beyond Nicaragua.

Second, the emphasis on subsistence hunting emerged from a socially accepted conservation ethic among campesinos: only hunt what you need without destroying the environment. The social norm of hunting for subsistence rather than profit was likely rooted in three sources: the history of hunting in the region and Nicaragua overall, the role of poverty in framing campesino identity, and conservation messaging. In El Pizotero, many residents reported stories wherein hunter X or hunter Y caught over 10 armadillos, coatis, agoutis, and other species per hunting trip. These individuals would walk the mountain trails with bounties of armadillo shells, coati pelts, and varieties of bushmeat. While these stories provided campesinos with fond memories of an abundant past, they also served as reminders of what the campesinos from their own and their family's past were capable of doing. These stories aligned with Nicaragua's history of uncontrolled wildlife trade in the 1970s and 1980s, even after the country joined the Convention on International Trade of Endangered Species of Wild Fauna and Flora (CITES) in 1977 (Nietschman 1990, Peréz 1999). Hunting for profit was thus associated with overhunting for individual gain at the expense of other campesinos and the environment. In turn, commercial hunting potentially challenged the collective identity of campesinos who relied on declining forest and wildlife resources to manage, or even escape, poverty. For this reason, campesino hunters and non-hunters alike placed anti-wildlife trafficking posters in their homes (Fig. 3.8). Furthermore, the most commonly cited hunting constraints were associated with conservation narratives in the region (e.g., environmental ethics and species reproductive potential). These observations suggest that campesinos either selected conservation messaging that complemented their hunting norms or that local conservation efforts were potentially targeting these norms. While the direct cause and effect relationship is difficult to discern, we suggest that a combination of these factors played a role in campesinos' support of anti-trafficking messages. As a result, this was the clearest form of hunting opposition in the community that was visible to outsiders, which helped mask local dependence on subsistence hunting, thereby making it invisible to outsiders' gaze, even among NGO workers. However, tensions between conservation and community members, particularly hunters, shed light on subsistence hunting. Anti-hunting messaging, for example, injected distrust and uncertainty between the researcher and certain community members (see Section 3.6). We believe this messaging contributed to widespread claims that campesinos had not hunted in the area for years, including the tendency to not assign cultural importance to hunting.

And third, our results highlight the importance of ethnographic engagement with vulnerable communities that hunt, whether campesino or indigenous. For example, the terms used to talk about different hunters (*cazador* and *montero*) are not coterminous because of the different cultural boundaries around each word. In the lexicon of El Pizotero campesinos, both words mean "hunter". Yet, the term *montero* more closely aligns with local hunting norms rather than *cazador*s. These findings suggest that this terminology may have acted as a signal for cultural membership, which provided a litmus test for assessing whether to be transparent about hunting practices or maintain the cultural script that "*no one hunts anymore*." In fact, this cultural script appeared to be invoked as a way to distance campesinos from conservation workers. Not only did it protect hunters and their families from potential legal repercussions, but it aligned with the prevailing conservation discourse from the local NGO. Such details would be otherwise inaccessible to 'parachute conservationists' whose interest may appear to be restricted to wild animals rather than the campesinos who hunt them. In turn, surface-level engagement with campesinos will limit researcher' access to, and understanding of, the fabric of campesino livelihoods and the role of hunting in holding this fabric together.

3.6. Limitations

We recognize three possible limitations to our work with campesino hunters in southwestern Nicaragua that may have influenced our results. First, community members' perceptions of the researcher as a nonmember of the culture may have discouraged participation, particularly for the first several months of the 2016 first field season. Based on field notes and interview transcripts, the socially and legally sensitive topic of this research combined with the lead author's past association with the local NGO led to suspicion from some community members. This suspicion was reported by several community members, and best explained by a community member who has known MAP since 2008:

> "*Sometimes Frederico calls you [MAP] 'the gringo' because he doesn't know your name. He says 'Sometimes the gringo asks about hunting, about the animals that someone kills, that's why I don't want to talk with him'. 'Yes', I tell him, 'He doesn't walk around with [the local NGO]. He's a gringo, he's a friend of Carlo [a pseudonym*

for his field guide]. People point you out to me and say 'No, he walks with [the NGO]'. I tell them, 'No', he's not with [the NGO], he comes here because he's a friend of Carlo. He doesn't work with anyone, not even with [the NGO]" (010).

The hunter (Frederico) mentioned above did not agree to an interview or any form of participation in this research, despite his reputation as a key hunter in El Pizotero and multiple conversations and interactions with him over the 11-month research period. His perception broadly represented others' skepticism and uncertainty towards MAP, for which one unknown community member reported him to the Nicaraguan National Guard – an incident that was then broadcasted over the local radio. These two incidents suggest that MAP's presence, background, and research topic initially altered his ability to build rapport and trust with this community, which likely explain his limited access to research participants in the 2016 field season. Moreover, these experiences also provide a cautionary note for researchers who interact with and/or study campesino hunters and hunting overall. While scholars widely recognize the difficulty of accessing campesino hunting spheres (Moure 2003, Montero 2004), the implications of these limitations should should be tempered to account for the legal, social, and historical contexts of hunting for each individual campesino community.

Second, the use of the term *cazador* rather than *montero* to describe campesino hunters for a portion of this study period may have altered how some participants responded. While MAP was well-versed in local idioms and phrases about natural resource uses in El Pizotero, he had conducted 12 interviews before any participants informed him about the *montero-cazador* dichotomy. We believe community members did not inform MAP at first because of perceived power dynamics or imbalances between resource poor campesinos and western researchers. For example, MAP's perceived collaboration with the local NGO led many to believe he was only studying wildlife rather than campesinos. Therefore, the study of hunting was solely seen as a way to determine how much of a threat campesinos posed to wildlife rather than a means for understanding campesino livelihoods and identity. By extension, his use of the word "*cazador*", which is associated with overhunting for commercial purposes, may have confused or altered some participants' responses to questions about hunting and its importance to campesino life and culture. However, these insights were only gained after several months of participant observation rather than from the local NGO or community guide. Overall, this limitation illustrates how a single word choice and local perceptions of researchers could combine to shift community members' willingness to participate in research on illicit topics such as hunting.

And third, we also only interviewed three NGO workers and three local government officials. Our access to both groups was restricted for three reasons. First, NGO presence was sporadic throughout the field seasons, which posed logistic challenges for arranging interviews. For example, the NGO would occasionally visit El Pizotero for their youth conservation program. Yet, all NGO representatives were occupied during these events. In addition, the MBWR only staffed 2 park guards who were the closest and most consistent NGO presence in the region. Second, MAP was aware of local perceptions of his association with the NGO and did not want to jeopardize access to an already reluctant study population – a reluctance that was magnified by his host family's association with the local NGO. And third, El Pizotero is a small community of ~150 residents. Therefore, the local CPC was proportionately small, with only 4 members. This meant that MAP's access to local government officials was limited. All of these factors represent the potential logistical and perceptual challenges of field work with remote campesino communities, not just in Nicaragua, but across Latin America.

3.7. Conclusion

Based on our results, we recommend that researchers further explore the contours of campesino hunting cultures to provide a broader picture of the similarities and differences among diverse groups of campesino hunters. Whereas our research found that campesino hunting culture was often imperceptible given its relationship with campesino identity, others have found that campesino hunting cultures were clearly delimited by value systems, hunting strategies, and beliefs about prey species (e.g., Ruiz-Serna 2015). Therefore, certain campesino communities may be more capable of articulating the elements of their hunting cultures than others, not because of educational levels or institutional access, but because describing hunting would require that it is disentangled from other livelihood strategies. Similarly, researchers' relationships with the campesino community, including the stated purpose of their work and time spent with the community, may shape how participants interact with researchers, or whether they do at all. These relationships are likely to be filtered through the community's history with conservation organizations as well. Communities and conservationists alike would therefore benefit from open dialogue about research goals and participatory expectations.

4. HUNTING AS A SOURCE OF LOCAL AND TRADITIONAL ECOLOGICAL KNOWLEDGE AMONG CAMPESINOS

4.1. Introduction

Hunting is described as the intentional killing or capture of wild animals through a variety of techniques (Redford 1992, Bennett and Robinson 2000). However, hunting is much more than the act of procuring an animal. The practice and products of hunting are also vital sources of nutrition, income, and identity for many rural people worldwide (Prescott-Allen and Prescott-Allen 1982, Schenck et al. 2006), the significance of which extend and vary across different social groups (Chausson et al. 2019). In Latin America, the most commonly studied and compared groups of hunters are indigenous peoples and *campesinos* (Ojasti 1996, 2000). In 2010, an estimated 45 million people (8.3% of the population) claimed membership to one of >800 indigenous groups across Latin America whose autochthonous cultures comprise distinct cosmologies, rituals, languages, and dress (United Nations 2014). In contrast, no official statistics exist on the total number of campesinos because the term represents a social group of small to medium scale agriculturalists of diverse ethnic origins who live, work, and identify with the *campo* (Latin America's agricultural countryside) (Loker 1996, Ploeg 2008). Yet, campesinos are estimated to be the most numerous hunters in Latin America (Ojasti 1996, 2000). Although 60 years of comparative studies and reviews have demonstrated differences in the strategies, game preferences, and sustainability of hunting among these groups (Bennett 1959, Redford and Robinson 1987, Naranjo et al. 2004a, Francesconi et al. 2018), such intergroup differences are not always present (Jerozolimski and Peres 2003). When variations are observed, most authors suggest that culture is the determining factor (Redford and Robinson 1987, Naranjo et al. 2004a).

While *culture* remains a contested concept in conservation discourse, the cultural roles and conservation implications of indigenous and campesino hunting are often accessed through community members' local and traditional ecological knowledge (LTK) (Berkes 2012, Petriello and Stronza 2020). Berkes (2012) seminally defined LTK as "…a cumulative body of knowledge, practice, belief, evolving by adaptive processes and handed down through generations by cultural transmission about the relationship of living beings (including humans) with one another and with their environment" (7). Yet, scholars and practitioners of conservation and development must critically wade through, or choose from, many LTK definitions, domains, models, and frameworks to effectively access LTK for different cultural groups (Ellen and Harris 2000, Davis and Ruddle 2010, Ruddle and Davis 2013). This epistemological dilemma opens these groups to long held assumptions and biases about their cultures and LTK systems. Indeed, the importance of LTK to conservation is often rooted in the assumption that indigenous knowledge is synonymous with *culture*, *sustainability*, *stewardship*, and *biodiversity*– a phenomenon that extends from the ecologically noble savage hypothesis in conservation (Redford 1991). In this vein, Berkes' (2012) LTK treatise romanticizes LTK as *sacred* precisely because it is indigenous. Such ecologically noble romanticism potentially presents LTK as a purely indigenous construct, positions it over other types of knowledge, and distances it from productive critical analysis in conservation (Davis and Ruddle 2010). These assumptions not only risk privileging certain types of LTK over others, but also feed into assumptions about different cultural groups and the integrity of their knowledge, such as campesino LTK.

Anthropologists have questioned the value of studying the culture and LTK of campesinos because they tend to be perceived as ignoble *peasants* and “uneducated forest destroyers” (Nygren 2000: 24) that lack “intact cultures” (Nygren 1999:270). In turn, the perceived lack of knowledge and culture suggests that campesinos are “short-sighted abusers of biological resources” (Loker 1996:76) “with no respect for the law” (Nygren 2004:145). Such narratives have left the hunting cultures, identities, and LTK of campesinos and analogous nonindigenous *peasants* relatively marginalized in anthropological and ecological research in conservation (Nugent 1993, Nygren 1999, Boglioli 2009). As a result, most campesino LTK research and frameworks appear to inadvertently emphasize practical and descriptive knowledge domains and structures that align with cultural and cognitive assumptions about campesinos as mere agriculturalists with limited cultures. Examples include agricultural knowledge, technical knowledge, and forest knowledge (Baraona 1987, Toledo 1990, Bentley and Rodríguez 2001, Ticktin et al. 2002, Rocha 2005, Shepherd 2005). Within conservation discourse, conservationists seem to focus on campesinos’ wildlife use knowledge, folk taxonomies, and hunting strategies to integrate campesino hunting LTK into natural resource planning and management (Garcia-Alaniz et al. 2010, García del Valle et al. 2015). They seem to omit broad conceptual knowledge about campesino ethics, beliefs, world views, and cosmologies unless the campesinos claim indigenous ancestry. While this omission is a potential indicator of campesino LTK trends, it may be an artifact of quantitative indices that are used to tailor campesino hunting LTK to species-specific or protected area-specific conservation goals, such as the cultural value index, local conservation priority index, and use value index (e.g., Osbahr and Morales 2012, Manzano-García and Martínez 2017, Ávila-Nájera et al. 2018). This omission is likely compounded by comparatively few campesino hunting studies occurring in Mesoamerican countries with lower indigenous populations, such as El Salvador, Honduras, Costa Rica, and Nicaragua (Petriello and Stronza 2020) and the trend of focusing ethnoecological research with campesinos on agricultural domains of their livelihoods (e.g., Ticktin et al. 2002).

We believe that regional, methodological, and conceptual homogeneity limit campesino hunting and LTK studies in three ways. First, the regional restriction reinforces knowledge gaps in Mesoamerican campesino LTK, ethnobiology, and hunting research (Brook and McLachlan 2008, León and Montiel 2008, Toledo and Alarcón-Cháires 2012, Albuquerque et al. 2013, Petriello and Stronza 2020). Second, ethnobiological cultural use and value indices emphasize *practical* knowledge about species (e.g., Reyes-García et al. 2007). They potentially reinforce colonialist perceptions of people as objects of study rather than as holders of knowledge (Toledo and Alarcón-Cháires 2012). In addition, these indices suggest that "cultural importance" and "shared knowledge" are determined by the number of informants who know different use strategies and frequencies. They do not assess whether those responses are culturally "correct", whether there is a shared *culture* of knowledge across all informants, and how this LTK is shared and maintained, including the social relations that underlie it. This can limit the domains of LTK that campesinos and conservationists share and associate with one another (e.g., Haenn 1999). Third, these restrictions may obscure conservationists' and policymakers' understanding of the complex relationships between hunting LTK, campesino cultures, and conservation. This gap leads to missed opportunities and conflicts related to the integration of campesino LTK in conservation policy and practice (Haenn 1999, Haenn et al. 2014, Oliva et al. 2014). Recent work also suggests that campesino hunting rates are declining (Gray et al. 2015, Coomes et al. 2016). This means that an incomplete understanding of campesino LTK could limit conservationists' ability to detect changes to it among this group, such as global trends in LTK erosion (Aswani et al. 2018). Thus, a deeper understanding of shared campesino hunting LTK can conceptually and methodologically expand LTK research, critically evaluate cultural assumptions about campesinos, and enhance conservation work with hunters in Latin America (Montero 2004, Altrichter 2006, Ruiz-Serna 2015). This requires reevaluating assumptions about the role, structure, and importance of hunting culture and knowledge among campesinos.

To address these gaps, we combined cultural consensus analysis (CCA) with ethnographic insights (Weller 2007, Carothers et al. 2014) in an ethnoecological framework (Toledo et al. 2002) to study campesino hunting LTK in southwestern Nicaragua. We answered the following questions: 1) Do campesinos belong to a single culture that comprises hunting LTK? 2) What forms of hunting LTK do campesinos say they have and share? 3) How do campesinos learn, transmit, and retain LTK from hunting and to whom? And 4) How does LTK from hunting inform campesino perceptions of their culture and identity? The CCA survey allowed us to conceptualize and measure cultural agreement, and by extension, evaluate the presence of a campesino hunting culture built on LTK. The ethnoecological lens not only allowed us to holistically explore LTK as *kosmos* (shared worldview, beliefs, religion, ethics), *corpus* (the repertoire of descriptive and classificatory knowledge), and *praxis* (resource use strategies), commonly referred to as the k-c-p complex (Toledo et al. 2002), but is also commensurate with other LTK models used within conservation and development (Table 4.1). Moreover, this framework was designed with campesinos and other rural groups in mind. We complemented these results with findings from participant observation and semi-structured interviews to construct a picture of a campesino hunting culture and the role of LTK in that culture. We recommend making campesino LTK a focus of research and as a guide for making conservation more inclusive and effective in Latin America.

Table 4.1 The similarities of the ethnoecology framework with 11 local and traditional ecological knowledge (LTK) models within conservation and development.

LTK models	Domains/categories		
Ethnoecology framework	*Kosmos*: "…the belief system or cosmovision" (Toledo 2002:514).	*Corpus*: "…the whole repertory of symbols, concepts, and perceptions on nature" (Toledo 1992:9).	*Praxis*: "…the set of practical operations through which take place the material appropriation of nature" (Toledo 1992:9).
The peasant cognitive system	n/a	*Corpus*: "…the sum and repertoire of ideas and perspectives of what we consider as the peasant cognitive system" (Baraona 1987:172).	*Praxis*: "…animation [of the *corpus*] through work and decision-making" (Baraona 1987:172).
Traditional ecological knowledge and management systems (TEKMS) frames of reference for environmental impact assessment (EIA)	Social Frame of Reference: "The social frame of reference includes the way indigenous peoples perceive, use, allocate, transfer, and manage their natural resources. This perspective is the hardest to bring into sharp focus, but it is no less important than the preceding three frames of reference. [TEK] cannot be used properly in isolation from the social and political structure in which it is imbedded" (Johannes 1993:35).	Taxonomic Frame of Reference: "Many indigenous peoples know only the local language names for most local plants and animals even when they speak the outside investigator's language well. Thus, to study traditional knowledge about these species, one must first become familiar with these names. The local significance of each indigenous plant and animal as well as soil/rock taxon should be determined" (Johannes 1993:34).	Social Frame of Reference Spatial Frame of Reference: "Fundamental to environmental impact assessment is recording the spatial distribution of living and non-living resources and amenities by mapping. Knowledge possessed by local users can be invaluable in this context, especially in regions where recorded knowledge of local environments is poor…Locations of rare or endangered species are more likely to be identified by local resource users involved in such mapping exercises than by outside researchers doing site inventories…Although not necessarily related, archaeological sites including burial grounds are often conveniently mapped at the same time as natural resources" (Johannes 1993:34).

Table 4.1 Continued

LTK models	Domains/categories		
TEKMS frames of reference for EIA (continued)			Temporal Frame of Reference: "Indigenous resource users usually know the location and timing of a host of significant biological events. Areas that appear as unremarkable to an environmental impact assessment researcher during a site inventory in one period may serve as aggregation sites or migration routes for important animals in another" (Johannes 1993:35).
A classification of traditional ecological knowledge (TEK)	Category 3: "Culturally based value statements about how things should be, and what is fitting and proper to do, including moral or ethical statements about how to behave with respect to animals and the environment, and about human health and well-being in a holistic sense" (Usher 2000:186). Category 4: "Underlying the first three categories is a culturally based cosmology–the foundation of the knowledge system–by which information derived from observation, experience, and instruction is organized to provide explanations and guidance" (Usher 2000:186).	Category 1: "Factual/rational knowledge about the environment…typically based on (a) empirical observations by individuals of specific events or phenomena; (b) generalized observations based on numerous experiences over a long time; or (c) generalized observations based on personal experience reinforced by the accounts of others both living…and dead…" (Usher 2000:186).	Category 2: "Factual knowledge about past and current use of the environment…or other statements about social or historical matters that bear on the traditional use of the environment and hence the rights and interests of the local aboriginal population in the regional environment" (Usher 2000:186).

Table 4.1 Continued

LTK models	Domains/categories		
Characteristics of indigenous knowledge (IK)	Characteristic 2: IK as orally-transmitted: "…transmitted through imitation and demonstration. The corollary is that writing it down changes some of its fundamental properties" (Ellen and Harris 2000:4). Characteristic 5: IK as repetition: "Repetition is a defining characteristic of tradition…even when new knowledge is added. Repetition (redundancy) aids retention and reinforces ideas; it is also partly a consequence of 1 and 2" (Ellen and Harris 2000:4). Characteristic 6: IK as constantly changing: "Tradition is 'a fluid and transforming agent with no real end' when applied to knowledge; negotiation is a central concept (Hunn 1993:13). IK is therefore…being produced as well as reproduced, discovered as well as lost, though it is often represented as being somehow static" (Ellen and Harris 2000:4).	Characteristic 1: IK as local: "it is rooted to a particular place and set of experiences, and generated by people living in those places… their taxonomic and utilitarian linkages are on the one hand, local, culture specific and restricted, and on the other, global, culturally decontextualized and extensive" (Ellen and Harris 2000:4). Characteristic 2: IK as orally-transmitted Characteristic 4: IK as empirical and empirico-hypothetical knowledge rather than theoretical knowledge: "1 and 3 support [this] general observation…To some extent its non-literate oral character—as well as, in many cases, its embeddedness in the non-verbally articulated interstices of everyday technical practice and the memory which informs this—hinders the kind of organization necessary for the development of true theoretical knowledge" (Ellen and Harris 2000:4).	Characteristic 1: IK as local Characteristic 2: IK as orally-transmitted Characteristic 3: IK as practical engagement with everyday life: "…is constantly reinforced by experience, trial and error, and deliberate experiment. This experience is characteristically the product of many generations of intelligent reasoning, and since its failure has immediate consequences for the lives of its practitioners its success is very often a good measure of Darwinian fitness" (Ellen and Harris 2000:4). Characteristic 4: IK as empirical and empirico-hypothetical knowledge rather than theoretical knowledge Characteristic 6: IK as constantly changing Characteristic 7: IK as shared knowledge

Table 4.1 Continued

LTK models	Domains/categories		
Characteristics of indigenous knowledge (IK) (continued)	Characteristic 7: IK as shared knowledge: "IK is characteristically shared to a much greater degree than other forms of knowledge, including global science. [It] also arises from its generation in contexts of everyday production…It is usually asymmetrically distributed within a population, by gender or age for example, and preserved through distribution in the memories of different individuals. Specialists may exist by virtue of experience, but also by virtue of ritual or political authority" (Ellen and Harris 2000:5). Characteristic 10: IK as cultural expression: "IK is characteristically holistic, integrative and situated within broader cultural traditions; separating the technical from the non-technical, the rational from the non-rational is problematic…" (Ellen and Harris 2000:5).	Characteristic 5: IK as repetition Characteristic 7: IK as shared knowledge Characteristic 8: IK as fragmentary knowledge: "…its distribution is always fragmentary: it does not exist in its totality in any one place or individual. Indeed, to a considerable extent it is devolved not from individual to individual at all, but in the practices and interactions in which people themselves engage" (Ellen and Harris 2000:5).	Characteristic 8: IK as fragmentary knowledge Characteristic 9: IK as "know-how": "Despite claims for the existence of underlying culture-wide (indeed universal) abstract classifications of the biological world based on non-functional criteria … where IK is at its densest its organization is essentially functional, denotative 'know-how' geared to practical response and performance…" (Ellen and Harris 2000:5).
Honduran Folk Entomology	n/a	Culturally important and easily observed taxa: "…have deep folk knowledge and hierarchical taxonomies" (Bentley and Rodríguez 2001:286)[a].	Culturally important and easily observed taxa Culturally important but difficult to observe taxa

Table 4.1 Continued

LTK models	Domains/categories		
Honduran Folk Entomology (continued)		Culturally important but difficult to observe taxa: "…folk knowledge is complex, and much of it classes with modern science" (Bentley and Rodríguez 2001:286). Culturally unimportant[b] and easy to observe taxa: "…have little hierarchical organization and correspond roughly to scientific orders and families. Folk classification [of these] organisms may be inconsistent with modern scientific taxonomy…" (Bentley and Rodríguez 2001:297).	
The six faces of TEK	4th face: ethics and values: "refers to [category 3 from Usher (2000)], this face of TEK is the connection between the belief system (the fifth face) and the organization of facts and actions…This face is the expression of values concerning correct attitudes, often identified as values of respect, to adopt toward nonhuman animals, the environment in general, and between humans" (Houde 2007:6)	1st face: Factual observations, classifications, and system dynamics: "The most understood aspect of TEK is the body of factual, specific observations that TEK holders are capable of generating" (House 2007:4).	2nd face: Management systems: "…refers to the strategies for ensuring the sustainable use of local natural resources…" (Houde 2007:5). 3rd face: factual knowledge about past and current uses of the environment: "…highlights the time dimension of [TEK] while locating it precisely in space. It is knowledge of the past and current uses of the environment that is transmitted through oral history…It refers to the knowledge of historical patterns of land use and settlement, occupancy, and harvest levels…[and] the location of medicinal plants, and cultural and historic sites" (Houde 2007:5).

Table 4.1 Continued

LTK models	Domains/categories		
The six faces of TEK (continued)	5th face: TEK as a vector for cultural identity: "…emphasizes the role of language and images of the past in giving life to culture…[It] understands the stories, values, and social relations that reside in places as contributing to the survival, reproduction, and evolution of Aboriginal cultures and identities" (Houde 2007:6). 6th face: cosmology: "…culturally based cosmology that is the foundation for all other faces and inseparable from them…relates to the assumptions and beliefs about how things work…This is the worldview…that explains the ways in which things are connected…and gives the principles that regulate human-animal relations and the role of humans in the world" (Houde 2007:7).		
Cosmopolitan semantic domains of TEK	Conceptual knowledge: "…understood here as "know-what" (i.e., referential knowledge about the world encoded in abstract mental concepts)" (Zent and Maffi 2009:54).	Conceptual knowledge	Practical skills: "essentially "know-how" (i.e., performative knowledge embedded and expressed through concrete behavioral activity" (Zent and Maffi 2009:54).
Knowledge-practice-belief complex	World view: "…shapes environmental perception and gives meaning to observations of the environment…The concepts provided by our conceptual order, the worldview, invariable provide the interpretation of our observations of the world around us" (Berkes 2012:18).	Local knowledge of land, animals: "…local and empirical knowledge of animals, plants, soils, and landscape. This level of knowledge includes information on species identification and taxonomy, life histories, distributions, and behavior" (Berkes 2012:17).	Land and resource management systems: "…a resource management system…that uses local environmental knowledge *and also includes* an appropriate set of practices, tools, and techniques. Those ecological practices require an understanding of ecological processes…" (Berkes 2012:17).

Table 4.1 Continued

LTK models	Domains/categories		
Knowledge-practice-belief complex (continued)			Social institutions: "…a traditional system of management requires appropriate social institutions, sets of rules-in-use, norms and codes of social relationships…there has to be a social organization for coordination, cooperation, and rule-making [and] may include *institutions of knowledge*…" (Berkes 2017:18).
General model of local knowledge	4th feature: Redundancy and holism: "Represented parallel in several cultural domains; embedded; characterized by holistic orientation through systemic relations with other aspects of culture" (Antweiler 2015:172). 5th feature: Tacit nature of knowledge: "Manifested as often implicit, uncodified, intuitive, embodied, nondisciplinary, less verbalized and less susceptible to verbal or written communication than performed procedural knowledge is" (Antweiler 2015:172). 6th feature: Informal learning: "Experienced through oral transmission, decentralized and piecemeal learning, learning by imitation, demonstration, and apprenticeship more than by instruction" (Antweiler 2015:172).	1st feature: Knowledge plus skills: "Rooted in a combination of specific factual knowledge and practical, action-oriented skills" (Antweiler 2015:172). 3rd feature: Empirical local basis and experiential saturation: generated by local observation and low-cost, low-risk, trial-and-error, and natural experiments; proven by coping over a prolonged period in the laboratory of life" (Antweiler 2015: 172). 5th feature: Tacit nature of knowledge 6th feature: Informal learning 7th feature: Scientific approach: "Conducted with at least partially systematic, methodical, parsimonious, empirical hypothetical, comprehensive, and distinguished by a capacity to generate causal theory" (Antweiler 2015:172).	1st feature: Knowledge plus skills 2nd feature: Adaptation to situational dynamics and variability: keyed to common, but never precisely identical, features of a particular place; thus adapted to ambiguous, mutable, stochastic, and thus indeterminate issues (Antweiler 2015:172). 8th feature: Optimal ignorance 9th feature: Evaluation criterion, test: "Based on practical efficacy as the yardstick vs. other criteria such as theoretical consistency, parsimony, and elegance (but see 4)" (Antweiler 2015:172).

Table 4.1 Continued

LTK models	Domains/categories		
General model of local knowledge (continued)		8th feature – Optimal ignorance: "Achieved through information only as detailed and accurate as necessary for addressing the problem, no more and no less" (Antweiler 2015:172).	10th feature: Resulting actions and solutions to problems: "Arrived at through solutions familiar and thus broadly accepted by local peoples, oriented to "satisficing" and optimizing (vs. maximizing) and the use of local or endogenous resources" (Antweiler 2015:172).
Forms and levels of local knowledge	Complex: "It may include causal knowledge and knowledge of complex systems…It may pertain to relationships in everyday life or information of relationships within the cosmos or to the aetiology of diseases, the creation of humankind, or the origin of a community" (Antweiler 2015:169).	Declarative: "It pertains to discreet entities relating to the natural and social environment, facts relating to neighboring groups or, for example, details on development organizations. But local knowledge may involve categories and classifications, such as plants, animals, or relatives" (Antweiler 2015:169).	Procedural: "It might comprise knowledge of rapid changes in the natural environment, in market prices for goods, or in experiences with development projects. Analytically, one can distinguish between knowledge of general and specific processes" (Antweiler 2015:169).
General principles behind the local component of TEK of soils and geomorphology	n/a	n/a	General principle #1: multiple resource management (MRM): "The principles behind MRM are similar to those supporting conventional land-use planning, land suitability or land evaluation. The premise is that management of a relatively wide range of resources increases food security and, in general, resilience, and is a sustainable form of community-based development" (Bocco and Winklerprins 2016:4).

Table 4.1 Continued

LTK models	Domains/categories	
General principles behind the local component of TEK of soils and geomorphology (continued)		General principle #2: the management of sedimentation through terracing: Bocco and Winklerprins (2016) present examples of intentional soil movements throughout history as a management practice for different cultures.
		General principle #3: soil amendments – constructing topsoil horizons: Bocco and Winklerprins (2016) reference historical evidence for topsoil management in the Netherlands, Germany, Northern Atlantic Islands, and the Amazon to construct a case for this principle as a component of TEK for soil management.

[a]We excluded Bentley and Rodríguez's (2001) fourth category – culturally unimportant and difficult-to-observe species – because such animals were "not known, named, or classified" (287) by the study participants.
[b]We excluded culturally unimportant and easy-to-observe taxa from the *praxis* category because this category of Honduran campesino folk taxonomies used generic names based on natural characteristics rather than specific names based on cultural uses as occurred for the other categories.

4.2. Study Region, Country, and Site

Mesoamerica comprises Mexico and Central America in conservation (Toledo et al. 2002). The region is a biodiversity hotspot and one of the most linguistically diverse places in the world (Gorenflo et al. 2012). It contains the most forest cover and highest number of forest ecoregions though fewer than a third are protected (Gillespie et al. 2012). Its critically threatened tropical dry forest fragments, mostly on the Pacific coast, are the least protected forests from agriculturally-driven deforestation and defaunation in Mesoamerica (de Albuquerque et al. 2015). Conservationists have called for direct collaborations with campesinos and indigenous peoples in these landscapes (Harvey et al. 2008). People in the region have experienced six armed conflicts, causing over 1000 deaths each and extensive ecological shifts from 1950 and 1990 (Hanson et al. 2009).

Nicaragua is the second largest, the poorest, and least biodiverse country in Mesoamerica (Pérez 1999). The most recent national estimates place the 2012 population at 6.071 million, with 41.5% to 44% living in rural areas from 1997 to 2005 (Toledo et al. 2002, INIDE 2005, 2012). Nearly 90% of rural residents do not self-identify as indigenous, are mainly Catholic, Evangelical, or Moravian (INIDE 2005), and are primarily employed in restaurants, hotels, agriculture, silviculture, fishing, and hunting (INIDE 2008).

Hunting is part of a complex and evolving conservation history in Nicaragua. The Somoza dictatorship codified hunting in 1956 as “pursuing, surprising, or attracting wild animals, in order to catch them dead or alive” (Decreto 206, 1956). Under this law, a hunter is “any person engaged in the exercise of hunting” who is categorized as either a licensed “professional” (i.e., profit-driven) or “amateur” (i.e., sport) hunter. The law also prohibited hunting in protected areas. However, wildlife dramatically declined as unlicensed hunting increased due to weak enforcement, legalization of wildlife exports in 1974, lack of alternative income sources for rural residents, and noncompliance with CITES between 1977 to 1985 (Pérez 1999). The Somoza government confiscated civilian guns in the 1978-1979 Sandinista Revolution, reducing pressures on overhunted wildlife (Nietschmann 1990). Thereafter, the new Sandinista government adopted a 'revolutionary' ecology platform wherein they established new policies and natural resource agencies that banned the hunting (and export) of endangered species, viewing them as a "legal object" for the first time in Nicaraguan history (Ruiz 1994, Faber 1999). However, the 1982-1990 Contra Conflict impeded these advances, while soldiers again viewed anyone who carried or hid guns as enemy combatants (Nietschmann 1990). After the conflict, Nicaragua's hunting calendar, bans, quotas, and other biodiversity provisions were put in place, including legal assurances to "take into account" indigenous and local communities' LTK and uses of biodiversity as their cultural heritage (Ley 217 1996, Resolución Ministerial [RM] 010-2006 2006, RM 011-2006 2006, Ley 807 2012). Currently, unlicensed hunting and hunting inside Nicaragua's 76 protected areas are prohibited yet common (Decreto 9-96 1996, Weaver et al. 2003), holding a penalty of 100 days to eight years in prison (Manzanarez 2012). These conditions disproportionately affect campesino hunters who cannot afford licenses, guide foreign hunters, and hunt for subsistence (MAP, *personal observation*).

We focused our research in the southwestern Nicaraguan community of El Pizotero (a pseudonym), located in the Department of Rivas between Lake Nicaragua (Cocibolca) and the Pacific Ocean (Fig. 3.1). The campesino communities in Rivas occupy the agricultural margins in parts of the last remaining tropical dry forest fragments in Mesoamerica. These fragments are interspersed between several small to medium-sized urban areas, tourist destinations, private protected areas, and wildlife reserves spanning its 2,162 km^2. In Rivas and adjacent departments, the Ministry of the Environment and Natural Resources (MARENA) and non-governmental organizations (NGOs) have aimed to reduce, sensitize, and collaborate with campesino hunters for conservation (Otterstrom et al. 2007, Fundación Cocibolca 2010). El Pizotero has experienced these and similar conservation interventions for over a decade. Yet, campesino hunting research in Nicaragua is scarce in that a recent review of campesino hunting research (1937-2018) found only 9 studies in 10 Nicaraguan Departments, none of which took place in Rivas (Fig. 1, Petriello and Stronza 2020).

El Pizotero has an estimated 150 residents across 30 households (Community president, *personal communication*). However, these figures vary. Residents refer to El Pizotero as a campesino community because their livelihoods depend on agriculture (rice, beans, corn, squash, plantains, mango, and manioc), itinerant farm labor, and housekeeping in the *campo* (Latin American agricultural countryside). El Pizotero straddles the mountainous boundaries between the Costa Rican Border and the southern municipalities of San Juan del Sur and Cárdenas near La Flor Wildlife Refuge, La Guacamaya Reserve, and Mono Bayo Private Wildlife Reserve established in 2017. Given the uncertainty about community size and extent, community members recognize two El Pizoteros: *El Valle* and *La Colina*. *El Valle* is the most populated sector with the community's central meeting location and school. Residents often disagree about community boundaries and who belongs to the "real" El Pizotero. We chose El Pizotero because of the lead author's field research documenting high levels of hunted species knowledge and his previous experience there with a conservation NGO through which he developed a longstanding rapport with community members.

4.3. Methods

4.3.1. Sampling Protocol

To construct our sample pool, we sought out LTK "experts" through a process of peer recommendations (Davis and Wagner 2003), snowball sampling and opportunistic sampling. We first asked three community elders and the four members of El Pizotero's Citizen Power Council (*Consejo de Poder Ciudadano,* CPC, see Bay-Meyer 2013) "Who in the community knows a lot about the forest and hunting?" All of the initial key informants were identified by our guide (a community member and NGO employee). Given the small community population, low number of active hunters, the legal sensitivity of campesino hunting, and two peer experts' reluctance to participate, our informant pool reached saturation (n = 6) midway through the first field season in 2016. We then interviewed these individuals and posed the same peer recommendation question at the end of each, expanding our initial sample to twelve informants. This sample size reached the threshold for saturation to determine perceptions/beliefs that are likely commensurate with CCA (n = 12) (Guest et al. 2006). However, we continued sampling with an opportunistic sampling protocol to account for informant gender bias (i.e., all male "experts"), which we also recorded in preliminary notes and participant observation of gendered LTK about hunting (e.g., women appeared to refer to meat preparation in hunting conversations). This hybrid approach not only addressed informant biases, but also allowed us to: 1) access nuanced, potentially marginalized, and often inaccessible knowledge, and 2) anticipate the challenges of obtaining a representative sample of hidden informants engaged in an 'illicit' activity (e.g., Cohen and Arieli 2011).

4.3.2. Data Collection

We used three interrelated yet distinct approaches in our study: cultural consensus analysis (CCA) surveys, ethnographic interviews, and participant observation (Carothers et al. 2014). The lead author conducted semi-structured interviews and CCA surveys with 30 informants, and 6 additional CCA surveys with informants that did not consent to full interviews, across 11 months of field work from May 2016 to August 2017. All interviews were audio recorded with informants' consent, ranging from 54 minutes to 2.85 hours. Interviews were held in informants' households, agricultural parcels, and the local *pulpería* (the community's central meeting location, primary source of purchasable goods, and the home of the community president). Prior to tape recording, the purpose of the study was explained to potential informants. After they provided their consent, informants were asked open-ended questions guiding by prompts about campesino and indigenous identity, general environmental knowledge, and hunting in the community. The lead author initiated each interview with open questions about being campesino and indigenous to situate their livelihoods and identities as the central topic of interest through which all other questions would be filtered. To avoid directing the conversation, the lead author would use only guided questions that naturally aligned with responses. For example, given the inseparable connection between campesinos and the campo, these conversations fluidly transitioned into informants' relationships with and knowledge of the natural world. In turn, reflections on peoples' knowledge of wildlife then filtered into the ways they valued, learned about, and used wildlife, including hunting. Informants who identified as hunters were also asked to delineate the strategies, seasonality, catch, frequency, and length of hunting trips per hunted species. However, these details often emerged from hunters and non-hunters descriptions alike. To not influence informants' responses to interview questions yet allow them to reflect on the entirety of their individual hunting knowledge, the CCA survey occurred at the end of the semi-structured interviews.

We designed our CCA survey to document the kosmos, corpus, and praxis of five modified cosmopolitan domains of hunting LTK, or “fields of meaning and action” (Zent 2010: 2). We asked informants whether they agreed or disagreed with 52 yes-no propositions (10 to 11 propositions per domain) about hunting (Appendix C) that were informed by the lead author’s ethnographic observations and conversations during 4 field seasons from 2008 to 2015 (cf. Carothers et al. 2014). We used dichotomous responses to align with the requirements of the formal CCM and accommodate informants’ logistic and time constraints (e.g., taking time away from agriculture, household labor, and childcare to participate). The CCA survey was pilot tested with 5 community members who helped adjust the language and phrasing to account for local idioms and education levels. The domains encompassed: 1) social knowledge (kosmos, praxis), 2) political knowledge (corpus, praxis), 3) hunted wildlife knowledge (corpus, praxis), 4) practical hunting knowledge (corpus, praxis), and 5) historical knowledge (kosmos, corpus). All propositions were read to informants because of high illiteracy levels and skepticism toward filling out paperwork from foreign researchers and government entities. We encouraged informants to elaborate beyond yes-no answers to contextualize and qualify their responses. Responses were also audio-recorded with informants’ consent. This systematic and targeted approach allowed us to understand the forms of knowledge comprising campesino hunting culture, whether this knowledge is shared or distinct among campesino residents, and how this knowledge informs perceptions of hunting. The lead author also conducted participant observation in the study community, spending time in the fields, homes, and forests where local campesinos lived, worked, and hunted. The lead author also participated in 3 hunting trips with one to eleven hunters each. These direct experiences, interviews, and CCA surveys provided a quantitative and qualitative data to understand how hunting LTK was manifested, shared, and used by campesinos.

We operationalized LTK as ≥ 16 respondents (~50% of 33 audio recorded interviews and 3 unrecorded CCA surveys) referencing dimensions of the kosmos, corpus, and praxis of hunting knowledge, such as hunting strategies, current and historical wildlife abundances, and local hunting beliefs (e.g., talismans). This approach allowed us to systematically document LTK and differentiate it from an informant simply talking about the environment (local ecological talk) or talking about others' environmental knowledge (local ecological skepticism) (Palmer and Wadley 2007), thereby enhancing its methodological and cultural validity and replicability (Davis and Ruddle 2010). Moreover, this value complemented the 50% threshold in CCA where an average cultural competency of 0.5 or more suggests there is a culturally "correct" set of knowledge or beliefs (Weller 2007).

4.3.3. Analysis, Coding of Interviews, and CCA Surveys

Cultural consensus analysis (CCA) is both a theory and a suite of statistical tools and models largely used by anthropologists to understand the degree of consensus (i.e., agreement) and social distribution of knowledge about a specific topic. In general, CCA estimates individual knowledge, also called 'competence scores', from agreement between respondents. The culturally "correct" answers, which are unknown to the researchers, are then estimated as weighted comparisons of peoples' individual responses to their individual competency, which are then combined across all respondents. The CCA model has three assumptions (Romney et al. 1986, Weller 2007, Anders et al. 2018, Batchelder et al. 2018). First, there is the assumption of a single culture, meaning there is one set of answers, and a culturally correct answer key, for all respondents. Second, conditional dependence is assumed, meaning that all informants' responses are provided independent of other respondents. And third, the survey questions are assumed to represent a single knowledge domain and are all at the same difficulty level. As a set of tools and models, CCA can accommodate open-ended, interval, ratio-scaled, ordinal, multiple-choice, or dichotomous responses. These data formats guide what type of CCA model (formal or informal) is used for analysis. As Weller (2007) explained, the formal model can analyze only multiple choice and open-ended responses, whereas the informal model can support the remaining data formats. In addition, procedures and assumptions for handling response/guessing bias vary per model.

Despite these differences, both models are essentially a factor analysis of an informant-by-informant correlation matrix. This analysis tests the assumption of a single culture, which is met when the ratio of the first to second eigenvalues is three-to-one or greater (Weller 2007). The second assumption, conditional dependence, is met based on the study design and data collection techniques (e.g., focus groups violate this assumption). The third assumption of homogeneous item difficulty is commonly overlooked but can be tested by comparing informants' competence scores across subsets of questions (Weller 2007).

Methods and software for conducting CCA are continually advancing and allowing researchers to work with data that do not meet these assumptions (Oravecz et al. 2014, Anders et al. 2018). For example, Anders et al. (2018) designed an R package – CCTpack – that can test and estimate CCA model fit for multiple cultures, heterogenous item difficulty, and varied response biases using a hierarchical Bayesian framework (Batchelder et al. 2018). This approach may be particularly useful when evaluating a shared culture from multiple dimensions of a single domain of knowledge, such as the k-c-p complex in ethnoecology.

Formal CCA can be carried out in several programs (e.g., ANTHROPAC, UCINET, R, MATLAB) using non-Bayesian and Bayesian packages (e.g., AnthroTools, FlexCCT, Bayesian Cultural Consensus Toolbox [BCCT], Hierarchical Condorcet Modeling Toolbox [HCMT]) depending on the type of model that fits the data (Batchelder et al. 2018). We used R (R Core Team 2018) to analyze our CCA results in the CCTpack package (see Appendix C for R script) (Anders et al. 2018, Batchelder et al. 2018). CCTpack runs a Bayesian hierarchical Condorcet model using noninformative priors to "to place maximum influence on the data for determining the model parameter values, rather than the priors" (Batchelder et al. 2018:257). This approach also aligns with the a priori assumption that researchers do not know the correct answers or parameters of consensus. Unlike frequentist statistics, Bayesian analyses "get from the probability of the data, given the model, to the probability of the model, given the data" (Kruschke 2010: 4). In other words, the Bayesian approach allowed us to test which model best fit our data and assess consensus if the initial assumptions of homogenous item difficulty and guessing bias were not met. CCTpack provided two paths to determine model fit. First, it produced a Deviance Information Criterion (DIC) value, for which lower values indicated better fit. Second, to evaluate model fit relative to CCA assumptions, CCTpack provided a formal "posterior predictive model check" to diagnose the model fit for the correct number of cultures ("culture number check") and homogeneity of item difficulty ("item difficulty check") (for details, see Anders et al. 2018, Batchelder et al. 2018:253). It also permitted the analysis of our data set with missing responses (*n* = 33 out of 1872), helping overcome the limitations of other packages such as AnthroTools (Purzychi and Jamieson-Lane 2016) and avoid the disputed practice of coin flipping (Weller 2007) to assign responses to missing data (Oravecz et al. 2014:189).

For the interview data and field notes, we applied qualitative content analysis (Elo and Kyngäs 2008) to 30 transcriptions in Nvivo 12.3 (QSR International 2018). Unlike quantitative content analysis and grounded theory, yet similar to CCA, the qualitative content analysis (QCA) process is not informed by prior knowledge or focused on theory building (Cho and Lee 2014). Instead, QCA is the process of interpreting subjective explanations and emergent meanings from textual and/or photographic data (Schrier 2012). The lead author initially used line-by-line open coding to analyze six interviews selected with a random number generator (three from 2016 and 2017). The purpose of this stage of analysis was to deeply familiarize the analyst with the data and to let the data speak for itself. This required the lead author to abandon the ethnoecology framework at this stage and record any thoughts, memos, and ideas about campesino hunting LTK and the social spheres in which it operates. In total, 66 open codes were identified. In the next stage, we refined and condensed open codes into focused codes, eliminating any code recorded in fewer than two interviews, resulting in 14 focused codes. This elimination process also allowed us to systematically document LTK and differentiate it from local ecological talk and local ecological skepticism (Palmer and Wadley 2007), thereby enhancing the methodological and cultural validity and replicability (Davis and Ruddle 2010).We then coded the remaining interviews using these focused code and continued to record relevant memos and notes. These codes allowed us to precisely target data collection and iteratively refine our analysis. After all interviews were coded, we filtered the 14 focused codes through the conceptual framework of ethnoecology (Toledo et al. 2002, Barrera-Bassols and Toledo 2005), distilling their relationships to the kosmos, corpus, and praxis of campesino hunting LTK.

4.4. Results

4.4.1. Sample Demographics

The informants captured a representative sample of community demographics. All were Nicaraguan citizens with a median age of 48 (range: 23 to 82). Nearly all had lived in the *El Valle* sector (92%) for a median of 16 years (0.5 to 65 years). Two of the three nonmembers of the community were NGO employees at Mono Bayo Private Wildlife Reserve, and the third identified as a member of *La Colina*. However, the sample was mostly male (72%). In addition, 78% had some form of formal education, including 28% who either completed primary school or are pursuing or obtained college or technical degrees. While 61% had hunted at some point in their lives, 50% currently identified as a hunter and four informants were active hunters. However, participant observation revealed an estimated 13 to 18 active hunters as of 2017.

4.4.2. Cultural Consensus Analysis

The scree plot from the Bayesian hierarchical Condorcet model showed a marked drop between the first and second eigenvalues, inferring the possibility of a single culture (Fig. 4.1). To determine which model best fit our data, we ran several iterations of the CCA model. We set the parameters of the first model to match the original CCA assumptions of a single culture and homogenous item difficulty, producing a DIC of 1616.13. While the assumption of a single culture was met, the item difficulty check was not satisfied. For the second model, we estimated a single culture and heterogenous item difficulty, which produced a lower DIC (1546.16). This model satisfied both the culture number check and item difficulty check (Fig. 4.2). Here, the ratio of the first eigenvalue to the second eigenvalue was 5.22 (9.62 : 1.85), and the first eigenvalue explained 53.21% of the variance, meeting the threshold to account for a single culture. Average posterior mean competence was high ($\theta = 0.68$, range 0.53 to 0.76) and respondents' individual competencies (θ_i) were not associated with gender, age, or hunter status (Fig. 4.3).

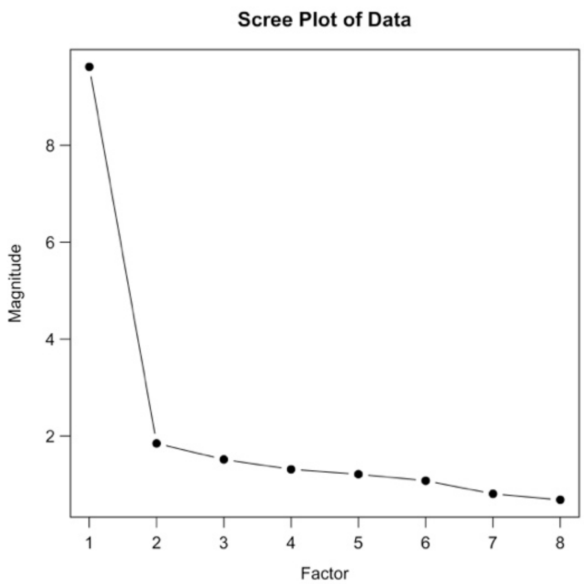


Figure 4.1 Scree plot of cultural consensus analysis testing the assumption of a single culture.

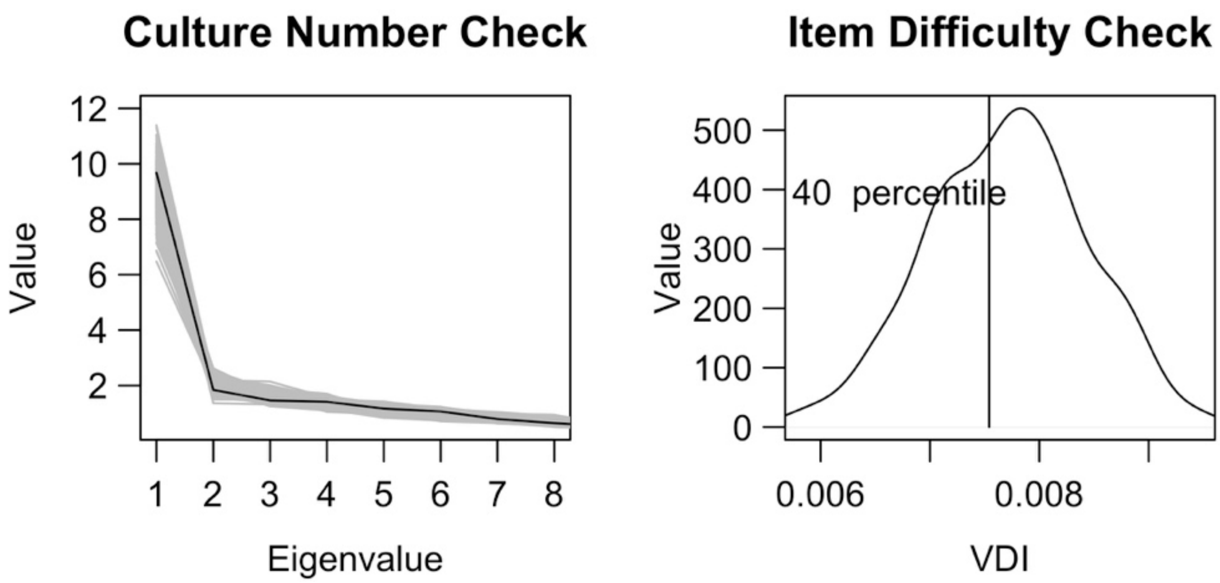


Figure 4.2 Posterior predictive model check to determine if the Bayesian hierarchical Condorcet model fits the assumptions of cultural consensus analysis: a single culture (500 simulations) and item homogeneity assumptions.

Figure 4.3 Posterior mean cultural competence scores across male and female campesino hunters and non-hunters.

4.4.3. Local and Traditional Ecological Knowledge (LTK) from Campesino Hunting

We found that each dimension of the k-c-p complex met the LTK threshold (Tables 4.2-4.4). Yet when separated into individual themes to account for their diverse components of campesino hunting knowledge, the *corpus* of wildlife knowledge comprised more themes than the *kosmos* and *praxis* combined. We drew from ethnographic insights to describe each dimension and their nested themes below.

4.4.3.1. *Campesino Hunting Kosmos: "The secrets of the hunt"*

The kosmos of campesino hunting culture was the least referenced dimension of LTK in El Pizotero, and was mainly comprised of cosmological beliefs (Table 4.2). Of the four kosmos themes, campesinos most widely referenced subsistence as a worldview and ethical orientation, and hunting beliefs as "*the secrets of the hunt.*" Subsistence comprised the ethical stance that hunting should be oriented toward family-level consumption rather than commercial hunting to cope with pervasive poverty, ensure dietary diversity, and avoid overhunting.

The secrets were associated with the uses of, and beliefs about, select parts of three species: the tails of nine-banded armadillos (*Dasypus novemcinctus*), the "stones" (bezoars) and "fangs" of white-tailed deer (*Odocoileus virginianus*), and the bile ducts of pacas (*Cuniculus paca*).

Table 4.2 Local and traditional knowledge themes associated with the kosmos of campesino hunting culture in El Pizotero, Nicaragua.

LTK dimension and themes	Respondents	References
Kosmos (31, 136)*		
Subsistence/hunting ethics	28	105
Cosmological beliefs	12	24
Religious beliefs	4	7
Enchanted rifles	1	1

*Parentheses denote the absolute number of respondents and references for each k-c-p dimension.

Armadillo tails were perceived to confer luck to campesino hunters when the tips had a "nail". According to one former hunter, "*Yes, the armadillo has a nail at the tip of its tail. The nail is large. Such is the secret of the armadillo: you keep that nail and you don't have to go far from your house to get an armadillo. You'll always be successful*" (027, $\theta_i = 0.75$). Whereas not all hunters used them ("*The elders say so, but in all the time I've hunted, I've never tried to see if it's true*" (015, $\theta_i = 0.62$), other active hunters provided more details on the use and limitations of using armadillo "nails".

> "*You have an armadillo and you remove the nail it has. That's where the dog comes in. You carry the nail in your bag, and I can go out with you. 'Michael, I have the nail. Let's go hunt'. We invite one or two more. Why? Because the older folks say that not all the armadillos have a nail. That's like a mystery, that the dog has more ease. It helps him manage to hunt that armadillo*" (014, $\theta_i = 0.69$).

However, allowing others to see your armadillo nail is taboo because it will lose its luck. In the words of a non-hunter who was married to a hunter, "*They say only you can see the animal, only you can see the nail. Others cannot see it because if someone saw it you won't hunt* *again. You have to take care of that nail. Here, they secretly hide them in their wallets. The secret is that you can't show anyone because if you go around showing off the nail, you won't ever hunt anything again*" (018, $\theta_i = 0.65$).

Similar to armadillo "nails", white-tailed deer bezoars and fangs, and paca bile ducts, were also believed to improve hunting success. During one CCA survey, a hunter qualified his "yes" answer to the statement "Deer stones give hunters good luck for hunting" with,

> "*The story of the deer is that not all deer have it. Maybe out of 100, one contains the secret: that's a secret of the deer. Because in the deer exist two types of secrets, the stone and the fang. When one shoots it, it vomits up that stone when it is going through the agonies of death. If the deer has a fang, they say that they have it in the roof of their mouth, above. Then you remove it and only you keep it. The same with the stone. You then go out, don't have to go far, and never lose a shot. You always come back with a deer. The paca that has that bag of bile gives you the same luck. But, according to history, if it was you that caught it, you can sell it to someone to use*" (027, $\theta_i = 0.75$).

Thus, while the deer and armadillo amulets lost their powers when their secret was revealed to others, the paca bile ducts did not. These beliefs were confirmed as culturally correct in the CCA surveys (see Social Knowledge in Appendix C).

4.4.3.2. *Campesino Hunting Corpus: "What we find are armadillos, deer, paca, and agoutis"*

The corpus of campesino hunting culture was the most referenced domain of LTK (Table 4.3). Respondents' corpus centered on 41 species, 20 of which were hunted. Hunted species, including the three species that held hunting "secrets", represented the core of this knowledge domain – six of which were referenced by ≥ 16 campesinos.

Table 4.3 The corpus of campesino hunting knowledge in El Pizotero, Nicaragua.

LTK dimension and themes	Local names	Scientific name	Respondents	References
Corpus (32, 435)*				
Mammals (32, 356)				
White-tailed deer	*Venado*	*Odocoileus virginianus*	32	99
Lowland paca	*Guardatinaja, tepezcuintle, guardiola*	*Cuniculus paca*	30	74
Nine-banded armadillo	*Cusuco, armado, pitero*	*Dasypus novemcinctus*	28	92
Central American agouti	*Guatusa, cherenga, chapina, guachara, guacharria*	*Dasyprocta punctata*	24	60
Collared peccary	*Sajino, chancho de monte*	*Pecari tajacu*	17	47
White-nosed coati	*Pizote*	*Nasua narica*	16	43
Unnamed monkeys	*Monos*	One of three potential species listed below	10	16
Jaguar	*Tigre, jaguar*	*Panthera onca*	10	15
Puma	*León, gato de monte*	*Puma concolor*	9	12
Baird's tapir	*Danto*	*Tapirus bairdii*	8	13
Northern raccoon	*Mapachín*	*Procyon lotor*	7	18
Eastern cottontail	*Conejo, conejo moro, conejo indio*	*Sylvilagus floridanus*	5	9
Variegated squirrel	*Ardilla*	*Sciurus variegatoides*	5	7
Kinkajou	*Cuyuso*	*Potos flavus*	5	7
Unnamed possums	*Zorros*	n/a	5	7
Mantled howler monkey	*Mono congo*	*Alouatta paliatta*	4	9
Geoffroy's spider monkey	*Mono bayo, mono amarillo, mono araña*	*Ateles geoffroyi*	4	9
White-faced capuchin	*Mono cara blanca, mico cara blanca*	*Cebus capucinus*	4	6
Common opossum	*Zorro pelón*	*Didelphis marsupialis*	4	5
Margay	*Tigrillo*	*Leopardus weidii*	4	4

Table 4.3 Continued

LTK dimension and themes	Local names	Scientific name	Respondents	References
Corpus (continued)				
Mammals (continued)				
Jaguarundi	*Gato negro*	*Herpailurus yagouaroundi*	1	2
Porcupine	*Zorro espina*	*Coendou mexicanus*	1	2
Gray fox	*Gato ostoche*	*Urocyon cinereoargenteus*	1	1
Birds (28, 125)				
Unnamed birds	*Pájaros, aves*	n/a	18	31
Unnamed parrots, parakeets, and macaws	*Loras, pericos, Chocoyos, zapoyoles, lapas, guacamayas*	n/a	17	50
Great curassow	*Pavo real, pavón*	*Crax rubra*	13	30
Unnamed doves	*Paloma*	n/a	5	8
Unnamed toucans	*Tucán*	n/a	4	7
Scarlet macaw	*Lapa roja*	*Ara macao*	4	4
Great green macaw	*Lapa verde*	*Ara ambiguous*	3	3
Unnamed hawks and vultures	*Gavilanes, Zopilotes*		3	3
White-throated magpie jay	*Urraca*	*Calocitta formosa*	2	2
Unknown	*Feliz*	Unknown	2	2
Montezuma oropendola	*Oropéndola*	*Psarocolius montezuma*	1	1
Unnamed ducks	*Patos*	n/a	1	1
Unknown	*Popolomboyo*	Unknown	1	1
Reptiles (27, 57)				
Unnamed snakes			16	32
Black ctenosaur	*Garrobo*	*Ctenosaura similis*	11	16
Fer-de-lance	*Terciopelo, barba amarilla*	*Bothrops asper*	7	10
Boa	*Boa*	*Boa imperator*	5	5
Green iguana	*Iguana, lapa verde*	*Iguana iguana*	5	5
Central American rattlesnake	*Cascabel*	*Crotalus simus*	2	3
Slender hognose viper	*Toboba*	*Porthidium ophryomegas*	3	4
Coral snake	*Coral*		2	2
Unknown	*Chocoya*	Unknown	1	1
Unknown	*Sabanera*	Unknown	1	1

*Parentheses denote the absolute number of respondents and references for each k-c-p dimension.

Hunters and non-hunters tended to distinguish the commonly hunted species from those that were rarely hunted or not hunted through two different modes of *knowing*: to intellectually or factually *know* (*saber*) about an animal and to personally *know* (*conocer*) an animal through experience. Although separate, these ways of *knowing* were interlinked through species' abundance and opportunities to hunt them. For instance, a 58-year old non-hunter used this distinction to answer the question "Why is it important that people know (*conocer*) the animals?":

> "*It's important because, well, for example, not everyone at this altitude knows* (conocer) *a deer – there aren't many – and if they* [say] *they know it, it's through videos. But personally? Look at my age. I don't know* (conocer) *the puma and I've lived in the mountains for all the life I've lived. There are things that we live and exist and we still don't know* (conocer) *them. I know* (conocer) *the tapir because I was in the war* [1979 Sandinista Revolution]. *Now there are no tapirs. Many people finished them and don't know* (conocer) *them. Much of this generation's youth doesn't know* (conocer) *the tapir because they just hear it sing. They don't even know* (saber) *what it is. That's why it's important that they are here so that the new generations know* (conocer) *it*" (013, $\theta_i = 0.71$).

The importance of knowing species was directly tied to hunting. Knowledge of each species was expressed in terms of their relative abundance, seasonal patterns, feeding ecology, reproductive potential, defense mechanisms, print identification, and other life history traits – all of which informed the praxis of hunting (see Campesino Hunting Praxis). The six most referenced species were all perceived to be in decline. According to two hunters, "*Paca is a very* *scarce animal*" (004, $\theta_i = 0.71$) and "*Hopefully, God wants those species of animals that were the most here to reproduce. There were pacas, armadillos, deer, collared peccaries – that was here in quantity. An animal they called* cherenga, guatusa (agoutis) *was here in quantity. They're not here too*" (036, $\theta_i = 0.71$). Given these perceived declines, campesinos paid unique attention to any sign of them, such as prints: "*When someone's working, they see whatever animal comes out. And there they see the hoof prints. I say* '*Man, a deer passed here. Here are the prints. This deer walked by here*'" (006, $\theta_i = 0.56$). Campesinos would then use their knowledge of reproductive patterns, defense mechanisms, habitat and refugia preferences, and feeding behavior to formulate plans for hunting specific species. Peccaries and coatis were considered high risks for hunters and hunting dogs in that "*Peccaries are extremely fierce. They plant themselves and follow dogs to bite them. They have large fangs where they grab a dog, twist it, and kill it*" (023, $\theta_i = 0.66$) and "*Coatis have canines like a dog, and the lone coati has canines that are even sharper; they can cut you through a rubber boot*" (014, $\theta_i = 0.69$).

Yet the interviews and CCA surveys showed that this repertoire of broader hunting knowledge did not extend into shared knowledge about hunting laws or wildlife management. Although nearly all campesinos reported that hunting was prohibited and few campesino hunters held permits, the culturally correct answers to questions about government enforcement, governmental hunting outreach, and local compliance with government hunting quotas were varied (see Political Knowledge in Appendix C).

4.4.3.3. ***Campesino Hunting Praxis: "Of dogs, machetes, and macanas"***

Based on our analysis, 13 themes emerged from the praxis of campesino hunting culture. However, only four themes met our LTK threshold (Table 4.4). Three of the four praxis themes were components of hunting techniques (i.e., tools, strategies, locations). Although hunting techniques overlapped with the dog and hunting tool themes, the frequency of references to the social, utilitarian, and hunting values of dogs, and specific hunting tools (e.g., machetes, shovels, and clubs (*macanas*)), suggested they warranted separate categories.

Table 4.4 The themes of campesino hunting praxis in El Pizotero, Nicaragua.

LTK dimension and themes	Respondents	References
Praxis (31, 272)*		
Hunting dogs and their symbolism	23	106
Meat preparation and preferences	23	65
Hunting techniques	23	63
Hunting tools	19	46
Time of day or week to hunt	14	27
Choosing hunt location	11	17
Animal behavior	9	22
Seasonality	8	18
Hidden hunting	4	4
Species habitat use	2	4
Animal dangers	2	2
Medicinal uses	2	2

*Parentheses denote the absolute number of respondents and references for each k-c-p dimension.

For El Pizotero campesinos, dogs were inseparable from hunting. Dog barks evoked thoughts of hunting ("*When you see the dogs, when you hear them bark, the hunters are carrying guns, they're going shooting*" (01, $\theta_i = 0.65$)) and an awareness of the presence of hunters and their use of dogs ("*And when they* [hunters] *hear with the dogs, 'oh, oh, oh'. That's where they take the animal*" (09, $\theta_i = 0.73$)). In this way, dogs were the initiators and facilitators of hunting for many. According to one campesino hunter that had lived there for 17 years, "*One goes out working, the dogs walk around and follow an animal. They hole it, there goes one* [dog]*, and they take it. Hunting happens with dogs more than anything. It's difficult without dogs. It's hard to find animals without them*" (012, $\theta_i = 0.66$). However, the ease of hunting with dogs depended on the connection between canine and campesino: "*When you go out to hunt, you have to connect with your dog, the dog and you, because if you go and stop at a point, he doesn't move from there, nor do you think he's going to be freaking out. The dog will begin to smell there and leaves when you leave"* (031, $\theta_i = 0.68$). This connection was mediated by campesinos' knowledge of dogs' prey preferences, such as their expertise in hunting diurnal or nocturnal animals: "*There are two ways for hunting dogs: there are dogs that hunt from paw prints in the day, and there are those that hunt at night, the nocturnal. It's better if we have a nocturnal because it senses nothing more than the forest, like it's not looking.*" (014, $\theta_i = 0.69$). Moreover, aligning with the corpus of campesino hunting knowledge, campesinos classified their dogs according to their expertise in hunting armadillos (*cusuqueros*), deer (*venaderos*), agoutis (*guatuseros*), pacas (*guarderos*), coatis (*pisoteros*), peccaries (*sajineros*), and wild cats (*tigreros*).

Although no hunters possessed all types of dogs, most campesinos owned at least one of the following hunting tools: machetes, rifles, clubs, pickaxes, and shovels. Therefore, hunters' tools and strategies varied according to the types of dogs they owned. Campesinos used *venaderos*, machetes, and .22 rifles to hunt deer because "*The deer runs hard. You sick the dogs on it and they kill it. They [hunters] reach it, and they shoot it*" (010, $\theta_i = 0.72$). Yet, deer hunting was rare because few campesinos legally owned firearms (i.e., licenses were cost prohibitive) or desired to put in the effort to hunt deer given their perceived low abundance and the energy required to hunt them. *Sajineros* were rare for the same reasons, which were compounded by the perceived risk of peccary hunting for humans and dogs alike (see Corpus above). On the other hand, *cusuqueros, guarderos*, and *guatuseros* cornered their prey in burrows and caves. Thus, campesino hunters relied on their dogs to pin down prey in their burrows, allowing hunters to excavate and block burrow networks using machetes, pickaxes and shovels and either use their dogs to extract prey that they then killed with one of the three tools – most often a machete – or carry it home alive (e.g., armadillos). One 23-year old hunter justified this latter approach by saying, "*I always take it alive. If I see that it's pregnant, I free it*" (034, $\theta_i = 0.65$). This strategy was considered the culturally correct approach to hunting in general (see Wildlife Knowledge in Appendix C). Conversely, coati hunting forced a compromise between tools and strategies. While some hunters used *pisoteros* to tree wandering coatis and shoot them, others elected to shoot them without a dog's assistance ("*The coati climbs up a tree, and you shoot it*" (006, $\theta_i = 0.56$)). This approach reduced the potential threats to dogs from coatis. Given these associations, dogs not only facilitated hunting, but acted as repositories for knowledge about species-specific hunting tools and techniques.

The second most prominent praxis theme was meat preparation and preferences (Table 4.4). Meat preparations involved field dressing and prepping the meat to cook. Campesinos skinned and gutted certain animals in the field or at home based on their odors, hunting dogs, and secondary uses of pelts (Table 4.4). For example, great curassows (*Crax rubra*) were commonly prepared in the forest: "*If it's a curassow, they remove the intestines, throw the feet and the head, and go on their way*" (009, $\theta_i = 0.73$). Armadillos and coatis were often field dressed at home to preserve the shells and pelts either for sale or training future hunting dogs: "*When you kill an armadillo, you skin it and the shell stays. You keep it and hang it from a tree to dry. When the dog is sick he doesn't sense it. You burn the shell and waft smoke onto him so that he senses those animals again* (018, $\theta_i = 0.65$). Others reported to have burned peccary pelts in the past to cure sick dogs.

In contrast, meat preferences guided campesinos' choice of targets independent of knowledge about hunting dogs. Whereas some suggested that campesinos preferred any meat (e.g., "*When you hunt daily, you don't lack the meat of all types of animals: doves, raccoons. The hunter sees all meat*" (002, $\theta_i = 0.71$)), most indicated a preference for one or several of the top hunted species. For example, one past hunter described peccaries as "*a very rich meat that we ate*" (008, $\theta_i = 0.73$) when reflecting on his hunting techniques. Others tended to prefer venison, armadillo, paca, agouti, coati, or curassow in various forms with family and friends: "*We hunted. But I did it to eat. The one who arrived [at the house] put a little venison in a hot tortilla. There was an armadillo in broth, fried, roasted, I made it different ways*" (028, $\theta_i = 0.67$). These preferences were often made in comparison to other similar meats. For example, Yet, amidst individual preferences, the CCA survey, interviews, and participant observation showed that campesinos culturally preferred paca as the tastiest meat.This preference was magnified by the challenges of hunting paca amidst their declining population, as expressed by the wife of one hunter: "*Few people find pacas here. They are here, but they are hidden because the hunters that find it will say 'Make sure that the dogs followed the paca last night'. You have to go and spy on them to see where they hide so you can take them. You grab it, skin it, and take all the meat off its little bones. It's very delicious!*" (018, $\theta_i = 0.65$). Above all the reported justifications for meat preferences, nearly all campesinos emphasized that wild meat consumption was a custom in their community. In the words of one self-described "house mom", "*It's a custom because I'm telling you that there are some that just like to eat the meat, to make themselves soup. Paca soup, armadillo soup, sometimes even venison soup, anything*" (011, $\theta_i = 0.67$).

4.5. Discussion

Our goal was not to test the ecological accuracy of informants' LTK, as some have pointed out as a potential limitation of LTK work (Ruddle and Davis 2011), but rather to empirically document the presence of a culture of knowledge where it is often assumed to be absent. Four key findings emerge from our analysis of the presence and content of a shared campesino hunting culture in Mesoamerica.

First, through our triangulated approach, we found that campesinos retained a shared culture of hunting knowledge that spanned social, biological, and institutional domains. Research has shown that indigenous and nonindigenous communities in Mesoamerica maintain their cultures with respect to resource appropriation and management strategies, such as hunting (Atran et al. 2005, Van Holt et al. 2010). For example, Barrera-Bassols and Toledo (2005) synthesized 60 case studies to find that hunting played a critical role in the culture of Yucatec Mayan environmental and social relationships. In addition, previous work has demonstrated that campesino knowledge about wildlife ecology, social uses of wildlife (e.g., medicinal, ornamental), gendered roles of hunting, and cosmological beliefs attributed to campesino hunting are components of campesino hunting cultures across Latin America (Molina 2004, Montero 2004, Smith-Cavros et al. 2012, Ruiz-Serna 2015). Yet to the best our knowledge, our study is the first to use CCA to assess this assertion within a campesino community. As Garro (2000) points out, CCA is concerned with the idea of best approximating group knowledge about a specific domain as a "socially transmitted information pool" (283). From this standpoint, our findings revealed that campesino hunting culture was retained in a community with few active hunters across ages or genders, suggesting that differences in demographics, perceived and self-reported hunting frequencies, and local perceptions of its importance may be incomplete indicators of the presence or absence of a single hunting culture. This is particularly important for a social group in which both members and nonmembers may assume an absence of culture relative to resource use strategies like hunting (Montero 2004, Ruiz-Serna 2015).

Second, we believe that our study is the first to combine CCA with interviews and ethnographic data to assess the cultural agreement and structure of campesino hunting LTK across ethnoecological domains. Our analysis revealed that hunting knowledge bridged the kosmos, corpus, and praxis in one Nicaraguan campesino community. In particular, although ethnoecology emerged from indigenous roots, our results show its application beyond these ethnic boundaries, geographic limitations, and cultural assumptions. For example, campesino uses of talismans for spiritual, medicinal, and hunting gains have been documented in other studies (Mellink et al. 1986, Rodríguez et al. 2012, Oliva et al. 2014), many of which directly or indirectly linked their uses to indigenous practices. One Mayan campesino hunter's account of using 'deer stones' (*tunich ceh* in Mayan) in Mexico seamlessly aligned with reports from El Pizotero campesinos in that "It's so you can shoot 100 deer. When you get such a stone, you're going to shoot deer every day and not miss" (Rodríguez et al. 2012, p. 219). This suggests two broader implications for campesino hunting LTK. First, the kosmos of campesino hunting may in some sense be rooted in indigenous beliefs that span Mesoamerica and may no longer be recognized as indigenous. Second, campesinos may adapt these beliefs to their worldviews and environmental circumstances. Given that subsistence is inseparable from the kosmos of hunting in this community, it makes sense that campesinos would develop the belief that sharing one's deer stone would deplete its power. This belief lines up with the ethic that hunting should benefit families and avoid overhunting; sharing this hunting luck among hunters would be unsustainable for deer populations. In other words, hunting beliefs are oriented towards maximizing subsistence in the campesino worldview. Indeed, subsistence in the face of financial and social adversity is a component of campesino culture and driver of campesino hunting throughout Latin America (Ploeg 2008, Petriello and Stronza 2020). In this way, conservationists and policymakers could promote cooperation with campesino hunters by reconceptualizing subsistence hunting as a cultural worldview rather than a conservation concern.

By extension, the perception that campesinos lack culture (i.e., kosmos) is both incomplete and unfounded. It is incomplete in the sense that culture is not just restricted to worldviews and cosmology, but how those worldviews interplay with the repertories of knowledge (corpus) and how that knowledge is used on the landscape (praxis). It is unfounded in that other studies have identified cosmological belief systems in campesino hunting cultures (Ruiz-Serna 2015). In turn, our finding of kosmos within El Pizotero's hunting culture suggests that this dimension should not be the sole indicator of culture but also not be discounted as a component of campesino hunting cultures. Moreover, this finding highlights a potential source of the longstanding assumption that campesinos are cultureless in that the kosmos of campesino hunting may only be accessible under two scenarios: 1) when it is directly tied to indigenous beliefs which provide a culturally and politically palatable justification for that worldview, or 2) when the researchers spends extensive time with the study community in order to overcome legal barriers and power imbalances that come from disclosing often illegal hunting practices. Campesinos may be unwilling to reveal this information when they are nonindigenous and/or when it pertains to illegal activities. This is vital for conservation because *kosmos* is analogous with complex, conceptual knowledge (Antweiler 2015) that tends to be overlooked in favor of more discrete components of campesino LTK such as agricultural practices and local wildlife taxonomies. Thus, the campesino LTK is unlikely to be granted the complexity that comes with indigenous knowledge systems because the *kosmos* is much less accessible or assumed to be nonexistent. Overall, non-indigeneity, illegality, and fear of losing a source of subsistence pose potential barriers to holistically understanding the cultural roles of hunting for campesinos.

Third, for this reason we believe that much of the campesino hunting LTK centered on select animals. There is less risk in asserting your knowledge of local animal names than explaining how or why that knowledge was obtained. Yet, this not only suggests that individual species are likely anchoring point for the cultural importance of broader knowledge sets as highlighted in recent ethnobiological work (Wajner et al. 2019), but also that past studies focused on species-specific knowledge, including quantitative measures of its cultural and practical importance, potentially captured a core dimension of campesino hunting cultures (e.g., Osbhar and Morales 2012, Garcia-Alaniz et al. 2010, Ávila-Nájera et al. 2018). Campesinos and conservationists, for example, have noted a decline in white-tailed deer populations in the region even though few campesinos reported hunting them. Despite these perceptions, deer were central to campesinos' hunting beliefs (*kosmos*), their broad knowledge and recognition of hunted animals (*corpus*), and their choice of hunting strategies (*praxis*). However, our findings also indicate that a narrow focus on knowledge of select species, including those of conservation importance, may overlook their contributions to diverse domains of campesino livelihoods and belief systems (Ruiz-Serna 2015). The *corpus* is therefore likely to be a more politically and socially acceptable entry point into broader sets of hunting LTK. These findings align with recently rekindled discussions about the contributions of ethnobiological classification to anthropological theory and conservation practice (Ludwig 2018, Rival 2018).

Fourth, the ethnoecology framework allowed us to analyze campesino hunting LTK as a realm of experience (Nazarea 2006). This lens not only allowed our findings to move beyond individual species, but also shifted campesinos from mere objects of study to legitimate knowledge holders (Toledo and Alarcón-Cháires 2012). In other words, the contributions of campesinos' cultural expertise, social systems, and LTK to hunting in this study were not restricted to their conservation implications. In his introductory review of ethnoecology, Toledo (1992) theoretically parsed out the differences between the Spanish verbs *saber* and *conocer* as science and wisdom, respectively. This distinction similarly emerged from campesinos' hunting corpus and praxis for which they adopted *saber* to differentiate scientific and depersonalized facts about hunting and wildlife (e.g., local names, population declines) from knowing (*conocer*) an animal through personalized experiences and stories of spying, pursuing, and capturing it to hunt and consume it. Personal knowledge, awareness, and familiarity (all captured through *conocimiento*) from hunting bestowed campesinos with the ability to fend for themselves amidst declining wildlife populations and disappearing forests. This knowledge connected to one's ability to properly dress and prepare an animal for consumption, which were connected to campesino cultural identity in other regions (Montero 2004). In turn, unlike knowing through facts (*saber*), knowledge (*conocimiento*) gained from experiences and stories about *conociendo* an animal were seen as paths towards sustainable environmental stewardship for campesino youth. In other words, each word represented different ways of knowing, maintaining, and transmitting campesino hunting LTK for campesinos and conservation alike. Similar hunting narratives and LTK have been found to inform campesino and indigenous conservation ethics and concerns in other studies (Barrasa and Reyes 2011, Reo and Whyte 2011, Smith-Cavros et al. 2012). These findings show that the relationship between campesino hunting *corpus* and *praxis* presents an indispensable window into campesino cognitive systems (Baraona 1987, Toledo 1990). When this relationship is interpreted through the often omitted *kosmos* of campesino hunting LTK, it transforms campesino hunting from a culturally divorced and contested practice into a cultural rich expression of LTK as lived experience. Future research on campesino hunting culture and LTK should further explore the contributions of hunting narratives and experiences as expressions of campesino cultures and conservation behaviors.

4.6. Conclusion

Our results suggest that hunting is a source of shared knowledge and culture among campesinos. This study found that campesino hunting culture can be both empirically validated and ethnographically described through multiple levels of knowledge. Through this process, we identified the components of campesino ethnoecology that are most salient in a campesino culture. From this standpoint, the worldviews, descriptive knowledge, and practices that comprise campesino LTK and culture should be considered in the implementation of conservation programs and policies directed towards the largest group of hunters in Latin America.

5. CONCLUSIONS

In this last section I condense the main implications of each article's formal conclusions into a brief summary of this dissertation's prominent themes. The purpose of this dissertation is to 1) expound the state of the literature on campesino hunting, and 2) use a case study of one campesino community's hunting practices (in southwestern Nicaragua) to more deeply and richly explore hunting as a source of shared meanings, knowledge, and culture for campesinos. Findings from my research in Section 2 position campesino hunting within broad global conservation trends and strategies to address biodiversity loss, particularly its importance to protected areas management. However, these results also highlight significant regional, conceptual, and methodological gaps in the focus and intent of conservation efforts with campesinos in Latin America – the lack of ethnographic research on campesino hunting culture and LTK in Mesoamerica being the most salient. Given that campesinos are not only considered the largest groups of hunters, but also the most populous and ethnically diverse rural group in the Americas, these gaps raise significant concerns at multiple levels for conservation research and practice in over 20 countries. I help bridge these gaps in Sections 3 and 4 through an ethnographic case study of one campesino hunting culture and its LTK system in the tropical dry forests of southwestern Nicaragua, located in the heart of the Mesoamerican Biodiversity Hotspot. Therefore this research is exceptionally well-suited to stimulate dialogue about, and shine a much needed light on, the often invisible cultures and livelihoods of campesinos as conservation targets and actors. To this end, I aim to answer several important questions that lie at the nexus of campesino culture, hunting, and conservation. These questions include: what are the shared components of campesino hunting cultures and LTK? How can campesino hunting inform theories of *peasant* identity and knowledge? And how can conservation scholars, practitioners, and policymakers effectively engage with the components of campesino hunting culture and knowledge? Answers to these questions, while incomplete, will hopefully help spearhead a research agenda on these invisible hunting cultures, their roles in campesino identity expression and maintenance, and their implications for broader conservation discourse about, and practice with, campesino hunters.

5.1. Campesino Hunting Culture as a Practical and Theoretical Concept

To understand broad trends in campesino hunting scholarship, including scholarly engagement with the culture of campesino hunting, I reviewed 334 papers in Section 2, ranging from peer-reviewed articles to grey literature (e.g., technical reports, popular media pieces), that described and/or analyzed diverse components of campesino hunting. This review revealed that campesino hunting research is restricted in two important ways. First, most papers focused on hunting among nonindigenous campesino communities in tropical broadleaf forests of Mexico, Peru, and Colombia. Second, scholars tended to study campesino hunters through their prey preferences, hunting frequency, and the species-specific – and protected area specific – conservation implications of these practices, rather than through their culture. By extension, few scholars had placed a broad and descriptive ethnographic lens on campesino hunting culture and knowledge as an independent research focus. While there have been exceptions, these studies mirror the same geographic limitations as the larger body of campesino hunting scholarship. For example, most of this kind of work has historically taken place in Mexico (Mellink et al. 1986, Roldán-Clarà et al. 2017) and Colombia (Montero 2004, Ruiz-Serna 2015), with more recent studies occurring in Argentina (Tamburini and Cáceres 2017). I am aware of only two studies that ethnographically explored some aspect of campesino hunting culture in Mesoamerica, both in Panama (Bennett 1959, Müller-Schwarze 2015). Moreover, researchers who broadly explored hunting as a component of campesinos' lived experiences, even with broad conceptual templates such as ethnoecology, mostly focused on cultural uses and knowledge about specific taxa including mammals (Contreras-Díaz and Pérez-Lustre 2008), herpetofauna (Leyte-Manrique et al. 2016), birds (González Romo et al. 2014), or wildlife in general (Barrasa 2012). While any effort to condense the shared components of campesino hunting cultures and knowledge systems will have to wade through biases about the value of these concepts for conservation, they provide starting points for identifying similarities that can help position campesino hunting research as its own area of scholarly inquiry. The remainder of this section is devoted to describing six components of campesino hunting cultures that emerged from this dissertation, followed with a brief explanation of how these components inform an ethnoecological model of campesino hunting.

5.1.1. Component 1: Mammals as Gateway Species into Campesino Hunting Systems

Section 2 showed that campesinos hunt a much more taxonomically diverse assemblage of species than previously known. Campesinos' diverse hunting preferences were focused primarily on birds and mammals. Yet, regardless of region or country, campesinos tended to prefer a wide array of mammalian prey, including ungulates (e.g., collared peccaries, white-lipped peccaries, white-tailed deer), rodents (e.g., pacas and agoutis), and cingulates (i.e., armadillos) over all other prey. The Nicaraguan campesinos in this dissertation demonstrated similar preferences through their self-reported preferences in Section 3 which were complemented by their species-specific knowledge in Section 4. These findings provide two overlapping implications for understanding and accessing campesino hunting cultures and knowledge.

First, they suggest that specific mammals, particularly those of least conservation concern, may act as gateway species, or cultural keystone species (CKS) (Cristancho and Vining 2004, Garibaldi and Turner 2004, Bonifácio et al. 2016), that provide sustainable anchors for maintaining and accessing campesino hunting cultures. Cristancho and Vining (2004) advanced the CKS concept to demarcate "those plant and animal species whose existence and symbolic value are essential to the stability of a cultural group over time" (155). In this way, select mammals such as white-tailed deer, nine-banded armadillos, and lowland pacas may be CKSs for El Pizotero campesinos in that hunters and non-hunters alike tended to repeatedly reference these species when asked to explain what they knew about the forest and wildlife. As a result, these animals were sustainable anchors of culture and knowledge in that they are relatively abundant in surrounding tropical dry forests and more likely to be observed, and therefore reinforce existing LTK.

Second, as species of least conservation concern (LC), mammals such as collared peccaries, lowland pacas, and nine-banded armadillos are less likely to be the focus of conservation efforts than the six threatened and endangered species among the top 25 animals hunted by campesinos (i.e., white-lipped peccaries, lowland tapirs, jaguars, margays, Baird's tapirs, and Geoffrey's spider monkeys). In turn, both campesinos and conservationists may be more likely to promote hunting of LC species even when establishing hunting bans, which has been shown in Peruvian campesino reserves (Shanee et al. 2015). And given that they were not threatened or endangered, and therefore of lower conservation interest, campesinos appeared more comfortable describing local hunting practices for these species and the knowledge they linked to each animal (e.g., habitat suitability, feeding ecology, mating behavior). These findings indicate that LC mammals offer a politically palatable, culturally appropriate, and ecologically reliable starting point for sensitive conversations about campesino hunting.

5.1.2. Component 2: Shallow and Deep Cultural Knowledge about Wildlife

Moreover, while these preferences manifested in many forms across campesino hunting cultures, conservationists often elicited cultural knowledge about wildlife population trends and uses (e.g., medicinal). This is not surprising in that a broad understanding of population trends (what I will term *shallow* knowledge) and life history traits is often the first step towards understanding the sustainability of hunting (Fitzgerald 2012, Weinbaum et al. 2013, van vliet and Nasi 2019). However, this knowledge must be qualified with fine-scale information (*deep* knowledge) about species' population parameters, which are not commonly elicited through, or incorporated within, campesino hunting LTK (Petriello and Stronza 2020). This suggests that knowledge about life history traits is less likely to be an immediately accessible component of campesino culture and LTK. Yet, this also suggests that such knowledge can be gleaned through a preliminary understanding of campesinos' cultural knowledge about population trends and uses. In other words, one can broadly say that *deep* knowledge may not be readily apparent but is most likely accessible through *shallow* knowledge about uses of species by campesinos.

5.1.3. Component 3: Marginalization, Disenfranchisement, and Poverty

Such a knowledge gradient indicates that conservationists can benefit from understanding the broader social and cultural context of wildlife uses for campesinos. Subsistence in the *campo* demands that campesinos navigate complex and challenging historical, political, and social realities that bound their resource use strategies. For example, the presence of State and extrajudicial paramilitary forces in La Macarena National Natural Park in Colombia and the Maya Biosphere Reserve in Guatemala directly impeded campesinos' access to hunting lands (Ruiz-Serna 2003, Devine 2014). However, these forces did not stop all hunters, which resulted in civilian deaths and widespread fear among campesino communities in these regions. Similarly, Nicaraguan campesinos have experienced years of political disenfranchisement as a result of counterproductive agrarian policies and civil conflict (Nietschmann 1990, Faber 1999). Politics and civil strife significantly affected hunters' access to wildlife, arable lands, and hunting implements. In El Pizotero, campesinos recounted war stories to reference declines in the abundance of hunted species. Hunters additionally noted their fear of using prohibited firearms from the 1979 Sandinista Revolution (and their lack of licenses) as one of the largest risks from hunting – both are extensions of decades of systemic poverty. In short, campesinos, whether hunters or non-hunters, are united by shared experiences of marginalization, disenfranchisement, and poverty, which have also been proposed as key components of campesino identity and livelihood strategies (Tocancipá-Falla 2005, Ploeg 2008).

5.1.4. Component 4: From Agriculture to Agoutis: The Multiple Uses of Hunting Tools

The contours of campesino livelihoods are not only shaped by scarcity, but also by how campesinos *manage* and *cope* with scarcity through agricultural production. Scarcity demands novel and creative thinking, such as devising multiple uses of everyday tools. Given the inseparable link between campesinos and agrarianism, agricultural tools are the most readily available implements for devising novel livelihood diversification strategies. Section 3 revealed the duel-purpose nature of agricultural tools for El Pizotero campesinos – machetes, shovels, pickaxes, hoes, and dogs allow campesinos to harvest crops *and* wildlife. Agoutis serve as ideal examples here. These medium-sized burrowing rodents are one of most hunted species by campesinos across the tropics (see Sections 2 and 4). They are abundant, readily available, and fairly easy to catch. As such, their habitat and refugia overlap with the fields and fallows that most campesinos tend. Agoutis are attracted to home gardens, where there are readily harvested. In turn, they are also one of the most recognized and referenced species by El Pizotero campesinos (see Section 4). However, it is the campesino's familiarity with croplands and hunting tools that facilitates agouti hunting. Dogs that patrol fields against crop pests also alert campesinos to the presence of these abundant rodents, and potentially act as deterrents for human-wildlife conflicts. Given that agriculture is largely considered the campesino's *raison d'être*, cultural knowledge and identity are imbedded in these tools. Based on my experience in El Pizotero and a growing body of literature, no one 'tool' embodies this relationship and extends from campesino and indigenous life more than hunting dogs.

5.1.5. Component 5: Dogs as Arbiters of Campesino Hunting Culture

Dobson et al. (2019) recently proposed a conceptual framework for assessing the effects of hunting in the tropics. Their framework positions hunting strategies as the filter through which these effects are interpreted, differentiating strategies as either *active* (e.g., firearms) or *passive* (e.g., snares). However, the framework omits ambiguous hunting strategies that may be of cultural importance for geographically widespread groups like campesinos, such as dogs (Koster 2009). The use of canines for hunting in the Americas is not culturally restricted (Boglioli 2009, Koster 2009). However, Sections 3 and 4 complement a growing body of research on the broader sociocultural and conservation importance of dogs to Latin American hunting cultures, whether indigenous, campesino, or other (Fitzgerald 1991, Koster 2009, Koster and Noss 2014, Constantino 2019, Plata et al. 2019). I found that just as mammals are gateways into the cultural LTK of campesinos, dogs are gateways into campesino hunting culture in Nicaragua. In Section 3, I recalled that dogs were inseparable from campesino hunting. Campesinos believed every effective hunter worth his mettle has at least one dog, and they perceived their dogs as active and passive mediators of hunting success.

Dogs are passive vehicles for hunting in that they will find prey regardless of hunters' intent. Hunters do not need to command their dogs to find signs of potential prey. Instead, hunters' respect their canines' agency, autonomy, and ability to locate the prey they prefer. For example, the diversity of specialized hunting dogs (e.g., *venaderos, guatuseros, and cusuqueros*), and their ability to "choose" which animals they want to pursue, was regularly referenced by community members. By exercising their freedom of choice despite the constrained harsh realities of the *campo*, hunting dogs symbolized campesino life for many; they are survivors like all campesinos. Similarly, campesinos reaped awards by allowing dogs to freely roam and maintain their autonomy; their "survival instincts" provided meat for the already stressed campesino families. These roaming instincts were further leveraged by campesinos to hunt white-tailed deer in the style of Mayan campesino *batida* hunts (Rodríguez et al. 2012). Hunters would locate a section or fragment of forest and position dog handlers on one end and shooters on the other. Once the shooters were in place, the dog handlers released the *venaderos* to flush the deer towards the shooters. According to several hunters, the dogs just knew what to do with minimal instruction from the handlers or shooters. In this sense, dogs were trusted to know how to navigate their forests and how to react when they approached a shooter – a level of trust that was maintained through years of shared experience, and therefore respect for, their shared livelihoods as campesinos.

The deer hunting example also points towards the way in which the lines between passive and active hunting dogs are blurred. Dogs are active arbiters of hunting in that they will accompany their campesino masters while they work the *campo* and pursue prey at their command. Although dogs did follow their “nature” by making their own prey preferences, campesino hunters were able to train dogs to chase the animals that the family preferred. The armadillo hunting dog (*cusuquero*) vignette in Section 3 supports this assertion. Similarly, hunters were able to identify the meanings behind different dog barks for individual dogs and packs. For instance, persistently loud and repetitive barks that sounded like yelps to the untrained ear and did not shift locations tended to indicate that the dog found a burrow, cave, or tree that housed the hunting target. Conversely, quieter barks that continually shifted locations often signaled that one dog was looking for his other pack members. Moreover, hunters could discern the identity of each dog, and with that, pack dynamics from a distance. Armed with this intimate knowledge, hunters would then shout commands through the brush to tell one dog to find his pack, stay in place, or return to the hunter’s side. In these ways, hunting dogs, and hunters’ intimate experience and personal knowledge about them, bridge the divide between passive and active hunting strategies; it embodies a campesino-canine relationship that is intermingled with, and an extension of, campesino livelihoods and culture.

5.1.6. Component 6: Survival Is More Than a Motivation, It Is a Worldview and Identity

Within the worldview of campesinos (and other ‘peasants’) globally, survival “refers to the reproduction, and, hopefully, to the improvement of one’s existence” (Ploeg 2008: 30). This perspective was mirrored by local perceptions and motivations assigned to campesino hunting in El Pizotero, which were predominantly seen as steps on the path towards survival. Most campesinos perceived hunting as a way to pursue subsistence while elevating their livelihoods. Hunting offered an escape from, and a reminder of, the daily monotony of strenuous life in the *campo* in three forms.

First, hunting helped ease the pressure of chronic food scarcity. Specific game were preferred for their flavor (see Section 4), which offset the monotony of a diet comprised of a narrow subset of staple crops: rice and beans. Wild meat was reported to simply make one feel good, with many field conversations focused on ranking the most flavorful meats. Second, the act of hunting not only eased dietary ‘boredom’, but also recreational boredom. Most hunters, for example, maintained the difficult practice of hunting because they enjoyed it. They enjoyed their time away from the fields and in the forests; they enjoyed and appreciated their ability to observe dwindling wildlife populations; they enjoyed spending time with their hunting dogs; and they enjoyed the distraction from life’s routines, which many characterized as a pervasive sense of boredom that came from a lack of amenities and recreational opportunities in the country. All of these benefits were reported despite 5-8 hour hunting trips through dense forests with little to no water or food. Third, hunting was considered an important subsistence livelihood strategy, particularly among the most disadvantaged in the community. In this way, the act of hunting served as a reminder of the harsh realities of being a campesino – a campesino must work to survive, whether through agriculture or hunting. The harder one worked, the more likely they were to surpass the financial, dietary, and recreational constraints on their lives. In turn, the highly exhausting work of hunting was tightly linked to campesino identity – an identity that placed ethical and cultural boundaries on hunting that seemed to allow campesino hunters to operate and cooperate within a resource-poor environment.

5.1.6.1. *Component 6a: Campesino Hunting Beliefs*

The boundaries of the worldview of campesino hunting culture in El Pizotero were defined by three interrelated characteristics: survival, hunting beliefs, and hunting ethics. The contours of survival as a worldview were outlined above. However, the ethnographic results of this dissertation revealed that hunting as a form of survival, often framed as subsistence, was mediated by hunting beliefs. These beliefs manifested in the use of animal parts (i.e., armadillo tails, white-tailed deer bezoars and fangs, and paca bile ducts) as hunting amulets. Tails, bezoars, fangs, and bile ducts were all believed to grant their owners the special ability to attain bountiful harvests of armadillos, deer, and paca. While these beliefs indicated that hunting success would beget more hunting success, they also pointed towards the potential for unsustainable hunting practices that would run counter to campesinos' survival; high success rates may deplete local populations and therefore limit other campesinos' access to valuable subsistence resources.

Yet, most campesinos suggested that there were three trends that limited the social and ecological effects of these beliefs. First, only a handful of hunters and community elders were reported to believe in the power of these amulets. It was not uncommon, for example, for non-hunting community members to agree that these beliefs were still prevalent but qualify their responses by noting that "*few people believe this*", "*that's what they say*", or "*so say the elders*". At the same time, these same community members were able to identify several hunters who collected these amulets or were *suspected* to have at least one over the course of my research. I write that they were *suspected* because of the second trend: no one could verify who currently owned a specific amulet given that they were believed to lose their power once other community members knew about them. In other words, sharing an amulet's luck with other hunters may diminish others' ability to hunt for their own survival. When combined with the belief that each animal amulet was difficult and rare to acquire, this cultural taboo ensured that few hunters would acquire the ability to overhunt and reduce game availability for other campesinos.

5.1.6.2. *Component 6b: Campesino Hunting Ethics*

Campesinos also averted overhunting through their widely held opposition to commercial hunting. Decades of unsustainable commercial hunting and unregulated wildlife trade prior to the 1980s (Ruiz 1994, Pérez 1999), whether for skins, artisanal crafts, and trophies, discouraged current hunters from repeated the mistakes by past campesinos. Long-term residents (>20 years of residency) recounted stories of prolific hunters who would kill *montones* (tons) of abundant animals for profit. These stories were reinforced by conservation discourse in the community that warned of the ecological and ethical dangers of trading threatened species, including yellow-naped parrots and Geoffrey's spider monkeys. While it is difficult to pinpoint the precise origin of this hunting ethic, opposition to commercial hunting was often qualified with a shared social acceptance of subsistence hunting. This acceptance pushed community members to perceive commercial hunting as antithetical to their worldview of survival; it stripped other campesinos of the opportunity to fend for themselves. Even the most avid anti-hunters and conservationists recognized the contributions of wild meat to campesino survival (see Section 3). Thus, hunting norms dictated that campesinos hunted in a way that aligned with the socially accepted worldview of campesinos in the region.

5.1.6.3. *Component 6c: Meat Sharing*

Hunting beliefs and ethics restricted the extent and motivations of hunting in El Pizotero. However, these cultural boundaries did not fully constrain local access to wild meat. Sections 3 and 4 illustrated that meat sharing and preparation were widespread practices and components of LTK in the study community. Meat sharing was filtered through a complex set of labor institutions, social expectations, and community dynamics that were inseparable from survival as a worldview. Local farm managers were expected to grant workers access to private hunting lands in exchange for a portion of hunters' catches. These agreements usually occurred during the workday, often inspired by animal signs and sightings (e.g., stumbling across an armadillo burrow on the edge of a field, a dog flushing out an agouti that the workers then followed). Due to low wages and subsistence-level livelihoods, each worker tended to be familiar with the living standards and needs of each family. In this way, meat sharing was a way to ensure communal wellbeing and maintain social bonds, as captured in the local saying *come y comamos* (you eat and we all eat). Meat sharing also solidified a unified sentiment of "*we're in this together*." As campesinos, survival was the main cultural imperative. Meat sharing guaranteed that this imperative could be met.

In summary, I outlined 6 components of campesino hunting culture drawn from this dissertation and past research. Although they are not exhaustive, each component acts as a window into the understudied phenomenon of campesino hunting cultures. The next section draws from these components to demonstrate how campesino hunting overlaps with models of campesino identity and LTK.

5.2. Merging Campesino Hunting with Models of "Peasant" Identity and Knowledge

As reviewed in the introduction, science has relegated the cultures, identities, knowledge, and practices of "peasants" to an invisible and amorphous space across disciplines, ranging from anthropology and peasant studies (Nugent 1993, Kearney 1996, Ploeg 2008) to conservation science (Nygren 1999). In response to the theoretical ambiguity underlying the "awkward science" of peasant identity and the 'peasant condition', Ploeg (2008) proposed a framework to constitute a comprehensive definition of the peasantry (Fig. 1.1).

Within his framework, Ploeg (2008) highlights an important context that cannot be ignored: the peasant condition is primarily agrarian. Yet, as he notes, this means that it can also be *strengthened* through non-agrarian livelihood strategies. In other words, peasants in general, and campesinos more specifically for the purpose of this dissertation, engage in multiple use livelihood strategies to enhance their chances of survival in hostile social and ecological environments (Toledo 1990, Toledo et al. 2008). It is this point that directly connects to campesino hunting as a practice and a worldview.

Based on my findings, I propose an ethnoecological model of campesino hunting that is adapted from Ploeg's (2008) choreography of the peasant condition (Fig. 5.1). Findings from Sections 2, 3, and 4 align with various components of this framework. Section 2 showed that the primary motivation underlying campesino hunting in Latin America was the *co-production* of resources (i.e., prey) to maintain survival and market relations. Similarly, as emphasized in Section 3, hunting was viewed as one of many practices that allowed Nicaraguan campesinos to survive, and in some cases thrive, in an environment of scarcity. In this vein, Sections 2 and 3 positioned *survival* and an *aversion to market hunting* (the dotted line) as indispensable components of campesinos' hunting worldview (*kosmos*). In other words, the boundaries of the *kosmos* are defined by survival, hunting beliefs, and ethics (e.g., aversion to market hunting) in relation to the harsh environment (*campo*) that defines campesino identity. In support of this domain, I also found that *cooperation* manifested in several forms: group hunts, meat sharing, and social agreements to hunt on private land. These forms of cooperation mediated hunters' capacity to survive and produce hunted resources. They therefore represented part of campesinos' hunting worldviews. In particular, access to hunting land was, in part, controlled by land managers and owners – commonly campesinos themselves – who often knew the hunters as friends, community members, and laborers. These institutions, often based in labor relations, tightly overlap with Ploeg's (2008) assertion that "Together, a self-controlled resource base and peasant-managed co-production constitute a specific labour process…where learning takes place and where novel ways of doing things are designed" (26).

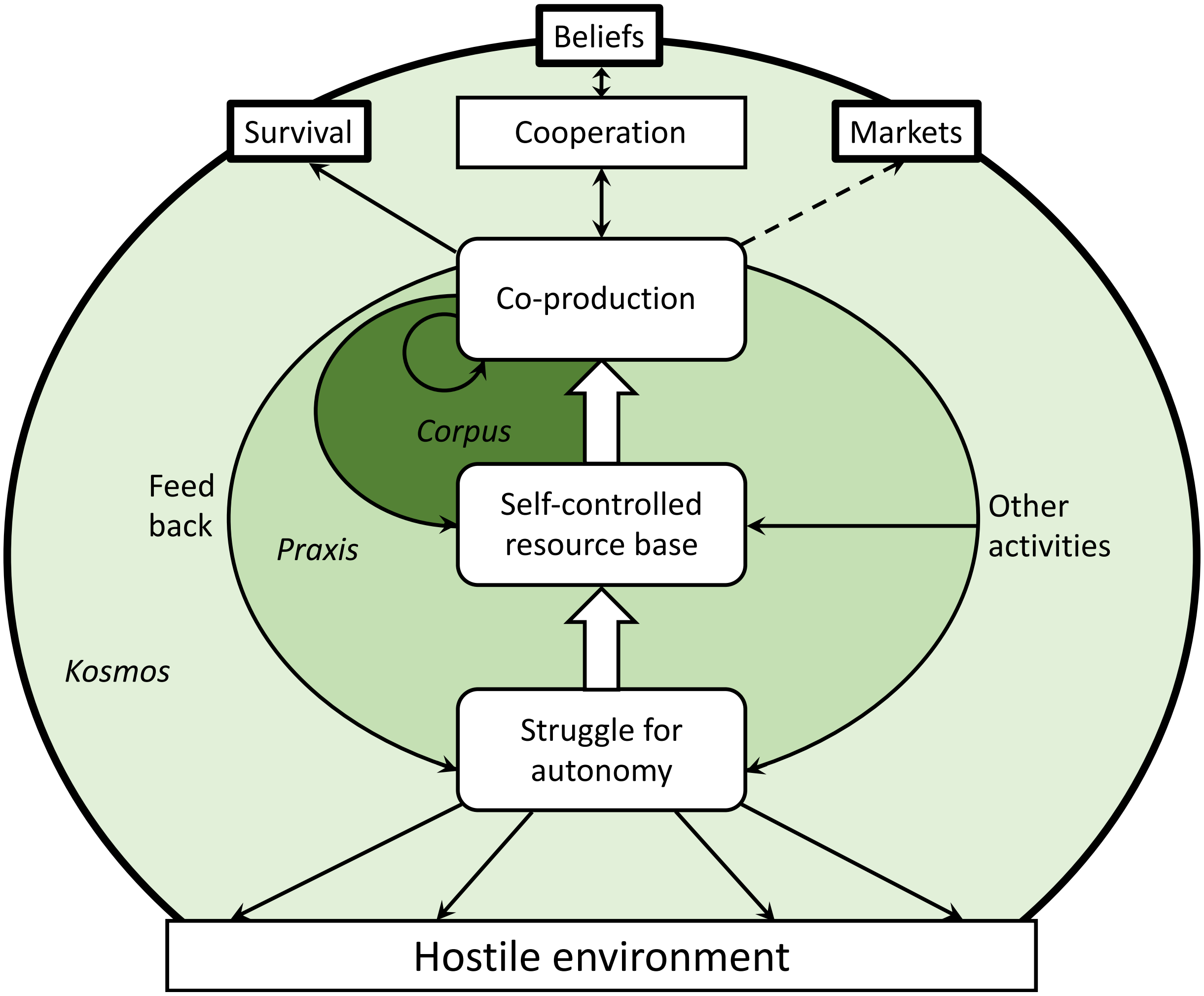


Figure 5.1 An ethnoecological model of campesino hunting (adapted from Ploeg 2008).
*The dashed arrow between "co-production" and "markets" represents their contested relationship as mediated by communal hunting norms and ethics (see Section 3**).**

Enveloped within the proposed *kosmos* is the *praxis* of campesino hunting. The *praxis* embodies the hunting strategies that campesinos used to survive through *co-production* (as described above), including hunting dogs. These strategies were the clearest representation of campesinos' *struggle for autonomy* in that they were controlled by the campesinos. In turn, hunting strategies similarly overlapped with, and provided a way for, campesinos to maintain a *self-controlled resource base*. They chose when and how to hunt, which is an expression of their independence, capacity to provide for themselves, and the ability to choose the frequency with which they obtain wild meat, despite their difficult circumstances. Moreover, campesinos additionally opted to avoid hunting in order for their resource based to replenish or elect to apply their limited energy towards more abundant prey. For example, white-tailed deer were the most preferred hunted species overall. Given population declines and few recent sightings, however, hunters refocused their efforts towards abundant agoutis, pacas, and armadillos. Not only did this shift ensure that excess energy was not spent chasing the rare deer, but it also reduced hunting pressures on deer populations. Moreover, the pursuit of less energy-intensive targets also opened up space for *other activities.* These *other activities* were mostly agricultural, yet comprises multiple use livelihood strategies that ensured a self-controlled prey base for hunting. These activities include, but are not limited to, home gardening, crop maintenance, controlled burning, beehive harvests, fence building, and dog training. These activities reside in the space between the *kosmos* and *praxis* by further facilitating survival amidst hostile social and ecological environments.

Lastly, the *praxis* represents campesino hunters autonomy and agency in how and where they used their knowledge of individual animals: the *corpus.* The center of Figure 5.1 represents the *corpus* of the ethnoecology of campesino hunting. This domain is broadly described as "the whole repertory of symbols, concepts, and perceptions on nature" (Toledo 1992:9). Importantly, this level of knowledge can also be described as "local and empirical knowledge of animals, plants, soils, and landscapes" (Berkes 2012: 17), "declarative" knowledge which comprises "discreet entities relating to the natural and social environment" (Antweiler 2015: 169), and "factual/rational knowledge about the environment" (Usher 2000:186). In the context of my research, the *corpus* most often manifested as species-specific knowledge (Section 4) that captured both shallow and deep levels of LTK (see section 5.1.2). The *corpus* signified discrete facts about wildlife that allow campesinos to successfully hunt, and are reinforced through hunting (see the cyclical arrows surrounding *co-production* and linking it to a *self-controlled resource base*). This process was best exemplified by one campesino's emphasis on the youth's lack of basic knowledge about wildlife, including their names and calls (see Section 4). Of particular relevance was his assertion that the only way the youth could gain this knowledge was through direct observations and experience such as those that are learned through hunting. While I did not interview children for this research, participant observation revealed that younger campesinos obtained aspects of the *corpus* through the local NGO's Junior Rangers Program. This knowledge did mirror local campesinos' *corpus*. Yet, the campesino youth openly opposed hunting, even if their parents were hunters. As a result, youth knowledge was divorced from the cycle of knowledge production associated with campesino hunting, *co-production*, and a *self-controlled resource base*.

Although it is not exhaustive, this ethnoecological model presents a way for hunting to shine a light on the contours of invisible campesino cultures. Furthermore, this model for conceptualizing campesino hunting aligns with other LTK frameworks (Section 4, Table 4.1), providing ample room for theoretical comparisons with multiple campesino hunting cultures across Latin America.

5.3. Concluding Remarks

The importance of hunting for campesino livelihoods and culture surpasses its importance for conservation. The framework I propose offers one path towards integrating campesino hunting cultures and LTK into conservation discourse and policy formation. Indeed, I suggest that this model's fundamental strength does not come from the individual examples I provided, but rather comes from its value as a blank template for diverse hunting cultures to fill. As a blank canvas, this ethnoecological framework is a tool that conservationists and policy makers can deploy to address campesino hunting in conservation programs and legislation.

5.3.1. Conservation Implications from Campesino Hunting

Conservation researchers and practitioners who work with campesinos are more familiar with campesino hunting as an illegal act (Shanee 2012) rather than an expression of campesino culture (Montero 2004, Ruiz-Serna 2015). In solely positioning campesino hunting as a threat to biodiversity and a violation of environmental laws, this act of survival and subsistence is relegated to another human behavior that needs to be changed for the sake of conservation. While the threats to global biodiversity cannot be ignored, neither can the needs of local communities whose very survival depends on these threatened resources. Yet, this dissertation highlights that changing hunting behaviors through conservation interventions or policies (i.e., hunting bans) may interrupt the flow of intergenerational knowledge and cultural maintenance for campesinos. Indeed, one conservationist in Section 3 directly stated this as a goal of the local NGO's hunter and youth interventions. In doing so, hunting bans may act as a self-fulfilling prophecy, removing a source of identity and culture at its roots because it is not visible in the first place. In this way, the campesino hunting ethnoecology framework shows that hunting not only promotes material survival, but cultural survival as well. This template would ensure that campesino hunting LTK is a baseline consideration for any outreach and education work with campesino communities.

As a baseline tool, the template yields several potential implications for conservation practice, research, and discourse. First, the proposed template can help avert the potential loss of campesino hunting LTK, thereby helping to counteract the increasing trends of eroding and threatened LTK systems around the globe (Gray et al. 2015, Tang and Gavin 2016, Aswani et al. 2018). Second, this could also stem the recapitulation of the ecologically noble savage lens as the only lens through which to perceive the cultural value of campesino hunting. In turn, a shifted discursive frame could help avoid conflicts based on this assumption and other stereotypes about campesinos (e.g., Oliva et al. 2014), and present a novel path to engage with otherwise inaccessible cultural knowledge for the benefit of campesino communities, conservationists, and wildlife. These recommendations follow a surge of recent evidence demonstrating the indispensable value of hunters' knowledge for wildlife and forest conservation (Parry and Peres 2015, Paneque-Gálvez et al. 2018, van Vliet et al. 2018, Shokirov and Backhaus 2020), including its contributions to all phases of participatory conservation research (Bélisle et al. 2018) and international efforts to safeguard biodiversity, LTK systems, and their potential to bolster environmental assessments and governance regimes, such as the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) (Tengö et al. 2014, Díaz et al. 2018). Third, campesino hunting and hunters can inform widely recognized and used conservation tools such as the IUCN Red List. Betts et al. (2020) found that conservation practitioners strongly rely on the Red List to pinpoint key species and locations for sustaining biodiversity. This level of knowledge falls under the domains of the *corpus* and *praxis* of campesino hunting LTK. Campesino LTK can help identify key sites (e.g., watering holes, private farms) that hold unique levels of biodiversity, and imperceptible wildlife population and subpopulation trends that may be instrumental for regional IUCN rankings. Moreover, conservationists could align their interests with campesinos' CKSs to identify priority areas for conservation research, planning, and practice in and near PAs (Bonifácio et al. 2016). In doing so, conservationists and campesinos could be equal partners in establishing the boundaries of conservation agendas, which could yield broad recognition for campesinos' contributions to a global conservation tool. Yet more importantly, such a shift would mean that conservation objectives would be framed around campesino culture and knowledge from the start rather than the other way around, setting the stage for reformulating legal mechanisms for engaging with, and recognizing, campesino hunting

5.3.2. Political Implications from Campesino Hunting

Currently, there are no in-depth, comparative synthesis of country-by-country hunting policies in Latin America (but see Ojasti 1996, 2000, van Vliet et al. 2019 for broad reviews, and Antunes et al. 2019 for an intricate analysis of Brazilian hunting policies). This means that any generalizations about the broad political applications of this model are speculative at best. Nonetheless, recent analyses from Antunes et al. (2019) and van Vliet et al. (2019) indicate that Latin American hunting legislation is steeped in inconsistencies and uncertainties about who gets to hunt, how they get to hunt, and the socially and politically acceptable motivations for hunting. In particular, van Vliet et al. (2019) delineated seven recommendations for countries that are focused on establishing or expanding their legal frameworks for hunting: 1) reevaluate the definition of *subsistence* hunting to account for cultural legitimacy, environmental sustainability, and rights to food sovereignty; 2) promote context-specific management options; 3) identify cultural wildlife management strategies; 4) create long-term monitoring programs for wildlife and local livelihoods; 5) establish self-management or co-management frameworks that account for traditional management strategies and their overlap with scientific knowledge and LTK; 6) generate regulatory priorities that balance sustainability with the real-world challenges of enforcement; and 7) analyze the entire legal framework, rather than several laws, to ensure the widest and most effective policy possible. Following van Vliet et al.'s (2019) recommendations, I propose that the most effective legal path forward is the recognition of campesino hunting as a source of cultural integrity, rights to food sovereignty, and generational LTK.

Before moving forward with my suggestions, it is crucial to note that the potential use of this model for policy implementation in Nicaragua is much more complicated. There are two immediate barriers to promoting campesino hunting as a cultural right. First, campesino hunting rights are not enshrined in any legislation. Instead, hunting rights are based on indigenous identity and financial means; either one's ethnicity or income permit one to hunt. El Pizotero campesinos do not fall into either category. Local understanding of the term "indigenous" centered on occupation and residency rather than ethnicity. Poverty is the other barrier to legal representation; most campesinos cannot afford hunting licenses and are highly reluctant to register illegal weapons from the Sandinista revolution. Second, the current political atmosphere is fraught with vitriolic bipartisanship and social upheaval in the forms of countrywide protests against now reversed social security reforms and state-led suppression of environmental NGOs and Nicaraguan intellectuals (Catanzaro 2019). While some authors have connected these protests to Nicaragua's environmental history (Petriello and Joslin 2019), this proposed linkage has not entered the mainstream conversation to date. The political opportunities for amended hunting legislation in these turbulent times are likely limited. Therefore, political and social realities would most likely restrict any effort to introduce campesino hunting as a legal and cultural right or a political priority as of 2020.

Yet, there are several paths forward. Campesino conservation concessions in Peru allowed residents to enforce communal hunting bans built on social norms, including the desire to remove crop 'pests' (Shanee et al. 2015). However, at a regional level, this strategy requires wading through the complex web of protected area designations and campesino and indigenous land management and tenure regimes that are present in the region. Some additional examples include Management Units for Conservation and Sustainable Use of Wildlife in Mexico (García-Marmolejo et al. 2008), private conservation areas in Peru (Shanee et al. 2015), and over 20 different definitions and boundaries placed on campesino lands in the constitution of every Latin American country (Basos de Datos Políticos de las Ámericas 1998). Importantly, campesino land rights in many countries were enacted through agrarian reforms that were catalyzed by campesino political movements in the 20th century. From this standpoint, more recent campesino social movements therefore offer another path towards political mobilization for campesino hunting rights at a broad scale. Many campesino social movements – but La Vía Campesina and Campesino-a-Campesino in particular – promote 'peasant' food sovereignty at national and international scales (Claeys 2015, UNDROP 2018). Although hunting is not explicitly mentioned as a means to achieve food sovereignty, the ethnoecological frame presented in this dissertation tightly overlaps with the definition of food sovereignty in the recently adopted United Nations Declaration on the Rights of Peasants and Other People Working in Rural Areas (UNDROP 2018). UNDROP (2018) "Recogniz[es] that the concept of food sovereignty has been used in many States and regions to designate the right to define their food and agriculture systems and the right to healthy and culturally appropriate food produced through ecologically sound and sustainable methods that respect human rights" (p. 3-4). Through this discursive frame, hunting can be positioned as a culturally appropriate form of food security. In particular, the emphasis on "culturally appropriate food produced through ecologically sound and sustainable methods" infers that communal rules, campesino culture, and sound scientific expertise would all have a place in this framework. With a politically palatable justification and the support of multi-country and multiscalar networks, advocates and allies could begin negotiating the terms and boundaries of individual community's, regions', and even nations' distinct campesino hunting cultures.

However, the inclusion of regional social movements is merely one path towards legal recognition of campesino hunting culture. Another complementary path, and likely the most politically expedient one for Nicaragua, would be for the Ministry of the Environment and Natural Resources (MARENA) to introduce a Ministerial Resolution (*Resolución Ministerial*) to the Nicaraguan Hunting Law (Law 206). Such a resolution could push forward the criteria and requirements to legally recognize, identify as, and grant special hunting licenses to *Cazadores Campesinos* and *Monteros Campesinos* (both Campesino Hunters). For example, MARENA very recently passed Ministerial Resolution 011-2006 to establish the criteria for granting sport hunting licenses. While this resolution focuses on a different sector of society, it provides a template for the various laws, decrees, and regulations that factor into hunting governance in the country, such as The General Law of the Environment and Natural Resources (Law 217) and The Law on the Organization, Competence, and Procedures of Executive Power (Law 290).

Based on my findings, their implications for the transmission and maintenance of campesino culture and LTK, and recent recommendations for improved hunting legislation in Latin America (van Vliet et al. 2019), I would suggest that a proposed resolution would permit campesinos to hunt species of least conservation concern with culturally 'traditional' campesino hunting tools (machetes, farming tools, and dogs). Firearms would not be included in the initial draft of the resolution because of their historical and legal sensitivity, the compounding legal implications of hunting vulnerable/threatened/endangered species with unregistered firearms, and my findings that firearms were not a highly prohibitive constraint on campesino hunting overall (see Section 2). These legal *monteros* would then be able to register for a permit that requires them to follow certain bag limits and hunting moratoriums that are annually readjusted in Nicaragua's National Hunting Schedule (Ministerial Resolution 010-2006). Given the vital importance of survival to campesinos' cultural and material worldviews, hunting bag limits can be based on individual family needs and regional species abundance estimates. For example, the hunting schedule designates five hunting regions; the Department of Rivas is part of Hunting Region 1. With these established legal structures, MARENA could provide annual estimates of regional populations, adjust campesino bag limits to stay within the bounds of sustainable hunting, and mandate that hunters register their kills with local officials for the purpose of monitoring and research (e.g., Bodmer et al. 2000, Puertas et al. 2000). In addition, local officials can check carcasses for signs of foul play (e.g., gun shots, discolored flesh from poisoning, the use of illegal traps). There is also space to integrate campesino cooperatives into this legislation, which could provide room for campesinos to establish their own hunting rules revolving around agricultural entities that informed campesino identity and social institutions that dictated access to private land for hunting (see Section 3).

The potential full implications for this research are yet unknown. Campesino hunting scholarship is still a disjointed body of literature and variable domain of conservation practice with myriad political ramifications for most of the Americas. My hope is that this dissertation offers a starting point for advancing this highly interdisciplinary and novel area of study. Hunting by Latin America's most vulnerable peoples will continue, whether legal or illegal, monitored or unmonitored. It’s the terms of engagement with the cultures and knowledge of those hunting communities that will decide whether conservation succeeds or fails.

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APPENDIX A[*]

CAMPESINO HUNTING LITERATURE REVIEW CRITERIA, DATA, AND ANALYSES

Table A-1 Literature review search terms in English, Spanish, and Portuguese with Boolean operators used in 5 databases: ISI Web of Science, Scopus, AAA AnthroSource, EBSCOhost Anthropological Literature, and eHRAF World Cultures[a]. The Boolean operator AND was used to create search strings across the 3 categories unless otherwise specified (e.g., llanero* AND biodivers* AND Latin America OR Latinoamérica OR América Latina).

Social Group	**Context/Descriptor**	**Geographic Location**
caatinguero*	animal*[b] OR hunted animal[b]	Central America OR Centroamérica OR América Central
caboclo*[a]	biodivers*	Latin America OR Latinoamérica OR América Latina
cabuco*[a]	bushmeat OR carne de monte OR carne de caza OR carne de caça OR carne selvagum	South America OR Sudamerica OR América del Sur OR América do Sul
caiçara*[a]	conservation OR conservación OR conservação	
cholo*[a] OR chola*[a]	diet*[a] OR dietétic*	
colono* OR colonist*	ethnograph* OR etnografía OR etnografia	
creole*[a] OR criollo* OR creulo*	gun*[b]	
de-tribal* OR destribalizado*	game*[a] OR animales de caza OR animais de caça	
farmer*	hunt*[a] OR caza* OR cacería OR caça*	
gaucho*	hunting and trapping[b]	
geraizeiro*	illegal hunt* OR caza illegal or caça ilegal	
half breed[b]	livelihood* OR sustento* OR meios de vida	
karboeger*[a,c]	nutrition* OR nutrición OR alimentación OR nutrição	
ladino*	poach*[a] OR caza furtiva OR caça furtiva	
llanero*	prey OR presa*	
mestiz*[a] OR mestiç*	subsist* OR subsistencia OR subsistência	
mulatto* OR mulato*	Surviv* OR supervivencia OR sobrevivencia OR sobrevivência	
non-indian* OR nonindian* OR no indio OR não indiano*	wildlife[a] OR vida silvestre OR animais selvagens OR animais selvagem	
non-indigenous OR nonindigenous OR no indígena OR não indígena	wildlife hunt*[b]	
non-native* OR nonnative* OR no nativ* OR não nativ*		
non-tribal OR nontribal OR no tribal OR não tribal		
peasant* OR campesin*[a] OR camponês OR campones*		

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quilombol*[a]	
riverin*[a] OR ribereñ*[a] OR ribeirinh*[a]	
rubber tapper*[b]	
vazanteiro*	
veredeiro*	

[a]Select terms that we cross-referenced with all 56 Latin American cultures in the Human Relations Area Files (eHRAF 2018) database given logistic and time constraints on the literature review.
[b]Terms exclusively applied to the eHRAF search that were omitted from the broader literature search given either their anachronistic prevalence in the database or logistic and time constraints on the literature review.
[c]The child of a black and mulatto/Indian parents in Suriname (Torres-Saillant 2006:183)

Table A-2 List of the 30 variables with their descriptions and selection criteria used in this literature review.

Variable		Description and selection criteria.
1	Year	The year the paper was published.
2	Language(s)	The language(s) in which the study was published.
3	Citation count	The number of times each paper was cited based on Google Scholar counts as of 10 November 2017.
4	Country	The country or countries in which the paper was focused or research took place.
5	Journal/book	The title of the journal or book where the source material was published.
6	Outlet	The type of publication format categorized as peer reviewed or grey literature.
7	Article context	The theoretical, conceptual, or applied framework underlying the authors' purpose for writing the article.
8	Article focus	The authors' stated objectives for writing their article and/or conducting their research.
9	Protected areas/reserves	Any area of land subject to environmental protection under local, national, or international designations through communal or legal mechanisms.
10	Social group(s)	Refers to the full number of social groups that were either the focus of the reviewed paper and/or contributed data to the study. The group identifiers are listed below.
11	Non-indigenous campesino social group(s)	This social group comprised campesino study subjects or participants who did not claim an indigenous identity (e.g., Quechua) or were not assigned one by the authors. We followed Loker's (1996) description of campesinos (see the introduction) and considered the following (and their common Spanish translations) to be members of the campesino social class, united by their shared dependence on small-scale agriculture and/or ranching in the Latin American countryside (*campo*): peasants, (*campesinos*), rural mestizos, agricultural colonists (*colonos*), *llaneros*, creoles (*criollos*), and riverine campesinos (*ribereños*).
12	Indigenous campesino social groups	We combined the above criteria from #11 with groups who identified as indigenous or were described as indigenous by the authors to delimit this category. Some examples are Mayan peasant-hunters, Guaraní campesinos, and Nahua campesinos.
13	Indigenous social group(s)	The indigenous identity that study participants or authors ascribed to the study population that was not identified as one of the above campesino groups or did not identify themselves as such.
14	Ecosystems and habitats	Authors' descriptions of the ecosystems and habitats where the study took place.
15	Major Ecosystem Type (MET)	We filtered authors' study site descriptions through the definitions and criteria outlined by Dinerstein et al. (1995) to categorize it as one of the 5 METs, which are defined as "a set of ecoregions that (a) share comparable ecosystem dynamics; (b) have similar response characteristics to disturbance; (c) exhibit similar degrees of beta diversity; and (d) require an ecosystem-specific conservation approach" (6).
16	Major Habitat Type (MHT)	We matched authors' habitat descriptions of the study site with the one of the 11 recognized MHTs, which is broadly defined as "a set of ecoregions that (a) experience

		comparable climatic regimes; (b) have similar vegetation structure; (c) display similar spatial patterns of biodiversity (e.g., levels of beta diversity); and (d) contain flora and fauna with similar guild structures and life histories” (Dinerstein et al. 1995:6).
17	Total METs	The cumulative number of Major Ecosystem Types comprising the study location
18	Total MHTs	The cumulative number of Major Habitat Types comprising the study location.
19	Sampling units	We categorized sampling units as ‘individuals’ and/or ‘households’ according to authors’ methods and results. We recorded both when reported.
20	Sample sizes	Similar to sampling units, we recorded the final sample sizes for each study by the number of individuals and/or households.
21	Methods	We documented the types of methods employed from each paper’s methods section.
22	Total methods	The total number of methods employed in each study to draw data from or make inferences about campesino hunting.
23	Hunting driver(s)	We defined hunting drivers as campesinos’ internal and external motives for hunting as reported by the authors and study participants.
24	Hunting constraint(s)	We defined hunting constraints as internal and external factors that direct campesinos to limit or refrain from hunting as reported by the authors and study participants.
25	Hunting conflict(s)	We defined hunting conflicts as situations where campesinos are motivated to, refrain from, or experience tensions from hunting in response to the adverse effects of human-human and/or human-wildlife interactions.
26	Hunted animals	The individual species that authors and/or study participants recorded as hunting targets for campesinos in each study. Revisted species names were cross-referenced and modified to capture currently accepted taxonomic designations on the IUCN Red List (IUCN 2018).
27	Hunted taxa	We condensed the reported target species (#26) into 5 broad taxonomic categories: 1) mammals; 2) birds; 3) reptiles; 4) amphibians; and 5) insects (see Tables A-16 to A-20).
28	Local and traditional knowledge (LTK) components	We adopted Toledo’s (2002) ethnoecological framework of Kosmos, Corpus, and Praxis, referred to as the k-c-p complex, to help guide our LTK analysis. When filtered through campesino hunting, each component captures a unique aspect of campesino hunting LTK. Kosmos represents cosmological and belief systems informing hunting, such as religious precepts. Corpus refers to the body of hunting knowledge, from local taxonomies to social and historical experiences with hunting over time. Praxis refers to the practical aspects of hunting, such as strategies and tools.
29	Sustainable	An author’s assessment, whether anecdotal or quantified, of the biological (e.g., population densities) and social effects (e.g., economic, cultural, institutional) of past, present, or future campesino hunting as either sustainable or unsustainable.
30	Sustainable justification	We classified authors’ assessments of the sustainability of campesino hunting (#25) as either anecdotal or measured. Anecdotes refer to unmeasured inferences or claims about sustainability. Measurements were considered any quantitative assessment used to determine the sustainability of wildlife harvests by campesinos, such as harvest rates or surplus production models.

Table A-3 Publication trend data for available papers (n = 334) about campesino hunting. Outlets are categorized as peer-reviewed (Peer) journal articles, book chapters, and monographs and grey literature (Grey) in popular magazines, society bulletins, conference proceedings, and technical reports. Study countries follow 3-letter country codes: Argentina (ARG), Belize (BLZ), Bolivia (BOL), Brazil (BRA), Chile (CHL), Colombia (COL), Costa Rica (CRI), Ecuador (ECU), El Salvador (SLV), Guatemala (GTM), Honduras (HND), Mexico(MEX), Nicaragua (NIC), Panama (PAN), Paraguay (PRY), Peru (PER), and Venezuela (VEN). Social groups refer to Nonindigenous campesinos (C), Indigenous campesinos (D), other Indigenous groups (I), other non-campesino groups (Z), Nonindigenous colonists (O), and ribereños (R). Sampling units are grouped as individuals (I) and households (H). Context and protected area identifiers are listed in Tables A-7 and A-8. Hunted taxa are mammals (M), birds (B), reptiles (R), amphibians (A), and insects (I).

Literature cited[a]		**Outlets**	**Study countries**	**Social groups**	**Sample size/units**		**Context**	**Protected Areas**	**Hunted taxa**
					I	**H**			
1	Acedo (1993)	Grey	GTM	C	n/a	n/a	8	n/a	B
2	Alcalá and Hernández (2016)	Peer	MEX	C	265	n/a	2	40, 136	M, B, R, A
3	Aldana et al. (2006)	Peer	COL	C	51	n/a	11	n/a	M, B, R
4	Altrichter (2005)	Peer	ARG	C	18	215	5	6, 88	M
5	Altrichter (2006)	Peer	ARG	C	35	157	9	n/a	M, B, R
6	Altrichter (2008)	Peer	ARG	C	28	58	27	n/a	M
7	Altrichter and Jiménez (1999)	Peer	NIC	C	40	21	2	71	M, B, R
8	Altrichter and Almeida (2002)	Peer	CRI	C	327	n/a	1	n/a	M
9	Altrichter and Boaglio (2004)	Peer	ARG	C	153	n/a	1	n/a	M
10	Altrichter and Basurto (2008)	Peer	ARG	C	40	58	27	n/a	M
11	Altrichter et al. (2006)	Peer	ARG	C	423	n/a	3	n/a	M
12	Álvarez et al. (2015)	Peer	MEX	C	263	n/a	1	23	M
13	Alvarez-Alonso (1997)	Peer	PER	C, I	n/a	n/a	5	116	M, B, R
14	Aquino and Calle (2003)	Peer	PER	R	n/a	n/a	2	1	M
15	Aquino et al. (2007a)	Peer	PER	R	n/a	n/a	5	n/a	M
16	Aquino et al. (2007b)	Peer	PER	R	n/a	n/a	15	n/a	M, B, R
17	Aquino et al. (2009)	Peer	PER	R	n/a	n/a	1	n/a	M
18	Aranda et al. (1999)	Peer	MEX	C, I	n/a	n/a	24	n/a	M, B, R, A
19	Ávila-Nájera et al. (2011)	Peer	MEX	C	42	n/a	1	n/a	M
20	Baigún (2002)	Grey	ARG	C	71	n/a	6	n/a	B
21	Barbarán (1999)	Peer	ARG	C, I	97	n/a	8	n/a	M
22	Barbarán (2012)	Grey	ARG	C	98	n/a	3	n/a	M, B, R

23	Barham et al. (1999)	Peer	PER	R	n/a	300	4	1	n/a
24	Begazo (1997)	Peer	PER	R	53	n/a	1	1	M, B
25	Begazo and Bodmer (1998)	Peer	PER	R	53	n/a	5	1	B
26	Bentley (1991)	Grey	HND	C	n/a	n/a	18	n/a	I
27	Bentley and Rodríguez (2001)	Peer	HND	C	n/a	n/a	3	n/a	I
28	Berlin (1985)	Peer	PER	O, I	102	21	28	n/a	M, B, R, A
29	Berlin (1989)	Peer	PER	C, I	n/a	18	7	n/a	M, R
30	Betancourt and Castillo (2010)	Peer	MEX	D	n/a		6	n/a	M, B
31	Bisbal (1993)	Peer	VEN	C, D	n/a	n/a	1	n/a	M
32	Bisbal (1994)	Peer	VEN	C, I	55	n/a	11	n/a	M, B, R
33	Bisbal (2000)	Peer	VEN	C, Z	127	n/a	10	n/a	M, B, R
34	Bisbal (2013)	Peer	VEN	C	40	n/a	5	n/a	M, B, R
35	Blackwell et al. (2009)	Peer	ECU	O, I	1954	n/a	7	n/a	n/a
36	Bodmer (1995)	Peer	PER	R	n/a	n/a	2	n/a	M
37	Bodmer and Lozano (2001)	Peer	PER	R, I	n/a	n/a	15	1, 2	M
38	Bodmer et al. (1988a)	Peer	PER	C	n/a	n/a	5	n/a	M
39	Bodmer et al. (1988b)	Peer	PER	R	n/a	n/a	5	n/a	M
40	Bodmer et al. (1990a)	Peer	PER	R	n/a	n/a	2	2	M
41	Bodmer et al. (1990b)	Peer	PER	R	99	n/a	1	n/a	M
42	Bodmer et al. (1994)	Peer	PER	R	n/a	n/a	2	2	M
43	Bodmer et al. (1997a)	Peer	PER	R	n/a	n/a	11	n/a	M
44	Bodmer et al. (1997b)	Peer	PER	R	n/a	n/a	14	2	M, R
45	Bodmer et al. (1999)	Peer	PER	R, I	n/a	n/a	14	1	M
46	Bodmer et al. (2000)	Peer	PER	R	n/a	n/a	2	1	M
47	Bodmer et al. (2004)	Peer	PER	R	n/a	100	9	1, 2	M
48	Bolkovic (1999)	Peer	ARG	C	114	67	11	6	M, B, R
49	Bonta (2004)	Peer	HND	C	n/a	n/a	2	131	n/a
50	Botero et al. (2012)	Peer	COL	C	n/a	1	4	n/a	B, R
51	Branchi (1945)	Peer	MEX	C	n/a	n/a	3	n/a	M
52	Briceño-Méndez et al. (2011)	Peer	MEX	C	30	n/a	6	n/a	M
53	Briceño-Méndez et al. (2014)	Peer	MEX	C	18	n/a	1	3	M

54	Buenrostro et al. (2016)	Peer	MEX	C	54	n/a	2	83	M, R
55	Caballero-Serrano et al. (2016)	Peer	ECU	C, I	138	n/a	17	n/a	n/a
56	Calmé and Sanvicente (2000)	Grey	MEX	C	377	n/a	1	3, 21, 53	
57	Camino (2013)	Peer	ARG	C, I	102	n/a	9	n/a	M
58	Camino et al. (2016)	Peer	ARG	C, I	113	n/a	14	n/a	M
59	Camino et al. (2018)	Peer	ARG	C, I	105	n/a	9	n/a	M, B, R
60	Carbonell and Torrealba (2007)	Peer	CRI, PAN	C, I	15	n/a	2	17	M
61	Cardozo (2011)	Peer	PER	C	102	n/a	2	10	n/a
62	Carrillo et al. (2000)	Peer	CRI	O	n/a	n/a	2	47, 63	M
63	Carrión de Samudio (1995)	Grey	PAN	C, Z, I	59	n/a	5	72	M, B, R
64	Castro Casal et al. (2013)	Peer	COL[b]	C, I	n/a	n/a	6	n/a	R
65	Castro et al. (1976)	Peer	PER	C	n/a	n/a	8	n/a	M, R, I
66	Chablé-Pascual et al. (2015)	Peer	MEX	C	160	n/a	3	n/a	M, B
67	Claggett (1998)	Grey	PER	R, I	n/a	85	7	n/a	M, B, R
68	Contreras-Díaz et al. (2008)	Peer	MEX	D	n/a	n/a	3	n/a	M
69	Contreras-Moreno et al. (2012)	Peer	MEX	C, I	20-164	n/a	6	25	M
70	Conway-Gómez 2008	Peer	BOL	R	n/a	133	7	n/a	M, R
71	Coomes 1996	Peer	PER	R	n/a	501	4	2	n/a
72	Coomes et al. (1996)	Peer	PER	R	n/a	300	15	1	n/a
73	Coomes et al. (2004)	Peer	PER	R	n/a	264	9	n/a	n/a
74	Coomes et al. (2010)	Peer	PER	R	n/a	155	4	n/a	n/a
75	Coomes et al. (2016)	Peer	PER	R, I	n/a	1768-1043120	4	n/a	M
76	Cordero (1990)	Peer	VEN	C	24-120	n/a	8	n/a	M, B, R
77	Cortés-Gregorio et al. (2013)	Peer	MEX	C, I	87	n/a	3	n/a	M, B, R
78	Cotí and Ariano-Sánchez (2008)	Peer	GTM	C	n/a		1	n/a	R
79	Cotta (2015)	Peer	PER	C, I	n/a	176	4	n/a	n/a
80	Cruz-Antía and Gómez (2010)	Peer	COL	C, I	210	n/a	8	n/a	M, B, R
81	de la Ossa and de la Ossa-Lacayo (2011)	Peer	COL	C	134	n/a	6	n/a	M, B, R
82	de la Ossa-Lacayo and de la Ossa (2012a)	Peer	COL	C	180	n/a	6	n/a	M, B, R
83	de la Ossa-Lacayo and de la Ossa (2012b)	Peer	COL	C	80	n/a	6	n/a	M, B, R

84	Devine (2014)	Peer	GTM	C, I	100	n/a	2	7	n/a
85	Dixon (1991)	Peer	MEX	C	n/a	n/a	24	n/a	M
86	Doane (2000)	Peer	MEX	C	n/a	n/a	15	n/a	M, B
87	Dourojeanni (1968)	Peer	PER	C	n/a	n/a	11	n/a	M[c]
88	Dourojeanni et al. (1968)	Peer	PER	C	180	n/a	11	n/a	M, B, A
89	Durand (2010)	Peer	MEX	C	206	n/a	2	22	n/a
90	Escamilla et al. (2000)	Peer	MEX	C, I	8-24	n/a	2	3	M, B
91	Espinosa (2008)	Peer	PER	R	74	37	7	1, 2	M, B, R
92	Espinosa (2010)	Peer	PER	R	74	37	29	1, 2	n/a
93	Ferrer et al. (2010)	Peer	VEN	C	424	n/a	11	55	M, B, R
94	Ferrer et al. (2013)	Peer	VEN	C, I	740	n/a	11	n/a	M, B, R
95	Ferrero (2008)	Peer	ARG	O	n/a	n/a	29	n/a	M
96	Fitch et al. (1982)	Peer	BLZ, CRI, SLV, GTM, HND, MEX, NIC, PAN	C, Z	n/a	n/a	1	n/a	R
97	Flesher (1999)	Peer	HND	C	n/a	n/a	1	n/a	M
98	Fort et al. (2018)	Peer	PAN	C, I	139	n/a	3	41, 52	M
99	Francesconi et al. (2018)	Peer	PER	R, I	230	42	6	n/a	M, B, R
100	Freese et al. (1982)	Peer	BOL, PER	C	n/a	n/a	25	1, 93, 110	M
101	Frost (1974)	Peer	CRI	C, I	n/a	n/a	3	n/a	M, B, R
102	Galindo-Leal and Lira-Torres (2011)	Grey	MEX	C	50	n/a	10	n/a	M
103	Gallina et al. (2012)	Peer	MEX	C	176	n/a	2	25	M
104	García del Valle et al. (2015)	Peer	MEX	C, I	189	n/a	3	4	M
105	Garcia-Alaniz et al. (2010)	Peer	MEX	C	60	n/a	3	4	M
106	García-Flores et al. (2014)	Peer	MEX	C	135	n/a	1	28	M
107	García-Flores (2018)	Peer	MEX	C	120	n/a	16	24	M, B, R, I
108	García-Frapolli and Toledo (2008)	Peer	MEX	D	n/a	n/a	15	n/a	n/a
109	García-Frapolli et al. (2008)	Peer	MEX	D	63	42	2	n/a	M, B
110	García-Marmolejo et al. (2008)	Peer	MEX	C, Z	39	n/a	9	70, 85, 90, 104, 120, 145,	M
111	García (2013)	Peer	MEX	C	37	n/a	2	77	M, B, R, I
112	Gavin (2007)	Peer	PER	O, I	n/a	67	5	48	M, B, R
113	Gil and Retana-Guiascón (2012)	Peer	MEX	C, I	66	n/a	12	n/a	M, B, R, I

114	Glanz (1991)	Peer	PAN	C	2	n/a	2	36	M
115	Gockel and Gray (2009)	Peer	PER	R	57	n/a	15	1	R
116	Gómez-Martínez et al. (2011)	Peer	NIC	C	59	n/a	18	n/a	R, A
117	Gómez-Martínez et al. (2014)	Peer	NIC	C	59	n/a	18	n/a	R, A
118	Góngora-Chin et al. (2016)	Peer	MEX	D	14	n/a	23	n/a	B
119	González Abraham et al. (2007)	Peer	MEX	C	32	n/a	10	n/a	M
120	González Pérez et al. (2017)	Peer	MEX	D	84	n/a	1	n/a	M
121	González Romo et al. (2014)	Peer	MEX	C	n/a	n/a	2	32, 56	B
122	González-Bocanegra et al. (2011)	Peer	MEX	C	190	n/a	2	154, 155	M, B, R
123	González-Marín et al. (2017)	Peer	MEX	C, Z	60	n/a	16	n/a	M, B, R
124	González (1999a)	Grey	PER	R	n/a	194	5	1	B
125	González (1999b)	Peer	PER	R, I	n/a	194	2	1	B, R
126	González (2003a)	Peer	PER	C, I	n/a	194	5	1	B
127	González (2003b)	Peer	PER	O, I	n/a	153	2	151	M, B, R
128	González (2004)	Peer	PER	C, I	n/a	194	5	1	B
129	Gorzula and Paolillo (1986)	Grey	VEN	C, Z, I	n/a	n/a	1	n/a	R
130	Gram et al. (2001)	Peer	PER	R, I	n/a	116	4	n/a	R
131	Gray et al. (2015)	Peer	ECU	C, I	n/a	601	7	n/a	M, B
132	Guerra and Naranjo (2003)	Peer	MEX	C, I	232	n/a	2	4	M, B
133	Guerra Roa et al. (2004)	Peer	MEX	C, I	44	n/a	11	n/a	M, B
134	Haenn (1999)	Peer	MEX	C	10	n/a	20	3	n/a
135	Halme and Bodmer (2007)	Peer	PER	R	26	n/a	12	n/a	M
136	Harvey et al. (2017)	Peer	BLZ	C, Z	112	112	1	n/a	M
137	Hellier et al. (1999)	Peer	MEX	C, I	57	n/a	12	n/a	M
138	Hernández-López et al. (2013)	Peer	MEX	C	n/a	n/a	2	144	M, B, R
139	Hernández-Tapia et al. (2018)	Peer	MEX	C	48	n/a	12	n/a	M, B, R, I
140	Hernandez et al. (2015)	Peer	ARG	C	171	n/a	3	127	M, B
141	Hernández and Espín (2003)	Peer	VEN	R	n/a	n/a	1	n/a	R
142	Hill et al. (1997)	Peer	PRY	C, I	n/a	n/a	5	8	M
143	Hill et al. (2003)	Peer	PRY	C, I	n/a	n/a	5	8	n/a
144	Hiraoka (1985a)	Peer	PER	R	n/a	n/a	4	n/a	n/a

145	Hiraoka (1985b)	Peer	PER	C	n/a	n/a	4	n/a	M, R
146	Hiraoka (1989)	Peer	PER	R	n/a	n/a	4	n/a	M, R
147	Hiraoka (1995)	Peer	PER	R	n/a	12	4	n/a	M, B, R
148	Humanez-López et al. (2016)	Peer	COL	C, I	n/a	n/a	1	n/a	M
149	Hurtado-Gonzales and Bodmer (2004)	Peer	PER	R	n/a	n/a	1	2	M
150	Infante-Ramírez and Arce-Ibarra (2015)	Peer	MEX	D	195	n/a	17	n/a	n/a
151	Infante-Ramírez et al. (2014)	Peer	MEX	D	215	n/a	17	n/a	n/a
152	Jiménez Valverde (2011)	Peer	CRI	C	15	n/a	2	76	n/a
153	Jiménez (1999)	Peer	CRI	C	27	n/a	1	n/a	M
154	Jiménez (2002)	Peer	NIC	C, Z, I	198	n/a	1	n/a	M
155	Jorgenson (1995)	Peer	MEX	C, I	n/a	n/a	6	21	M, B
156	Kamienkowski and Arenas (2012)	Grey	ARG	C, I	n/a	n/a	7	n/a	I
157	Kampichler et al. (2010)	Peer	MEX	C	n/a	n/a	1	3	B
158	Kamppinen (1988)	Peer	PER	C	n/a	n/a	24	n/a	n/a
159	Koford (1957)	Peer	ARG, BOL, CHL, PER	C, I	n/a	n/a	1	n/a	M
160	Kvist et al. (2001)	Peer	PER	R, I	n/a	12	4	1	n/a
161	Lavariega et al. (2016)	Peer	MEX	D	68	n/a	1	n/a	M
162	Lavariega et al. (2012)	Peer	MEX	C	22	n/a	1	135	M
163	Leberatto 2016	Peer	PER	C	47	n/a	8	n/a	n/a
164	León and Montiel 2008	Peer	MEX	D	10	14	2	5	M, B, R
165	Leyte-Manrique et al. (2016)	Peer	MEX	C	180	n/a	3	n/a	R, A
166	Lichtenstein and Vilá (2003)	Peer	ARG, BOL, CHL, PER	C	n/a	n/a	1	n/a	M
167	Lira-Torres (2011)	Grey	MEX	C	n/a	n/a	1	n/a	M
168	Lira-Torres and Briones-Salas (2011)	Peer	MEX	C	50	n/a	10	n/a	M, B
169	Lira-Torres et al. (2004)	Peer	MEX	C	24	n/a	2	61	M
170	Lira-Torres et al. (2006)	Peer	MEX	C	n/a	n/a	1	n/a	M
171	Lira-Torres et al. (2011)	Peer	MEX	D	51	11	10	n/a	M
172	Lira-Torres et al. (2012)	Peer	MEX	C	50	11	10	n/a	M
173	Loaiza et al. (2015)	Peer	ECU	C, I	n/a	111	30	29	M, B
174	López et al. (2017)	Peer	COL	C	74	n/a	3	34	M
175	Maass et al. (2005)	Peer	MEX	C	180	n/a	17	n/a	M, B, R

176	Mandujano and Rico-Gray (1991)	Peer	MEX	D	11	n/a	3	n/a	M, B
177	Manzano-García and Martínez (2017)	Peer	ARG	C, Z	55	n/a	2	35, 78, 119	M, B
178	Manzi and Coomes (2009)	Peer	PER	R	n/a	57	1	n/a	n/a
179	McAllister et al. (2009)	Peer	ARG	C	n/a	n/a	7	82	M
180	Medina-Torres et al. (2016)	Peer	MEX	C, I	76	n/a	3	n/a	M
181	Mejía et al. (2016)	Peer	COL	C	18	n/a	3	n/a	M, B, R
182	Mellink et al. (1986)	Peer	MEX	C	n/a	n/a	12	n/a	M, B, R, A, I
183	Mellink et al. (1988)	Peer	MEX	C	n/a	n/a	12	n/a	B
184	Méndez-Cabrera and Montiel (2007)	Peer	MEX	D	220	n/a	2	5, 121	M, B, R
185	Molina (2004)	Peer	VEN	C	60	n/a	1	26, 132	M
186	Monroy and García-Flores (2013)	Peer	MEX	D	79	n/a	7	n/a	M, B, R, A
187	Monroy Martínez et al. (2011)	Peer	MEX	C	150	n/a	2	28, 86	M
188	Monroy-Vilchis et al. (2008)	Peer	MEX	C	117	n/a	2	134	M, B, R
189	Montero (2004)	Grey	COL	C	21	n/a	9	n/a	M, B
190	Monterrubio et al. (2007)	Peer	MEX	C	n/a	61	1	4	M
191	Montes-Pérez et al. (2018)	Peer	MEX	C	n/a	n/a	6	n/a	M
192	Montiel Ortega et al. (1999)	Peer	MEX	D	35	n/a	19	n/a	M, B, R
193	Montiel Ortega (2010)	Peer	MEX	D	n/a	n/a	2	5	M, B, R
194	Morsello et al. (2015)	Peer	BRA[d], COL	C, O, I	1273	99	13	n/a	n/a
195	Moure (2003)	Peer	COL	C	n/a	n/a	6	n/a	M
196	Naidoo and Ricketts (2006)	Peer	PRY	C, Z, I	n/a	n/a	9	8	M, B, R
197	Naranjo (2008)	Peer	MEX	C, I	449	n/a	10	4, 37, 43, 80, 95, 102, 152	M
198	Naranjo and Aldán (1998)	Peer	MEX	C	36	n/a	1	79	M
199	Naranjo et al. (2004a)	Peer	MEX	C, I	232	n/a	5	n/a	M, B, R
200	Naranjo et al. (2004b)	Peer	MEX	C, I	232	n/a	5	n/a	M
201	Naughton-Treves (2002)	Peer	PER	R, O	175	49	23	27	M
202	Naughton-Treves et al. (2003)	Peer	PER	R, I	24	n/a	2	27	M
203	Naveda-Rodríguez and López (2006)	Peer	VEN	C	118	n/a	1	n/a	M
204	Neville et al. (1976)	Peer	PER	R	n/a	n/a	1	1	M
205	Newing and Bodmer (2003)	Peer	PER	R	n/a	n/a	14	2	n/a

206	Nichols (1937)	Peer	ARG	C	n/a	n/a	4	n/a	n/a
207	Nietschmann (1990)	Peer	NIC	C	n/a	n/a	20	n/a	M
208	Norman (1987)	Peer	PRY	D	84	n/a	1	n/a	M, R
209	Novack et al. (2005)	Peer	GTM	C	n/a	n/a	1	7	M
210	Núñez 2010	Peer	GTM	C	7	n/a	7	7, 133	M, B
211	O'Shea et al. (1988)	Grey	VEN	C, I	150	n/a	1	n/a	M
212	Ojasti (1970)	Peer	VEN	C	n/a	n/a	21	n/a	M
213	Oliva and Montiel (2016)	Grey	MEX	D	66	n/a	2	5	n/a
214	Oliva et al. (2014)	Peer	MEX	D	66	n/a	20	5	M
215	Orlove 1977	Peer	PER	C	n/a	n/a	4	n/a	M
216	Ortíz-Martínez and Rico-Gray (2007)	Peer	MEX	D	4	n/a	1	n/a	M
217	Osbahr and Morales (2012)	Grey	COL	C	278	n/a	12	n/a	M, B, R
218	Otterstrom (2001)	Peer	NIC	C	103	n/a	2	122	M, B, R, I
219	Pacheco and López (2017)	Peer	COL	C	138	n/a	3	n/a	M
220	Parra-Colorado et al. (2014)	Peer	COL	C	20	n/a	12	44-46, 98-101	M
221	Pasachnik et al. (2014)	Peer	HND	C	132	n/a	1	n/a	R
222	Pascual-Ramos et al. (2014)	Peer	MEX	C, I	77	n/a	3	n/a	R
223	Peñaloza 2011	Peer	VEN	R	n/a	n/a	1	n/a	R
224	Peñaloza et al. (2013)	Peer	VEN	R	n/a	n/a	1	33	R
225	Periago et al. (2017)	Peer	ARG	C	40	n/a	17	n/a	M
226	Pfeiffer (1986)	Peer	NIC	C	n/a	n/a	21	n/a	M, R
227	Pierret and Dourojeanni (1966)	Peer	PER	R	181	21	13	n/a	M, R
228	Pierret and Dourojeanni (1967)	Peer	PER	R	2919	430	16	n/a	M, R
229	Pinedo et al. (2000)	Peer	PER	R	12	41	14	n/a	M
230	Pinedo-Vasquez et al. (2002)	Peer	PER	R	n/a	n/a	15	n/a	M, R
231	Pires et al. (2016)	Peer	BOL, PER	C	38	n/a	8	n/a	B
232	Pires and Clarke (2011)	Peer	BOL	C	n/a	n/a	8	n/a	B
233	Pires and Clarke (2012)	Peer	MEX	C	68	n/a	8	n/a	B
234	Porini (2006)	Peer	ARG	C, I	n/a	n/a	1	n/a	R
235	Puertas and Bodmer (2004)	Peer	PER	R	n/a	3	14	2	M
236	Puertas et al. (1995)	Peer	PER	R	n/a	n/a	1	2	M

237	Puertas et al. (2000)	Peer	PER	R	n/a	3	2	1, 2	n/a
238	Puertas et al. (2003)	Peer	PER	R, I	n/a	3	5	1, 2	n/a
239	Pyhälä et al. (2006)	Peer	PER	R	n/a	94	4	10	n/a
240	Quiroga et al. (2016)	Peer	ARG	C	41	n/a	1	6, 30	M
241	Rabinovich et al. (1991)	Peer	ARG	C	n/a	n/a	1	81	M
242	Racero-Casarrubia and Cogollo (2014)	Peer	COL	C	30	n/a	10	n/a	M
243	Racero-Casarrubia and González-Maya (2014)	Peer	COL	C	112	n/a	5	112	M
244	Ramírez-Barajas and Naranjo (2007)	Peer	MEX	C, I	52	n/a	6	n/a	M, B
245	Ramírez-Mella et al. (2016)	Peer	MEX	C, I	184	n/a	12	n/a	M, B, R
246	Ramos-Arreola et al. (2015)	Peer	MEX	C	19	n/a	3	n/a	M, B, R, A
247	Ramos-Elorduy et al. (2008)	Peer	MEX	D	200	n/a	3	n/a	I
248	Redford and Stearman 1989	Peer	BOL	C, I	n/a	36	2	13	M, R
249	Reeves et al. (1996)	Peer	PER	R, I	n/a	n/a	1	1	M
250	Reyna Rojas et al. (2015)	Peer	MEX	C	105	n/a	3	24	R, A
251	Reyna-Hurtado (2009)	Grey	MEX	C, I	21	n/a	1	3	M
252	Reyna-Hurtado and Tanner (2010)	Peer	MEX	C, I	80	n/a	1	3	M
253	Reyna-Hurtado et al. (2010)	Peer	MEX	C, I	19	n/a	1	n/a	M
254	Reynolds et al. (1995)	Peer	CRI	C	3	n/a	1	n/a	M
255	Ríos et al. (1973)	Peer	PER	R	545	88	11	n/a	M, B, R
256	Rodas-Trejo et al. (2014)	Peer	MEX	C	123	n/a	10	n/a	M
257	Rodríguez-Ríos and García-Páez (2016)	Peer	ECU	C	n/a	806	26	n/a	M
258	Rodríguez-Ríos and García-Páez (2017)	Grey	ECU	C	n/a	806	26	n/a	M
259	Rodríguez et al. (2012)	Peer	MEX	D	40	n/a	19	5	M
260	Rojano et al. (2013)	Peer	COL	C	20	n/a	1	n/a	M
261	Roldán-Clarà et al. (2017a)	Peer	MEX	C	4	n/a	3	n/a	B
262	Roldán-Clarà et al. (2017b)	Peer	MEX	C, I	79	n/a	3	n/a	B
263	Roldán-Clarà (2018)	Peer	MEX	C	75	n/a	8	n/a	n/a
264	Ruiz-Serna (2003)	Peer	COL	C	n/a	n/a	2	18	n/a
265	Ruiz-Serna (2015)	Peer	COL	C	n/a	n/a	3	18	M
266	Sahley et al. (2004)	Peer	PER	C	n/a	n/a	1	124	M

267	Saldaña and Saldaña (2011)	Peer	PER	C	10	n/a	2	1	M, B, R
268	Santana et al. (1990)	Peer	MEX	C	n/a	n/a	2	23	M, B, R,
269	Santos-Fita et al. (2012)	Peer	MEX	C, I	127	n/a	7	n/a	M, B
270	Santos-Fita et al. (2013)	Peer	MEX	C, I	33	n/a	6	n/a	n/a
271	Santos-Fita et al. (2015)	Peer	MEX	C, I	n/a	n/a	19	n/a	M
272	Sarti et al. (2015)	Peer	BRA[d], COL	C, Z, I	1696	140	13	n/a	n/a
273	Schelhas and Pfeffer (2005)	Peer	CRI	C	67	n/a	2	17	M
274	Shanee (2012)	Peer	PER	C	169	n/a	8	n/a	M, B, R
275	Shanee (2013)	Peer	PER	C	n/a	n/a	14	n/a	n/a
276	Shanee (2016)	Peer	PER	C	n/a	n/a	15	n/a	n/a
277	Shanee and Shanee (2015)	Peer	PER	C	n/a	n/a	22	9, 12, 19, 49	M
278	Shanee and Shanee (2016)	Peer	PER	C	n/a	n/a	15	n/a	n/a
279	Shanee et al. (2013)	Peer	PER	C	n/a	n/a	1	11, 12, 14-16, 20, 50, 51, 62, 105, 107, 113, 117, 130, 137, 150	M
280	Shanee et al. (2015)	Peer	PER	C	169	n/a	22	9, 11, 14-16, 19, 20, 31, 38, 39, 54, 57, 66-69, 73-75, 84, 89, 94, 96, 97, 103, 106, 109, 111, 115, 118, 123, 125, 129, 138, 139, 141-143, 146, 147, 149, 153	M
281	Silva and Strahl (1991)	Peer	VEN	C, I	147	n/a	1	n/a	B
282	Silva and Strahl (1996)	Peer	VEN	C	301	n/a	2	26, 58, 60, 64, 65, 114, 126, 140, 148	M, B
283	Smith-Cavros et al. (2012)	Peer	MEX	C	11	n/a	1	n/a	M
284	Smith (2003)	Peer	PAN	C, I	n/a	59	9	n/a	n/a
285	Smith (2005)	Peer	PAN	C, I	33	59	23	n/a	M, B, R

286	Smith (2008)	Peer	PAN	C, I	n/a	59	6	n/a	M, B, R
287	Sosa-Escalante (2011)	Peer	MEX	C	n/a	n/a	8	n/a	M, B, R
288	St-Laurent et al. (2013)	Peer	PAN	O	36	n/a	30	n/a	n/a
289	Stearman (1990)	Peer	BOL	O, Z, I	19	n/a	7	n/a	M
290	Stearman (1992)	Peer	BOL	C, I	n/a	n/a	7	n/a	M, R
291	Strahl et al. (1992)	Peer	VEN	O, I	n/a	n/a	25	n/a	M
292	Suárez et al. (2009)	Peer	ECU	O, I	n/a	n/a	13	29	M, B, R
293	Suárez and Lizcano (2002)	Grey	COL	C	n/a	n/a	2	91	M
294	Sunquist (1984)	Peer	VEN	C	n/a	n/a	1	n/a	M
295	Takasaki et al. (2000)	Peer	PER	R	n/a	300	4	1	n/a
296	Takasaki et al. (2001)	Peer	PER	R	n/a	251	4	1	n/a
297	Tamayo (1961)	Peer	VEN	C	n/a	n/a	1	n/a	M
298	Tamburini and Cáceres (2017)	Peer	ARG	C	40	n/a	7	42	M, B, R
299	Tarifa (2000)	Peer	BOL	C, I	n/a	25	1	13	M
300	Tejada-Cruz et al. (2014)	Peer	MEX	C	159	162	10	4	M, B, R
301	Thompson and Osgood (2011)	Peer	PER	R	n/a	n/a	14	2	M
302	Timm et al. (1986)	Peer	ECU	O, I	2	n/a	1	n/a	M
303	Tlapaya and Gallina (2010)	Peer	MEX	C	77	n/a	18	n/a	M
304	Torres et al. (1985)	Peer	ARG	C	n/a	n/a	28	n/a	M
305	Trillo et al. (2016)	Peer	ARG	C, Z	40	n/a	3	n/a	M, B, R
306	Turbay et al. (2001)	Peer	COL	C, I	n/a	n/a	2	87	M
307	Uberhuaga et al. (2012)	Peer	BOL	O, I	n/a	118	4	n/a	M, B, R
308	Valencia-Parra and de la Ossa (2016)	Peer	COL	C	200	n/a	6	n/a	M, B, R
309	Vallejo-Betancur et al. (2018)	Peer	COL	C	129	n/a	22	n/a	R
310	van Vliet et al. (2014)	Peer	BRA[d], COL, PER	C, O, I	16	n/a	13	n/a	n/a
311	van Vliet et al. (2015a)	Peer	BRA[d], COL, PER	C, Z, I	95	n/a	13	n/a	M, R, I
312	van Vliet et al. (2015b)	Peer	COL	C, O, I	1145	n/a	16	n/a	M, R, I
313	van Vliet et al. (2017)	Peer	COL	O, Z, I	n/a	n/a	13	n/a	M, B, R
314	van Vliet et al. (2018)	Peer	BRA[d], COL, PER	C, O, I	28	n/a	13	n/a	M, R
315	Varela Scherrer and Trabanino (2016)	Peer	MEX	D	n/a	n/a	19	108	M
316	Vargas-Tovar (2012a)	Peer	COL	C, Z, I	n/a	n/a	16	n/a	n/a

317	Vargas-Tovar (2012b)	Grey	COL	C, Z, I	n/a	n/a	16	n/a	n/a
318	Vásquez-Cruz et al. (2014)	Peer	MEX	D	90	n/a	3	n/a	B
319	Vásquez-Sánchez et al. (1992)	Peer	MEX	D	n/a	n/a	10	4	M, B, R
320	Vela Alvarado et al. (2017)	Grey	PER	C, I	n/a	n/a	3	n/a	M, B
321	Vispo (1998)	Peer	VEN	C	n/a	118- 122	9	n/a	M, R
322	Viveros Colorado and Bazáñez (2015)	Peer	MEX	C	n/a	n/a	21	n/a	M, B, R
323	Wallace and Painter (2013)	Peer	BOL	R	1	n/a	25	n/a	M
324	Waters (2015)	Peer	BLZ	C, I	168	n/a	1	n/a	M
325	Weber (2014)	Peer	MEX	C, I	84	n/a	11	n/a	M, B
326	Werner (1991)	Peer	PAN	C	n/a	n/a	1	n/a	R
327	Wheeler and Hoces (1997)	Peer	PER	C	n/a	n/a	1	156	M
328	Williams (2016)	Peer	NIC	C, Z, I	193	n/a	18	n/a	M
329	Zambrano-González et al. (2003)	Peer	COL	C	n/a	n/a	1	n/a	I
330	Zamudio et al. (2010)	Peer	ARG	C, Z	39	n/a	3	n/a	M, I
331	Zapata-Ciro et al. (2016)	Peer	COL	C	101	n/a	1	n/a	R
332	Zárate et al. (2010)	Peer	MEX	C	36	n/a	9	22, 59	M
333	Zenteno et al. (2013)	Peer	BOL	C, I	50	239	4	n/a	n/a
334	Zorondo-Rodríguez et al. (2014)	Peer	CHL	C	n/a	37	3	92	M

[a]See Table A-21 for complete literature cited.
[b]Although Castro Casal et al. (2013) present a historical regional review of documents from multiple countries, Colombia is listed given that the primary data regarding contemporary campesino uses and hunting of two freshwater turtle species (*Podocnemis expansa*, *P. unifilis*) drawn from for this review were derived from the lead author's personal observations and an organization's interviews with hunters in that country.
[c]Hunted taxa were derived from an inaccessible mimeographed work (Dourojeanni 1966) cited by the author.
[d]Brazil was included as part of several longitudinal multi-site comparisons in the Amazonian Trifrontier region from the same research group.

Table A-4 Chi-square test of standardized residuals on the number of publications in citation count categories as of 10 November 2017. Standardized chi-square residuals represent the deviation between the observed and expected values from the chi-square test.

Citations	N	Standardized χ^2 residual
200-448	5	-6.79**
150-199	8	-6.39**
100-149	8	-6.39**
50-99	29	-3.57**
25-49	52	-0.49
<25	232	23.63**

*p < 0.0083; **p < 0.0007. Adjusted p values were used to account for multiple comparisons using Bonferroni corrections.

Table A-5 Chi-square test of standardized residuals on the number of campesino hunting publications per decade. Standardized chi-square residuals represent the deviation between the observed and expected values from the chi-square test.

Decades	N	Standardized χ^2 residual
1930s	1	-6.29**
1940s	1	-6.29**
1950s	1	-6.29**
1960s	5	-5.59**
1970s	6	-5.41**
1980s	20	-2.98*
1990s	53	2.77
2000s	96	10.25**
2010s	151	19.83**

*p < 0.0056; **p < 0.0007. Adjusted p values were used to account for multiple comparisons using Bonferroni corrections.

Table A-6 Chi-square test of standardized residuals on the number of campesino hunting publications per country. Standardized chi-square residuals represent the deviation between the observed and expected values from the chi-square test.

Countries	N	Standardized χ^2 residual
Argentina	29	1.77
Belize	3	-4.07**
Bolivia	13	-1.82
Brazil	5	-3.62**
Chile	3	-4.07**
Colombia	35	3.12*
Costa Rica	9	-2.72
Ecuador	8	-2.94
El Salvador	1	-4.51**
Guatemala	6	-3.39*
Honduras	6	-3.39*
Mexico	105	18.85**
Nicaragua	9	-2.72
Panama	10	-2.49
Paraguay	4	-3.84**
Peru	91	15.70**
Venezuela	21	-0.02

*p < 0.003; **p < 0.00033. Adjusted p values were used to account for multiple comparisons using Bonferroni corrections.

Table A-7 Chi-square test of standardized residuals on the number of publications categorized in each research context. Standardized chi-square residuals represent the deviation between the observed and expected values from the chi-square test.

Study contexts		N	Standardized χ^2 residual
1	Conservation and management of taxonomic group(s)	66	16.73**
2	Conservation and management in PAs	45	10.33**
3	Human-wildlife relationships	30	5.75**
4	Livelihoods	19	2.40
5	Sustainable hunting and management	18	2.09
6	Subsistence hunting	16	1.48
7	Globalization/modernization/colonization/market integration	14	0.87
8	Wildlife trade/conservation criminology	12	0.26
9	Conservation and management strategies/plans	11	-0.04
10	Conservation and management in specific ecosystem	11	-0.04
11	Wildlife management	11	-0.04
12	Local and traditional knowledge	9	-0.65
13	Bushmeat consumption/trade	8	-0.96
14	Community-based conservation and management	8	-0.96

15	Conservation and development	8	-0.96
16	Biodiversity and food security	6	-1.57
17	Ecosystem services	5	-1.87
18	Agriculture	5	-1.87
19	Hunting traditions	4	-2.18
20	Conflict	3	-2.48
21	Conservation and wildlife management in specific countries	3	-2.48
22	Conservation program assessments	3	-2.48
23	Home gardens	3	-2.48
24	Human-environment relationships	3	-2.48
25	Natural history	3	-2.48
26	Buen Vivir	2	-2.78
27	Common-pool resources	2	-2.78
28	Cultural dietary patterns	2	-2.78
29	Gender in conservation	2	-2.78
30	REDD+	2	-2.78

*$p < 0.0017$; **$p < 0.00056$. Adjusted p values were used to account for multiple comparisons using Bonferroni corrections.

Table A-8 Ranked list of protected areas (n = 156) by number of campesino hunting studies (n = 126) with official English designations, IUCN management categories, study contexts (see Table A-7 for context identifiers) and countries (see Table A-3 for country codes). Designations and IUCN categories[a] were abbreviated as follows: biological reserves (BRV), Biosphere reserves (BIO), communal reserves (COR), ecological conservation zones (ECZ), ecological reserves (ECO), forest reserves (FRV), integrated management regional districts (IMR), marine national park (MNP), national parks (NPA), national reserves (NRV), national sanctuaries (NSA), natural monuments (NMO), natural parks (NTK), natural national parks (NNP), private conservation areas (PCA), protection forests (PFO), provincial nature park and natural forest reserves (PNF), provincial reserves (PRV), Ramsar sites (RAM), regional conservation areas (RCA), restricted zones (RZO), state parks (SPA), state reserves (SRV), UNESCO-MAB Biosphere Reserves (MAB), UNESCO World Heritage Sites (WHS), wildlife refuges (WRG), Not Applicable (NA), and Not Reported (NR).

	Protected area	Designation	IUCN category	Context(s)	Country	Studies
1	Pacaya-Samiria National Reserve	NRV	VI	1, 2, 4, 5, 7, 9, 14, 15, 25, 29	PER	25
2	Tamshiyacu-Tahauyo Communal Reserve	RCA	NR	1, 2, 4, 5, 7, 9, 14, 15, 29	PER	15
3	Calakmul Biosphere Reserve	BIO	VI	1, 2, 20	MEX	7
4	Montes Azules Biosphere Reserve	MAB	NA	1, 3, 6, 10	MEX	7
5	Los Petenes Biosphere Reserve	BIO	VI	2, 19, 20	MEX	6
6	Copo National Park	NPA	II	1, 5	ARG	3
7	Maya Biosphere Reserve	MAB	VI	1, 2, 7	GTM	3
8	Mbaracayu Biosphere Reserve	MAB	NR	5, 9	PRY	3
9	Abra Patricia-Alto Nieva Private Conservation Area	PCA	NR	1, 22	PER	2
10	Allpahuayo-Mishana National Reserve	NRV	VI	2, 4	PER	2

11	Alto Huayllabamba Conservation Concession	NR	NR	1	PER	2
12	Alto Mayo Protect Forest	PFO	VI	1, 22	PER	2
13	Beni Biosphere Reserve	BIO	NR	1, 2	BOL	2
14	Berlin Private Conservation Area	PCA	NR	10	PER	2
15	Copallin Private Conservation Area	PCA	NR	2	PER	2
16	Delta Conservation Concession	NR	NR	11	PER	2
17	La Amistad Biosphere Reserve	MAB	NA	2, 3	CRI , PAN	2
18	La Macarena Natural National Park	NNP	II	9	COL	2
19	La Pampa del Burro Private Conservation Area	PCA	NR	2	PER	2
20	Rio Nieva Reserved Zone	RZO	NR	2, 9	PER	2
21	Sian Ka'an Biosphere Reserve	BIO	Ia	2	MEX	2
22	Sierra de Huautla Biosphere Reserve	BIO	VI	1, 2	MEX	2
23	Sierra de Manantlán Biosphere Reserve	BIO	Ia	3, 16	MEX	2
24	Sierra de Montenegro State Reserve	SRV	NR	6	MEX	2
25	Sierra de Tabasco State Park	ECO	NR	1, 2	MEX	2
26	Sierra Nevada National Park	NPA	II	2, 23	VEN	2
27	Tambopata-Candamo Reserve Zone	NRV	VI	1, 2	PER	2
28	Tepozteco National Park	NPA	II	13, 30	MEX	2
29	Yasuní National Park	NPA	NR	12	ECU	2
30	Aborigen Reserve	NR	NR	22	ARG	1
31	Abra Patricia-Alto Nieva Conservation Concession	NR	NR	22	PER	1
32	Alta Cima Campesino Reserve	NR	NR	1	MEX	1
33	Arrau Turtle Wildlife Refuge	NR	NR	3	VEN	1
34	Ayapel Wetlands Complex	IMR	VI	2	COL	1
35	Bamba Natural Water and Recreation Reserve	NR	NR	2	ARG	1
36	Barro Colorado Island Forest Reserve	NMO	III	1, 22	PAN	1
37	Bonampak Natural Monument	NMO	III	2	MEX	1
38	Bosque el Quinillal Conservation Concession	NR	NR	22	PER	1
39	Bosques de Pailayco Cuñumbuza Conservation Concession	NR	NR	22	PER	1
40	Cerro del Muerto Natural Monument	NMO	NR	3	MEX	1
41	Cerro Hoya National Park	NPA	II	17	PAN	1
42	Chancaní Provincial National Park and Forestry Reserve	PNF	VI	10	ARG	1
43	Chankín Communal Reserve	NR	NR	1, 22	MEX	1
44	Civil Society Natural Reserve 1	NR	NR	12	COL	1
45	Civil Society Natural Reserve 2	NR	NR	12	COL	1
46	Civil Society Natural Reserve 3	NR	NR	12	COL	1
47	Corcovado National Park	NPA	II	5	CRI	1

48	Cordillera Azul National Park	NPA	II	22	PER	1
49	Cordillera de Colán National Sanctuary	NSA	III	1	PER	1
50	Cordillera Escalera Regional Conservation Area	RCA	NR	1	PER	1
51	Corosha Private Conservation Area	NR	NR	3	PER	1
52	Darien National Park	WHS	NA	1, 22	PAN	1
53	Ejido Xbonil Forest Reserve	NR	NR	2	MEX	1
54	El Breo Conservation Concession	NR	NR	22	PER	1
55	El Caura Forestry Reserve	FRV	VI	2	VEN	1
56	El Cielo Biosphere Reserve	MAB	NA	2	MEX	1
57	El Gran Simacache Conservation Concession	NR	NR	22	PER	1
58	El Guácharo National Park	NPA	II	2	VEN	1
59	El Limón de Cuauchichinola Management Unit for Conservation and Sustainable Use of Wildlife (UMA)	NR	NR	9	MEX	1
60	El Tamá National Park	NPA	II	2	VEN	1
61	El Triunfo Biosphere Reserve	BIO	Ia	1	MEX	1
62	Gira-Sisa Conservation Concession	NR	NR	2	PER	1
63	Golfo Dulce Forest Reserve	FRV	VI	2	CRI	1
64	Guatopo National Park	NPA	II	2	VEN	1
65	Henri Pittier National Park	NPA	NR	2	VEN	1
66	Hierba Buena-Allpayacu Private Conservation Area	PCA	NR	22	PER	1
67	Huaylla Belen-Colcomar Private Conservation Area	NR	NR	22	PER	1
68	Huicungal Conservation Concession	NR	NR	22	PER	1
69	Huiquilla Private Conservation Area	PCA	NR	22	PER	1
70	Ik Balam UMA	NR	NR	9	MEX	1
71	Indio-Maíz Biological Reserve	BRV	NR	5	NIC	1
72	Isla Bastimentos National Marine Park	MNP	II	2	PAN	1
73	Juan Guerra Conservation Concession	NR	NR	22	PER	1
74	Juningue Private Conservation Area	PCA	NR	22	PER	1
75	Kopal Urku Private Conservation Area	NR	NR	22	PER	1
76	La Cangreja National Park	NPA	NR	2	CRI	1
77	La Encrucijada Biosphere Reserve	BIO	Ia	22	MEX	1
78	La Rancherita Communal Natural Reserve	NR	NR	1	ARG	1
79	La Sepultura Biosphere Reserve	BIO	Ia	10	MEX	1
80	Lacantún Biosphere Reserve	NR	NR	1	MEX	1
81	Laguna Blanca Reserve	MAB	NA	7	ARG	1
82	Laguna de Pozuelos Biosphere Reserve	MAB	NA	2	ARG	1
83	Lagunas de Chacahua National Park	NPA	II	2	MEX	1

84	Lamas Conservation Concession	NR	NR	22	PER	1
85	Las Flores UMA	NR	NR	9	MEX	1
86	Las Lagunas de Zempoala National Park	NPA	II	2	MEX	1
87	Las Orquídeas Natural National Park	NNP	II	5	COL	1
88	Loro Hablador Provincial Reserve	PRV	IV	2	ARG	1
89	Los Chilchos Private Conservation Area	PCA	NR	22	PER	1
90	Los Jaguares UMA	NR	NR	9	MEX	1
91	Los Nevados National Park	NNP	II	3	COL	1
92	Los Queules National Reserve	NRV	IV	25	CHL	1
93	Manu National Park	NPA	II	10	PER	1
94	Martin Sagrado Conservation Concession	NR	NR	22	PER	1
95	Metzabok Communal Reserve	RAM	NR	10	MEX	1
96	Milpuj-La Heredad Private Conservation Area	PCA	NR	22	PER	1
97	Monte Cristo Conservation Concession	NR	NR	22	PER	1
98	Municipal Protected Area 1	NR	NR	12	COL	1
99	Municipal Protected Area 2	NR	NR	12	COL	1
100	Municipal Protected Area 3	NR	NR	12	COL	1
101	Municipal Protected Area 4	NR	NR	1	COL	1
102	Nahá Communal Reserve	RAM	NR	1	MEX	1
103	Nawta Kashuyuc Private Conservation Area	NR	NR	22	PER	1
104	Nuevo Becal UMA	NR	NR	9	MEX	1
105	Ocol Private Conservation Area	NR	NR	1	PER	1
106	Ojos de Agua Conservation Concession	NR	NR	22	PER	1
107	Pachiza Conservation Concessions	NR	NR	19	PER	1
108	Palenque National Park	NPA	II	25	MEX	1
109	Palm Forest Taulia Molinopampa Private Conservation Area	PCA	NR	22	PER	1
110	Panguana Biological Field Station	PCA	NR	1	PER	1
111	Paraiso de Yurilamas Conservation Concession	NR	NR	22	PER	1
112	Paramillo Natural National Park	NNP	II	9	COL	1
113	Paujil Conservation Concession	NR	NR	2	PER	1
114	Península de Paria National Park	NPA	II	5	VEN	1
115	Porvenir-Pelejo Conservation Concession	NR	NR	22	PER	1
116	Pucacuro Communal Reserve	NRV	VI	1	PER	1
117	Pucunucho Private Conservation Area	PCA	NR	2	PER	1
118	Pukawicsa Private Conservation Area	NR	NR	22	PER	1
119	Quebrada de Condorito National Park	NPA	II	2	ARG	1

120	Reserva Itzamná UMA	NR	NR	9	MEX	1
121	Ría Celestún Biosphere Reserve	MAB	NA	2	MEX	1
122	Rio Escalante-Chacocente Wildlife Reserve	WRG	IV	1	NIC	1
123	Sacha Runa Conservation Concession	NR	NR	22	PER	1
124	Salinas y Aguada Blanca National Reserve	NRV	VI	2	PER	1
125	San Antonio Private Conservation Area	PCA	NR	22	PER	1
126	San Esteban National Park	NPA	II	3	VEN	1
127	San Guillermo Biosphere Reserve	MAB	NA	1	ARG	1
128	San Matías-San Carlos Protection Forest	PFO	VI	2	PER	1
129	Shitariyacu Conservation Concession	NR	NR	22	PER	1
130	Shunte Regional Conservation Area	NR	NR	6	PER	1
131	Sierra de Agalta National Park	NPA	II	1	HND	1
132	Sierra de la Culata National Park	NPA	II	7	VEN	1
133	Sierra de Lacandón National Park	NPA	NR	2	GTM	1
134	Sierra de Nanchititla National Reserve	NTK	NR	1	MEX	1
135	Sierra de Villa Alta Important Bird Conservation Area	NR	NR	2	MEX	1
136	Sierra Fría Ecological Conservation Zone	ECZ	NR	1	MEX	1
137	Simacache Private Conservation Area	NR	NR	2	PER	1
138	Sun Angel's Gardens Conservation Concession	NR	NR	22	PER	1
139	Tambo Ilusión Private Conservation Area	PCA	NR	22	PER	1
140	Terepaima National Park	NPA	II	2	VEN	1
141	Territorio Ancestral Kichwa Nuevo Barranquita-Ishichiwi Conservation Concession	NR	NR	22	PER	1
142	Tilacancha Private Conservation Area	PCA	NR	22	PER	1
143	Tres Quebradas Conservation Concession	NR	NR	22	PER	1
144	Usumacinta Canyon Flora and Fauna Protected Area	SPA	NR	2	MEX	1
145	Uulumul Keej UMA	NR	NR	9	MEX	1
146	Valle del Biavo Conservation Concession	NR	NR	22	PER	1
147	WAHA Conservation Concession	NR	NR	22	PER	1
148	Yacambú National Park	NPA	II	1	VEN	1
149	Yacu Kawsanapa Conservation Concession	NR	NR	22	PER	1
150	Yambrasbamba Private Conservation Area	NR	NR	2	PER	1
151	Yanesha Communal Reserve	COR	VI	10	PER	1

152	Yaxchilán Natural Monument	NMO	III	2	MEX	1
153	Zapatero Conservation Concession	NR	NR	22	PER	1
154	Zona Sujeta a Conservación Ecológica Humedales La Libertad	RAM	NR	2	MEX	1
155	Zona Sujeta a Conservación Ecológica Sistema Lagunar Catazajá	RAM	NR	22	MEX	1
156	Pampa Galeras National Reserve	NRV	VI	1	PER	1

[a]Designations and management categories were cross-referenced with the World database on protected areas (IUCN & UNEP 2018).

Table A-9 Chi-square test of standardized residuals on the IUCN protected area management categories associated with campesino hunting publications. Standardized chi-square residuals represent the deviation between the observed and expected values from the chi-square test.

IUCN protected area management categories		**N**	**Standardized χ^2 residual**
Ia:	Strict Nature Reserve	5	-2.81*
II:	National Park	25	0.44
III:	Natural Monument or Feature	4	-2.98*
IV:	Habitat/Species Management Area	3	-3.14*
VI:	Protected area with sustainable use of natural resources	17	-0.86
NA:	Not applicable	8	-2.32
NA:	Not reported	94	11.67**

*p < 0.007, **p < 0.0018. Adjusted p values were used to account for multiple comparisons using Bonferroni corrections.

Table A-10 Chi-square test of standardized residuals on the number of protected areas per context in which campesino hunting publications were carried out. Standardized chi-square residuals represent the deviation between the observed and expected values from the chi-square test.

Study contexts in or near protected areas		**N**	**Standardized χ^2 residual**
1	Conservation and management of taxonomic group(s)	34	8.81**
2	Conservation and management in PAs	48	13.68**
3	Human-wildlife relationships	8	-0.23
4	Livelihoods	3	-1.96
5	Sustainable hunting and management	8	-0.23
6	Subsistence hunting	3	-1.96
7	Globalization/modernization/colonization/market integration	5	-1.27
9	Conservation and management strategies/plans	13	1.51
10	Conservation and management in specific ecosystems	7	-0.57
11	Wildlife management	1	-2.66
12	Local and traditional knowledge	7	-0.57
13	Bushmeat consumption/trade	1	-2.66
14	CBC and management	2	-2.31
15	Conservation and development	2	-2.31
16	Biodiversity and food security	1	-2.66

17	Ecosystem services	1	-2.66
19	Hunting traditions	2	-2.31
20	Conflict	2	-2.31
22	Conservation program assessments	44	12.29**
23	Home gardens	1	-2.66
25	Natural history	3	-1.96
29	Gender in conservation	2	-2.31
30	REDD+	1	-2.66

*$p < 0.0023$; **$p < 0.00076$. Adjusted p values were used to account for multiple comparisons using Bonferroni corrections.

Table A-11 Summary of the 75 Indigenous groups in 124[a] campesino hunting articles from 1937-2018 ranked by number of studies per group.

Category 1 (*n* = 45)				Category 2 (*n* = 22)		Category 3 (*n* = 5)		Category 4 (*n* = 3)	
Groups	Studies	Groups	Studies	Groups	Studies	Groups	Studies	Groups	Studies
Ayoreos	1	Piaroa	1	Aguaruna	2	Shipibo-Conibo	5	Cocama-Cocamilla	12
Bora	1	Pilagá	1	Chimane	2	Zapotec[a]	5	"Indigenous"[a, c]	21
Bribri	1	Rama	1	Emberá-Wounaan	2	Yagua	6	Maya[a,d]	37
Cabécares	1	Sáliva	1	Garifuna	2	Quechua[b]	8		
Chinanteca	1	Sanema	1	Huambisa	2	Ngöbe-Buglé	8		
Chiriguanos	1	Secoya	1	Miskito	2				
Chorotes	1	Shipibo-Shinto	1	Nahua[a]	2				
Cofán	1	Shiwiar	1	Pemón	2				
Curripaco	1	Shuar-Achuar	1	Tapieté	2				
Ese'Eja	1	Shuar-Kichwa	1	Tobas	2				
Hiwi	1	Sikuani	1	Waorani	2				
Hoti	1	Siona	1	Yuquí	2				
Lengua	1	Sirionó	1	Yuracare	2				
Lules	1	Toba-Pilagá	1	Aché	3				
Matacos	1	Tojolobal	1	Ashéninkas	3				
Mixe	1	Totonac	1	Guaraní[a]	3				
Mixteca	1	Trinitario	1	Shuar	3				
Mojenos	1	Tsimané	1	Yekuana	3				
Murui	1	Vilelas	1	Yoreme	3				
Nasos	1	Warao	1	Huitoto	4				
Nivaclé	1	Yanesha	1	Ticuna	4				
Otomi	1	Zoque	1	Wichí	4				
Peba	1								

[a] Twenty four studies described study samples as indigenous campesinos such as Mayan peasant-hunters. Those groups are denoted in the table.
[b]Includes regional and ethnic variations of the name such as Quechua Lemista, Quichua, and Kichwa
[c]Denotes unnamed ethnic groups described as one of the following: "Amerindian", "Indian", "Indigenous", or "acculturated Indigenous group"

[d]Includes Mayan groups without (23) and with ethnonyms and ethnolinguistic markers of Lacandón (7), Tzeltal (6), Yucatec (4), Chol (3), and Guatemalan (1). The study count is the absolute number of studies with these groups because multiple Mayan groups were compared in several studies (e.g., Naranjo et al. 2004a).

Table A-12 Chi-square test of standardized residuals on the methods used to understand and document campesino hunters and hunting. Standardized chi-square residuals represent the deviation between the observed and expected values from the chi-square test.

Methods	**N**	**Standardized χ^2 residual**
Interviews	225[a]	27.19**
General interview/informal conversation	83	n/a
Semi-structured	76	n/a
Structured/directed/formal	35	n/a
Unstructured/open/life history/in-depth	29	n/a
Systematic	2	n/a
Surveys and questionnaires	74[a]	4.15**
General uncategorized survey	39	n/a
Household socioeconomic/dietary surveys	26	n/a
Market surveys/visits	11	n/a
Participant observation	63	2.47
Transects and biodiversity/vegetation surveys	53	0.94
Hunting/hunter registries/checkpoints/camp visits	31	-2.42
Direct observations of hunters/hunting	28	-2.87
Workshops	28	-2.87
Reviews/overviews/case studies/archival records	22	-3.79*
Participatory mapping	14	-5.01**
Focus groups	10	-5.62**
Visual methods (e.g., camera traps, photo essay)	8	-5.93**
Spatial/economic/population models	6	-6.23**

[a]Total numbers of studies drawing data from interviews and surveys are absolute values given that 3 used multiple survey types, 40 used multiple interview types, and 265 used combinations of surveys and interviews.
*$p < 0.0042$; **$p < 0.0006$. Adjusted p values were used to account for multiple comparisons using Bonferroni corrections.

Table A-13 Chi-square test of standardize residuals on the number of publications identifying drivers and constraints of campesino hunting. Standardized chi-square residuals represent the deviation between the observed and expected values from the chi-square test

Hunting drivers and constraints	**N**	**Standardized χ^2 residual**
Drivers	195	14.09**
Constraints	9	-9.41**
Both	103	2.46
None	27	-7.14**

*$p < 0.0125$; **$p < 0.0042$. Adjusted p values were used to account for multiple comparisons using Bonferroni corrections.

Table A-14 Chi-square test of standardize residuals on the types of environmental conflicts associated with campesino hunting. Standardized chi-square residuals represent the deviation between the observed and expected values from the chi-square test.

Types of conflicts	N	Standardized χ^2 residual
Protection of crops, livestock, and people against predators	76	19.72**
Conflicts with scientific, managerial, and legal entities	14	0.85
Social norms	7	-1.28
Conflict with external or foreign hunters	4	-2.19
Trespassing on others' land	4	-2.19
Outcompete other hunters and/or predators	2	-2.80
Low incentives to not hunt	2	-2.80
Hunting economically important species	1	-3.10*
Cosmological belief	1	-3.10*
Community regulations	1	-3.10*

*p < 0.005; **p < 0.00125. Adjusted p values were used to account for multiple comparisons using Bonferroni corrections.

Table A-15 Chi-square test of standardize residuals on local and traditional knowledge (LTK) themes from 178 campesino hunting publications. Standardized chi-square residuals represent the deviation between the observed and expected values from the chi-square test.

Local and Traditional Knowledge (LTK) themes	N	Standardized χ^2 residual
Wildlife population sizes, distributions, and trends	67	6.70**
Medicinal uses of hunted wildlife	62	5.76**
Cosmological/religious beliefs, practices, and hunting taboos	52	3.88*
Species identifications and local taxonomies	39	1.43
Wildlife habitat preferences and uses	33	0.30
Hunting techniques and tools	20	-2.14
Species feeding ecology	17	-2.71
Species movement ecology	8	-4.40**
Species breeding biology and reproductive potential	8	-4.40**
General unspecified LTK (e.g., intergenerational knowledge transfer)	8	-4.40**

*p < 0.005; **p < 0.00083. Adjusted p values were used to account for multiple comparisons using Bonferroni corrections.

Table A-16 List of mammals hunted by campesinos from 234 studies published from 1945-2018. IUCN statuses are least concern (LC), lower risk/least concern (LR/LC), lower risk/conservation dependent (LR/CD), lower risk/near threatened (LR/NT), near threatened (NT), vulnerable (VU), endangered (EN), critically endangered (CD), extinct in the wild (EW), data deficient (DD), and not evaluated (NE).

Hunted taxa[a]	**Species**[a]	**IUCN status**	**Study years**	**Study countries**	**Total studies**
***Mammals* (10 orders, 207 species)**					
Cetartiodactyla (21)					
Collared peccary[b] 3	*Pecari tajacu*	LC	1966–2018	14	137
White-lipped peccary[b]	*Tayassu pecari*	VU	1966–2018	12	86
Red brocket deer	*Mazama americana*	DD	1966–2018	9	76
White-tailed deer	*Odocoileus virginianus*	LC	1986–2018	7	75
Grey brocket deer	*Mazama gouazoubira*	LC	1988–2018	6	26
Vicuña[b]	*Vicugna vicugna*	LC	1957–2015	4	9
Chacoan peccary	*Catagonus wagneri*	EN	1999–2013	1	7
Yucatán brown brocket deer	*Mazama pandora*	VU	2000–2014	2	6
Central American red brocket deer	*Mazama temama*	DD	2010–2016	1	6
Mule deer	*Odocoileus hemionus*	LC	1986–2016	1	3
Dwarf red brocket	*Mazama rufina*	VU	1996–2014	2	3
Northern pudu	*Pudu mephistophiles*	VU	2012–2014	2	2
Guanaco	*Lama guanicoe*	LC	2012–2015	1	2
Pronghorn	*Antilocapra americana*	LC	1986	1	1
Barbary sheep[c]	*Ammotragus lervia*	VU	1986	1	1
Páramo deer	*Odocoileus lasiotis*	NE	2004	1	1
Amazon river dolphin	*Inia geoffrensis*	DD	2010	1	1
Taruca	*Hippocamelus antisensis*	VU	2012	1	1
Amazonian brown brocket deer	*Mazama nemorivaga*	LC	2015	1	1
Wild boar[c]	*Sus scrofa*	LC	2016	1	1
Coues' white-tailed deer	*Odocoileus virginianus cariacou*	LC	2017	1	1
Perissodactyla (3)					
Lowland tapir[b]	*Tapirus terrestris*	VU	1961–2018	8	51
Baird's tapir[b]	*Tapirus bairdii*	EN	1991–2015	5	26

Mountain tapir	*Tapirus pinchaque*	EN	2002	1	1
Rodentia (55)					
Paca[b]	*Cuniculus paca*	LC	1966–2018	13	117
Central American agouti	*Dasyprocta punctata*	LC	1986–2017	9	40
Capybara[b]	*Hydrochoerus hydrochaeris*	LC	1966–2018	7	39
Black agouti	*Dasyprocta fuliginosa*	LC	1994–2018	4	24
Mexican gray squirrel	*Sciurus aureogaster*	LC	1990–2017	1	17
Green acouchy	*Myoprocta pratti*	LC	1989–2017	1	11
Red-tailed squirrel	*Sciurus granatensis*	LC	1990–2017	3	11
Mexican hairy dwarf porcupine	*Coendou mexicanus*	LC	2004–2016	1	9
Hispid pocket gopher	*Orthogeomys hispidus*	LC	1995–2016	1	9
Mountain paca	*Cuniculus taczanowksii*	NT	1996–2015	3	7
Rock squirrel	*Otospermophilus variegatus*	LC	1986–2016	1	7
Bicolor-spined porcupine	*Coendou bicolor*	LC	1989–2017	2	7
Red-rumped agouti	*Dasyprocta leporina*	LC	1990–2013	1	7
Mexican agouti	*Dasyprocta mexicana*	CE	2007–2017	1	6
Brazilian porcupine	*Coendou prehensilis*	LC	1990–2010	3	5
Pacarana	*Dinomys branickii*	LC	2003–2017	2	5
Plains vizcacha	*Lagostomus maximus*	LC	1999–2018	1	5
Chacoan mara (cavy)	*Dolichotis salinicola*	LC	1999–2018	1	5
Brown agouti	*Dasyprocta variegata*	DD	1966–2003	1	4
Deppe's squirrel	*Sciurus deppei*	LC	2007–2013	1	4
Lesser capybara	*Hydrochoeris isthmius*	DD	2014–2017	1	4
Southern mountain vizcacha	*Lagidium viscacia*	LC	1977–2012	2	2
Azara's agouti	*Dasyprocta azarae*	DD	1997–2006	1	2
Lesser tropical ground squirrel	*Notocitellus adocetus*	LC	1999–2018	1	2
Yucatan squirrel	*Sciurus yucatanensis*	LC	2008–2016	1	2
Sonoran woodrat	*Neotoma phenax*	NT	2013–2016	1	2
Giant pocket gopher	*Orthogeomys grandis*	LC	2013–2015	1	2
Mexican ground squirrel	*Ictidomys mexicanus*	LC	2011	1	1
Ring-tailed ground squirrel	*Notocitellus annulatus*	LC	1990	1	1

Spotted ground squirrel	*Xerospermophilus spilosoma*	LC	1986	1	1
Collie's squirrel	*Sciurus colliaei*	LC	1990	1	1
Northern Amazon red squirrel	*Sciurus igniventris*	LC	2007	1	1
Mexican fox squirrel	*Sciurus nayaritensis*	LC	2016	1	1
Andean squirrel	*Sciurus pucheranii*	DD	2012	1	1
Southern Amazon red squirrel	*Sciurus spadiceus*	LC	1995	1	1
White-throated woodrat	*Neotoma albigula*	LC	1986	1	1
White-toothed woodrat	*Neotoma leucodon*	LC	2016	1	1
Hispid cotton rat	*Sigmodon hispidus*	LC	1986	1	1
Llano pocket gopher	*Cratogeomys gymnurus*	NE	1990	1	1
Buller's pocket gopher	*Pappogeomys bulleri*	LC	1990	1	1
Marsh rat	*Holochilus sciureus*	LC	1985	1	1
Brown hairy dward porcupine	*Coendou vestitus*	DD	1996	1	1
Desmarest's spiny pocket mouse	*Heteromys desmarestianus*	LC	2008	1	1
Peter's climbing rat	*Tylomys nudicaudus*	LC	2008	1	1
Patagonian mara (cavy)	*Dolichotis patagonum*	NT	2017	1	1
Common yellow-toothed cavy	*Galea musteloides*	DD	2016	1	1
Montane guinea pig	*Cavia tschudii*	LC	1968	1	1
Haullaga spiny rat	*Proechimys brevicauda*	LC	1989	1	1
Tome's spiny rat	*Proechimys semispinosus*	LC	1995	1	1
Richmond's squirrel	*Sciurus richmondi*	LC	1995	1	1
Armored rat	*Hoplomys gymnurus*	LC	1995	1	1
Trinidad spiny rat	*Proechimys trinitatis*	DD	1996	1	1
Guaira spiny rat	*Proechimys guairae*	LC	1990	1	1
House rat	*Rattus rattus*	LC	2016	1	1
Coypu	*Myocastor coypus*	LC	2016	1	1
Cingulata (13)					
Nine-banded armadillo	*Dasypus novemcinctus*	LC	1966–2018	10	94
Giant armadillo	*Priodontes maximus*	VU	1990–2017	5	11
Northern naked-tailed armadillo	*Cabassous centralis*	DD	2004–2016	2	7
Southern naked-tailed armadillo	*Cabassous unicinctus*	LC	1990–2017	3	4

Six-banded (Yellow) armadillo	*Euphractus sexcinctus*	LC	1997–2018	2	5
Large hairy armadillo	*Chaetophractus villosus*	LC	1999–2018	1	5
Screaming (Small) hairy armadillo	*Chaetophractus vellerosus*	LC	1999–2018	1	5
Three-banded armadillo	*Tolypeutes matacus*	NT	1999–2018	1	4
Chacoan naked-tailed armadillo	*Cabassous chacoensis*	NT	1999–2018	1	4
Seven-banded armadillo	*Dasypus septemcinctus*	LC	1997–2018	2	3
Greater long-nosed armadillo	*Dasypus kappleri*	LC	1994	1	1
Greater naked-tailed armadillo	*Cabassous tatouay*	LC	1997	1	1
Hairy long-nosed armadillo	*Dasypus pilosus*	DD	2012	1	1
Pilosa (8)					
Giant anteater	*Myrmecophaga tridactyla*	VU	1990–2017	5	18
Southern tamandua	*Tamandua tetradactyla*	LC	1976–2018	2	14
Northern tamandua	*Tamandua mexicana*	LC	1999–2017	3	14
Three-toed sloth	*Bradypus variegatus*	LC	1994–2008	4	9
Hoffmann's two-toed sloth	*Choloepus hoffmanni*	LC	1996–2012	3	4
Pygmy anteater	*Cyclopes didactylus*	LC	1998–2015	2	2
Pale-throated three-toed sloth	*Bradypus tridactylus*	LC	1989–1995	1	2
Linné's two-toed sloth	*Choloepus didactylus*	LC	2012	1	1
Carnivora (42)					
White-nosed coati	*Nasua narica*	LC	1990–2018	5	55
Jaguar	*Panthera onca*	NT	1945–2018	10	48
Puma	*Puma concolor*	LC	1945–2018	6	46
Northern raccoon	*Procyon lotor*	LC	1986–2018	2	36
Ocelot	*Leopardus pardalis*	LC	1966–2017	6	33
Kinkajou	*Potos flavus*	LC	1990–2017	5	29
Margay	*Leopardus wiedii*	NT	1990–2018	6	27
Jaguarundi	*Herpailurus yagouaroundi*	LC	1966–2018	5	22
South American coati	*Nasua nasua*	LC	1966–2017	4	20
Neotropical river otter	*Lontra longicaudis*	NT	1966–2017	4	20
Gray fox	*Urocyon cinereoargenteus*	LC	1986–2018	2	20
Tayra	*Eira barbara*	LC	1966–2017	3	19

Coyote	*Canis latrans*	LC	1986–2018	1	15
Hooded skunk	*Mephitis macroura*	LC	1986–2018	1	15
Crab-eating fox	*Cerdocyon thous*	LC	1993–2016	3	11
American hog-nosed skunk	*Conepatus leuconotus*	LC	1986–2018	1	9
Bobcat	*Lynx rufus*	LC	1986–2018	1	9
Striped hog-nosed skunk	*Conepatus semistriatus*	LC	1966–2017	2	7
Ringtail	*Bassariscus astutus*	LC	1986–2018	1	6
Andean bear	*Tremarctos ornatus*	VU	1966–2014	2	6
Crab-eating raccoon	*Procyon cancrivorus*	LC	1996–2018	4	6
Long-tailed weasel	*Mustela frenata*	LC	1986–2015	2	5
Giant otter	*Pteronura brasiliensis*	EN	1967–2012	2	4
Eastern spotted skunk	*Spilogale putorius*	VU	1986–1999	1	4
Molina's hog-noses skunk	*Conepatus chinga*	LC	1999–2016	1	4
Northern tiger cat	*Leopardus tigrinus*	VU	2004–2015	1	4
Geoffrey's cat	*Leopardus geoffroyi*	LC	1999–2018	1	4
Culpeo	*Lycalopex culpaeus*	LC	1985-1999	2	3
America badger	*Taxidea taxus*	LC	1986–2016	1	3
Pampas fox	*Lycalopex gymnocercus*	LC	2016-2017	1	3
Argentine gray fox	*Lycalopex griseus*	LC	1985–2014	2	2
Bush dog	*Speothos venaticus*	NT	1992–2018	2	2
Northern olingo	*Bassaricyon gabbii*	LC	1993–2008	2	2
Lesser grison	*Galictis cuja*	LC	1999–2012	1	2
Western mountain coati	*Nasuella olivacea*	NT	2004–2014	1	2
Cacomistle	*Bassariscus sumichrasti*	LC	2008–2010	1	2
Pampas cat	*Leopardus colocolo*	NT	2012–2014	1	2
Western spotted skunk	*Spilogale gracilis*	LC	2012	1	1
Kodkod (Guiña)	*Leopardus guigna*	VU	2014	1	1
Greater grison	*Galictis vittata*	LC	2015	1	1
Pygmy spotted skunk	*Spilogale pygmaea*	VU	2016	1	1
Maned wolf	*Chrysocyon brachyurus*	NT	2016	1	1
Didelphimorphia (9)					

Common opossum	*Didelphis marsupialis*	LC	1986–2017	5	32
Virginia opossum	*Didelphis virginiana*	LC	1990–2018	1	13
White-eared opossum	*Didelphis albiventris*	LC	1999–2016	2	6
Gray four-eyed opossum	*Philander opossum*	LC	1995–2011	3	5
Water opossum (Yapok)	*Chironectes minimus*	LC	2004–2017	3	3
Brown four-eyed opossum	*Metachirus nudicaudatus*	LC	2004–2016	1	2
Brown-eared woolly opossum	*Caluromys lanatus*	LC	2004	1	1
Central American woolly opossum	*Caluromys derbianus*	LC	2011	1	1
Mexican mouse opossum	*Marmosa mexicana*	LC	2015	1	1
Lagomorpha (10)					
Eastern cottontail	*Sylvilagus floridanus*	LC	1986–2017	3	25
Forest rabbit	*Sylvilagus brasiliensis*	LC	1990–2016	6	15
Mexican cottontail	*Sylvilagus cunicularius*	LC	1990–2018	1	8
Desert cottontail	*Sylvilagus audubonii*	LC	1986–2016	1	3
European hare[c]	*Lepus europaeus*	LC	2012–2016	1	3
White-sided jackrabbit	*Lepus callotis*	NT	1986–2018	1	2
Antelope jackrabbit	*Lepus alleni*	LC	2013–2016	1	2
European rabbit[c]	*Oryctolagus cuniculus*	NT	2013	1	2
Black-tailed jackrabbit	*Lepus californicus*	LC	1986	1	1
Volcano rabbit	*Romerolagus diazi*	EN	1999	1	1
Sirenia (2)					
Antillean manatee	*Trichechus manatus manatus*	VU	1961–2012	5	10
Amazonian manatee	*Trichechus inunguis*	VU	1976–2001	2	6
Primates (44)					
Red howler monkey	*Alouatta seniculus* ssp. *Seniculus*	LC	1990–2017	4	30
Geoffrey's spider monkey	*Ateles geoffroyi*	EN	1974–2017	7	23
Woolly monkey[b]	*Lagothrix lagotrica*	VU	1994–2018	4	23
Brown capuchin	*Sapajus apella*	LC	1988–2017	3	17
White-fronted capuchin	*Cebus albifrons*	LC	1994–2017	3	17
Squirrel monkey	*Saimiri sciureus*	LC	1994–1999	2	12
Monk saki monkey	*Pithecia milleri*	DD	1994–2017	1	12

Yucatán Black howler monkey	*Alouatta pigra*	EN	1992–2016	2	11
Saddleback tamarin	*Saguinus fuscicollis*	LC	1982–2017	2	8
Bald-headed uakari	*Cacajao calvus*	VU	1988–2017	1	8
Coppery (red) titi monkey	*Plecturocebus cupreus*	LC	1994–2017	1	8
Black spider monkey[d]	*Ateles paniscus*	VU	1994–2004	1	7
White-faced capuchin	*Cebus capucinus*	NE	1974–2017	4	7
Nancy Ma's night monkey	*Aotus nancymaae*	VU	1994–2004	1	6
Mantled howler monkey	*Alouatta palliata*	LC	1995–2013	4	6
White-bellied spider monkey	*Ateles belzebuth*	EN	1976–2012	2	5
Black-faced black spider monkey	*Ateles chamek*	EN	1976–2017	2	5
Black-chested mustached tamarin	*Saguinus mystax*	LC	1988–2017	1	4
Brown weeper capuchin	*Cebus brunneus* (*C. olivaceus*)	LC	1990–2013	1	4
Yellow-tailed woolly monkey	*Oreonax flavicauda*	CE	2012–2016	1	4
Black-mantled tamarin	*Saguinus nigricollis*	LC	1982–2007	2	3
Pygmy marmoset	*Cebuella pygmaea*	LC	1994–2009	2	3
Poeppig's woolly monkey	*Lagothrix poeppigii*	VU	2007–2012	2	3
Graell's black-mantle tamarin	*Saguinus nigricllis* spp. *graellsi*	NT	1982	2	2
Yellow-handed titi monkey	*Callicebus lucifer*	LC	2007	1	2
Red titi monkey	*Callicebus discolor*	LC	2007–2009	2	2
Colombian night monkey	*Aotus lemurinus*	VU	2011–2012	1	2
Cotton-headed tamarin	*Saguinus oedipus*	CE	2017	1	2
Hairy saki	*Pithecia hirsuta*	NE	1988	1	1
Red-bellied titi monkey	*Plecturocebus moloch*	LC	1988	1	1
Black-headed squirrel monkey	*Saimiri boliviensis*	LC	1997	1	1
Central American squirrel monkey	*Saimiri oerstedii*	VU	2000	1	1
Mexican spider monkey	*Ateles geoffroyi* ssp. *vellerosus*	VU	2007	1	1
Equatorial saki	*Pithecia aequatorialis*	LC	2007	1	1
Golden-mantled saddleback tamarain	*Saguinus tripartitus*	NT	2009	1	1
Varied white-fronted capuchin	*Cebus versicolor*	EN	2012	1	1
San Martin titi monkey	*Plecturocebus oenanthe*	CE	2012	1	1
Andean night monkey	*Aotus miconax*	VU	2012	1	1

Peruvian white-fronted capuchin	*Cebus yuracus*	NE	2013	1	1
Large-headed capuchin	*Sapajus macrocephalus*	LC	2013	1	1
Brown-headed spider monkey	*Ateles fusciceps*	CE	2017	1	1
Golden-backed black uakari	*Cacajao melanocephalus*	VU	2017	1	1
Goeldi's monkey	*Callimico goeldii*	VU	2017	1	1
Black-headed (Peruvian) night monkey	*Aotus nigriceps*	LC	2017	1	1
			1945–2018	**16**	**234**[e]

[a]Common and Latin names and statuses were cross-referenced with current taxonomic and status updates from the IUCN Red List (2018) and the Catalogue of Life (2018).
[b]Total study and country counts for these species were adjusted to account for studies in multiple countries.
[c]Non-native species to the country of capture and their associated study.
[d]Species reported range from IUCN (2018) does not overlap with one or several study locations or countries.
[e]Totals represent the absolute number of countries and studies from which species were documented.

Table A-17 List of birds hunted by campesinos from 103 studies published from 1968-2018. IUCN statuses are least concern (LC), lower risk/least concern (LR/LC), lower risk/conservation dependent (LR/CD), lower risk/near threatened (LR/NT), near threatened (NT), vulnerable (VU), endangered (EN), critically endangered (CD), extinct in the wild (EW), data deficient (DD), and not evaluated (NE).

Hunted taxa[a]	**Species**[a]	**IUCN status**	**Study years**	**Study countries**	**Total studies**
***Birds* (23 orders, 425 species)**					
Galliformes (45)					
Crested guan	*Penelope purpurascens*	LC	1974–2016	6	26
Great curassow	*Crax rubra*	VU	1974–2014	5	19
Ocellated turkey	*Meleagris ocellata*	NT	1991–2016	1	18
Plain chachalaca	*Ortalis vetula*	LC	1991–2017	1	17
Spix's guan	*Penelope jacquacu*	LC	1973–2017	4	16
Speckled chachalaca	*Ortalis guttata*	LC	1995–2018	2	10
Blue-throated piping guan	*Pipile cumanensis*	LC	1973–2015	2	9
Razor-billed curassow	*Mitu tuberosum*	LC	1997–2012	1	9
Common piping guan	*Pipile pipile (Aburria pipile)*	EN	1991–2017	4	8
Crested bobwhite[c]	*Colinus cristatus*	LC	1996–2016	3	7
Northern bobwhite quail	*Colinus virginianus*	NT	1986–2018	1	6

West Mexican chachalaca	*Ortalis poliocephala*	LC	1990–2018	1	6
Alagoas curassow&	*Mitu mitu (Crax mitu)*	EW	1973–2017	1	5
Rufous-vented chachalaca	*Ortalis ruficauda*	LC	1990–2013	1	5
Variable (little) chachalaca	*Ortalis motmot*	LC	1991–2010	3	5
Black curassow	*Crax alector*	VU	1991–2013	2	5
Yellow-knobbed curassow	*Crax daubentoni*	NT	1990–2017	2	4
Banded quail	*Philortyx fasciatus*	LC	1990–2018	1	4
Salvin's curassow	*Mitu salvini*	LC	1997–2012	2	4
Montezuma quail	*Cyrtonyx montezumae*	LC	1999–2016	1	4
Chaco chachalaca	*Ortalis canicollis*	LC	1999–2018	1	4
Chestnut-winged chachalaca	*Ortalis garrula*	LC	2011–2016	1	4
Singing quail	*Dactylortyx thoracicus*	LC	1990–2014	1	3
Long-tailed wood-partridge	*Dendrortyx macroura*	LC	1990–2014	1	3
Helmeted curassow	*Pauxi pauxi*	EN	1991–2004	2	3
Nocturnal curassow	*Nothocrax urumutum*	LC	1997–2004	1	3
Black-throated bobwhite	*Colinus nigrogularis*	LC	1999–2012	1	3
Spotted wood-quail	*Odontophorus guttatus*	LC	2000–2007	1	3
Grey-headed chachalaca	*Ortalis cinereiceps*	LC	2008–2013	2	3
Wattled curassow	*Crax globulosa*	EN	1973–2004	1	2
Scaled quail	*Callipepla squamata*	LC	1986–2016	1	2
Band-tailed guan	*Penelope argyrotis*	LC	1991–1996	1	2
Crestless curassow	*Mitu tomentosum*	NT	1991–2013	1	2
Wattled guan	*Aburria aburri*	NT	1996–2003	2	2
Wild turkey	*Meleagris gallopavo*	LC	2014–2016	1	2
Marail guan	*Penelope marail*	LC	1994	1	1
Venezuelan wood-quail	*Odontophorus columbianus*	NT	1996	1	1
Sickle-winged guan	*Chamaepetes goudotii*	LC	2003	1	1
Marbled wood-quail	*Odontophorus gujanensis*	NT	2004	1	1
Rusy-margined guan	*Penelope superciliaris*	LC	2006	1	1
Gambel's quail	*Callipepla gambelii*	LC	2013	1	1
White-bellied chachalaca	*Ortalis leucogastra*	LC	2015	1	1

Common pheasant	*Phasianus colchicus*	LC	2016	1	1
Baudo guan	*Penelope ortoni*	EN	2017	1	1
Common quail	*Coturnix coturnix*	LC	2018	1	1
Gruiformes (9)					
Grey-necked wood-rail	*Aramides cajanea*	LC	1990–2017	3	7
Limpkin	*Aramus guarauna*	LC	1990–2015	3	3
Pale-winged trumpeter	*Psophia leucoptera*	NT	1998–2004	1	3
American coot	*Fulica americana*	LC	2013–2017	1	2
Grey-winged trumpeter	*Psophia crepitans*	NT	2007–2017	1	2
Andean coot	*Fulica ardesiaca*	LC	1968	1	1
Giant coot	*Fulica gigantea*	LC	1968	1	1
Common gallinule	*Gallinula galeata*	LC	1968	1	1
Rufous-necked wood-rail	*Aramides axillaris*	LC	1990	1	1
Suliformes (3)					
Neotropic cormorant	*Phalacrocorax brasilianus*	LC	1999–2017	4	10
Anhinga	*Anhinga anhinga*	LC	1999–2017	3	7
Double-crested cormorant	*Phalacrocorax auritus*	LC	2013	1	1
Struthioniformes (22)					
Great tinamou	*Tinamus major*	NT	1974–2017	6	12
Undulated tinamou	*Crypturellus undulatus*	LC	1973–2017	1	9
Grey tinamou	*Tinamus tao*	VU	1973–2013	2	5
Eastern thicket tinamou	*Crypturellus cinnamomeus*	LC	1990–2014	1	5
Little tinamou	*Crypturellus soui*	LC	1973–1996	2	3
Brown tinamou	*Crypturellus obsoletus*	LC	1996–2016	2	3
Greater rhea	*Rhea Americana*	NT	1999–2016	1	3
Brushland tinamou	*Nothoprocta cinerascens*	LC	2006–2017	1	3
Red-legged tinamou	*Crypturellus erythropus*	LC	1990–1996	1	2
Cinereous tinamou	*Crypturellus cinereus*	LC	2003–2004	1	2
Lesser rhea	*Rhea pennata*	LC	2012–2015	1	2
Elegant crested tinamou	*Eudromia elegans*	LC	2016–2017	1	2
Highland tinamou	*Nothocercus bonapartei*	LC	1996	1	1

Black tinamou	*Tinamus osgoodi*	VU	1998	1	1
White-throated tinamou	*Tinamus guttatus*	NT	2003	1	1
Boucard's tinamou	*Crypturellus boucardi*	LC	2004	1	1
Quebracho crested tinamou	*Eudromia formosa*	LC	2006	1	1
Tataupa tinamou	*Crypturellus tataupa*	LC	2006	1	1
Puna tinamou	*Tinamotis pentlandii*	LC	2012	1	1
Spotted nothura	*Nothura maculosa*	LC	2016	1	1
Red-winged tinamou	*Rhynchotus rufescens*	LC	2016	1	1
Darwin's nothura	*Nothura darwinii*	LC	2017	1	1
Cariamiformes (1)					
Black-legged seriema	*Chunga burmeisteri*	LC	2006–2017	1	4
Anseriformes (22)					
Muscovy duck	*Cairina moschata*	LC	1974–2018	4	16
Black-bellied whistling duck	*Dendrocygna autumnalis*	LC	2000–2017	3	16
White-faced whistling duck	*Dendrocygna viduata*	LC	2011–2016	1	5
Northern screamer	*Chauna chavaria*	NT	2011–2016	1	4
Blue-winged teal	*Spatula discors*	LC	2000–2017	3	3
Mallard[c]	*Anas platyrhynchos*	LC	2013–2016	1	3
Andean goose	*Chloephaga melanoptera*	LC	1968–2012	2	2
Fulvous whistling duck	*Dendrocygna bicolor*	LC	2000–2017	2	2
Horned screamer	*Anhima cornuta*	LC	2004–2017	1	2
Yellow-billed teal	*Anas flavirostris*	LC	1968	1	1
Yellow-billed pintail	*Anas georgica*	LC	1968	1	1
Ruddy duck	*Oxyura jamaicensis*	LC	1968	1	1
Crested duck	*Lophonetta specularioides*	LC	1968	1	1
Southern screamer	*Chauna torquata*	LC	2002	1	1
Ringed teal	*Callonetta leucophrys*	LC	2006	1	1
Orinoco goose	*Neochen jubata*	NT	2010	1	1
Canada goose	*Branta canadensis*	LC	2013	1	1
Mexican duck	*Anas diazi*	NE	2013	1	1
Coscoroba swan	*Coscoroba coscoroba*	LC	2016	1	1

Northern pintail	*Anas acuta*	LC	2017	1	1
Northern shoveler	*Anas clypeata*	LC	2017	1	1
Redhead	*Aythya americana*	LC	2017	1	1
Accipitriformes (17)					
Roadside hawk	*Rupornis magnirostris*	LC	1998–2017	2	9
Osprey	*Pandion haliaetus*	LC	2011–2016	1	5
Black-collared hawk	*Busarellus nigricollis*	LC	2004–2012	2	4
Bicolored hawk	*Accipiter bicolor*	LC	2008–2012	2	2
Red-tailed hawk	*Buteo jamaicensis*	LC	1986	1	1
Harris's hawk	*Parabuteo unicinctus*	LC	1986	1	1
Black hawk-eagle	*Spizaetus tyrannus*	LC	1995	1	1
Snail kite	*Rostrhamus sociabilis*	LC	2004	1	1
Sharp-shinned hawk	*Accipiter striatus*	LC	2012	1	1
Broad-winged hawk	*Buteo platypterus*	LC	2012	1	1
Black solitary eagle	*Buteogallus solitarius*	NT	2012	1	1
White-tailed kite	*Elanus leucurus*	LC	2012	1	1
Black-chested buzzard-eagle	*Geranoaetus melanoleucus*	LC	2012	1	1
Harpy eagle	*Harpia harpyja*	NT	2012	1	1
Zone-tailed hawk	*Buteo albonotatus*	LC	2014	1	1
Common black hawk	*Buteogallus anthracinus*	LC	2017	1	1
Crane hawk	*Geranospiza caerulescens*	LC	2017	1	1
Falconiformes (7)					
American kestrel	*Falco sparverius*	LC	1986–2017	2	4
Yellow-headed caracara	*Milvago chimachima*	LC	2011–2016	1	4
Southern crested caracara	*Caracara plancus*	LC	1986–2011	2	3
Red-throated caracara	*Ibycter americanus*	LC	1998–2017	1	2
Prairie falcon	*Falco mexicanus*	LC	1986	1	1
Collared forest falcon	*Micrastur semitorquatus*	LC	2004	1	1
Peregrine falcon	*Falco peregrinus*	LC	2012	1	1
Passeriformes (124)					
Blue-gray tanager	*Tangara episcopus*	LC	1998–2017	3	9

Northern mockingbird	*Mimus polyglottos*	LC	1986–2017	1	6
Blue-black grassquit	*Volatinia jacarina*	LC	1999–2017	2	6
Northern cardinal	*Cardinalis cardinalis*	LC	1986–2017	1	5
Blue grosbeak	*Passerina caerulea*	LC	1986–2017	1	5
Lesser goldfinch	*Spinus psaltria*	LC	1986–2017	1	5
Great-tailed grackle	*Quiscalus mexicanus*	LC	2005–2017	2	5
House finch	*Haemorhous mexicanus*	LC	1986–2017	1	4
Baltimore oriole	*Icterus galbula*	LC	1986–2017	1	4
House sparrow[c]	*Passer domesticus*	LC	1986–2017	1	4
Gray silky-flycatcher	*Ptiliogonys cinereus*	LC	1986–2017	1	4
Curve-billed thrasher	*Toxostoma curvirostre*	LC	1986–2017	1	4
American robin	*Turdus migratorius*	LC	1986–2017	1	4
Brown-backed solitaire	*Myadestes occidentalis*	LC	1990–2017	1	4
Saffron finch	*Sicalis flaveola*	LC	2011–2016	1	4
Ruddy-breasted seedeater	*Sporophila minuta*	LC	2011–2016	1	4
Ultramarine jay	*Aphelocoma ultramarina*	LC	1986–1999	1	3
Lark sparrow	*Chondestes grammacus*	LC	1986–1999	1	3
Red-winged blackbird	*Agelaius phoeniceus*	LC	1986–2017	1	3
Cedar waxwing	*Bombycilla cedrorum*	LC	1986–2017	1	3
Pyrrhuloxia	*Cardinalis sinuatus*	LC	1986–2017	1	3
Bronzed cowbird	*Molothrus aeneus*	LC	1986–2017	1	3
Phainopepla	*Phainopepla nitens*	LC	1986–2017	1	3
Black-headed Grosbeak	*Pheucticus melanocephalus*	LC	1986–2017	1	3
Bullock's oriole	*Icterus bullockiorum*	LC	1988–2017	1	3
Crested oropendola	*Psarocolius decumanus*	LC	1990–1998	2	3
Blue mockingbird	*Melanotis caerulescens*	LC	1990–2017	1	3
Scott's oriole	*Icterus parisorum*	LC	1999–2017	1	3
Yellow-backed oriole	*Icterus chrysater*	LC	2004–2016	1	3
Cactus wren	*Campylorhynchus brunneicapillus*	LC	1986–1988	1	2
Hooded oriole	*Icterus cucullatus*	LC	1986–1988	1	2
Black-vented oriole	*Icterus wagleri*	LC	1986–1988	1	2

Canyon towhee	*Melozone fusca*	LC	1986–1988	1	2
Red tanager[c]	*Piranga flava*	LC	1986–1988	1	2
Cassin's kingbird	*Tyrannus vociferans*	LC	1986–1988	1	2
Flame-coloroed tanager	*Piranga bidentata*	LC	1986–1999	1	2
Summer tanager	*Piranga rubra*	LC	1988–1999	1	2
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	LC	1988–2017	1	2
Yellow-rumped cacique	*Cacicus cela*	LC	1990–2017	2	2
Great kiskadee	*Pitangus sulphuratus*	LC	1998–2017	2	2
Lazuli bunting	*Passerina amoena*	LC	1999	1	2
Brown-headed cowbird	*Molothrus ater*	LC	1999–2017	1	2
Indigo bunting	*Passerina cyanea*	LC	1999–2017	1	2
Yellow grosbeak	*Pheucticus chrysopeplus*	LC	1999–2017	1	2
Eastern bluebird	*Sialia sialis*	LC	1999–2017	1	2
Black-headed siskin	*Spinus notatus*	LC	1999–2017	1	2
White-collared seedeater	*Sporophila torqueola*	LC	1999–2017	1	2
Rufous-backed robin	*Turdus rufopalliatus*	LC	1999–2017	1	2
Great thrush	*Turdus fuscater*	LC	2004–2012	1	2
Black-billed thrush	*Turdus ignobilis*	LC	2004–2012	1	2
Green jay	*Cyanocorax yncas*	LC	2004–2017	2	2
Tropical mockingbird	*Mimus gilvus*	LC	2006–2017	2	2
Orchard oriole	*Icterus spurius*	LC	2011–2017	1	2
White-throated magpie-jay	*Cyanocorax formosus*	LC	2013–2017	1	2
Common raven	*Corvus corax*	LC	2014–2017	1	2
Steller's jay	*Cyanocitta stelleri*	LC	2014–2017	1	2
Clay-colored thrush	*Turdus grayi*	LC	2014–2017	1	2
Varied bunting	*Passerina versicolor*	LC	1999–2017	1	2
Slate-colored solitaire	*Myadestes unicolor*	LC	2017	1	2
Painted bunting	*Passerina ciris*	NT	2017	1	2
European starling[c]	*Sturnus vulgaris*	LC	2017	1	2
Chihuahuan raven	*Corvus cryptoleucus*	LC	1986	1	1
Loggerhead shrike	*Lanius ludovicianus*	NT	1986	1	1

Eastern meadowlark	*Sturnella magna*	LC	1986	1	1
Western meadowlark	*Sturnella neglecta*	LC	1986	1	1
Eastern kingbird	*Tyrannus tyrannus*	LC	1988	1	1
Orange-crowned oriole	*Icterus auricapillus*	LC	1990	1	1
Yellow oriole	*Icterus nigrogularis*	LC	1990	1	1
Silver-beaked tanager	*Ramphocelus carbo*	LC	1990	1	1
White-throated thrush	*Turdus assimilis*	LC	1990	1	1
Pale-breasted thrush	*Turdus leucomelas*	LC	1990	1	1
Red-capped cardinal	*Paroaria gularis*	LC	1998	1	1
Rufous-crowned sparrow	*Aimophila ruficeps*	LC	1999	1	1
Florida scrub-jay	*Aphelocoma coerulescens*	VU	1999	1	1
Rufous-capped warbler	*Basileuterus rufifrons*	LC	1999	1	1
Elegant euphonia	*Euphonia elegantissima*	LC	1999	1	1
Omao[c]	*Myadestes obscurus*	VU	1999	1	1
Western bluebird	*Sialia mexicana*	LC	1999	1	1
Pine siskin	*Spinus pinus*	LC	1999	1	1
Oriole blackbird	*Gymnomystax mexicanus*	LC	2004	1	1
House wren	*Troglodytes aedon*	LC	2004	1	1
Lemon-rumped tanager	*Ramphocelus icteronotus*	LC	2006	1	1
Blue bunting	*Cyanocompsa parellina*	LC	2007	1	1
Russet-backed thrush	*Catharus ustulatus*	LC	2012	1	1
Barn swallow	*Hirundo rustica*	LC	2012	1	1
White-browed blackbird	*Leistes superciliaris*	LC	2012	1	1
Patagonian mockingbird	*Mimus patagonicus*	LC	2012	1	1
Andean solitaire	*Myadestes ralloides*	LC	2012	1	1
Chestnut-bellied thrush	*Turdus fulviventris*	LC	2012	1	1
Glossy-black thrush	*Turdus serranus*	LC	2012	1	1
Crimson-collared grosbeak	*Caryothraustes celaeno*	LC	2014	1	1
Rufous-browed peppershrike	*Cyclarhis gujanensis*	LC	2014	1	1
Melodious blackbird	*Dives dives*	LC	2014	1	1
White-throated towhee	*Melozone albicollis*	LC	2014	1	1

Blue seedeater	*Amaurospiza concolor*	LC	2017	1	1
Yellow-billed Cacique	*Amblycercus holosericeus*	LC	2017	1	1
Western scrub-jay	*Aphelocoma californica*	LC	2017	1	1
Chestnut-capped brush-finch	*Arremon brunneinucha*	LC	2017	1	1
Spotted nightingale-thrush	*Catharus dryas*	LC	2017	1	1
Black-headed nightingale-thrush	*Catharus mexicanus*	LC	2017	1	1
Blue-crowned chlorophonia	*Chlorophonia occipitalis*	LC	2017	1	1
Red-legged honeycreeper	*Cyanerpes cyaneus*	LC	2017	1	1
Purplish-backed jay	*Cyanocorax beecheii*	LC	2017	1	1
Black-throated magpie-jay	*Cyanocorax colliei*	LC	2017	1	1
Ultramarine grosbeak	*Cyanoloxia brissonii*	LC	2017	1	1
Gray-crowned yellowthroat	*Geothlypis poliocephala*	LC	2017	1	1
Hooded grosbeak	*Hesperiphona abeillei*	LC	2017	1	1
Evening grosbeak	*Hesperiphona vespertina*	LC	2017	1	1
Altamira oriole	*Icterus gularis*	LC	2017	1	1
Yellow-tailed oriole	*Icterus mesomelas*	LC	2017	1	1
Yellow-eyed junco	*Junco phaeonotus*	LC	2017	1	1
(White-rumped) munia[c]	*Lonchura striata domestica*	LC	2017	1	1
Shiny cowbird	*Molothrus bonariensis*	LC	2017	1	1
Orange-breasted bunting	*Passerina leclancherii*	LC	2017	1	1
Black-backed grosbeak	*Pheucticus aureoventris*	LC	2017	1	1
Common canary[c]	*Serinus canaria*	LC	2017	1	1
American goldfinch	*Spinus tristis*	LC	2017	1	1
Zebra finch[c]	*Taeniopygia guttata*	LC	2017	1	1
Yellow-faced grassquit	*Tiaris olivaceus*	LC	2017	1	1
Crissal thrasher	*Toxostoma crissale*	LC	2017	1	1
Long-billed thrasher	*Toxostoma longirostre*	LC	2017	1	1
Black thrush	*Turdus infuscatus*	LC	2017	1	1
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*	LC	2017	1	1
White-crowned sparrow	*Zonotrichia leucophrys*	LC	2017	1	1
Pelecaniformes (15)					

Cocoi heron	*Ardea cocoi*	LC	1999–2017	2	7
Great blue heron	*Ardea herodias*	LC	2011–2013	2	4
Rufescent tiger heron	*Tigrisoma lineatum*	LC	2003–2017	1	3
Boat-billed heron	*Cochlearius cochlearius*	LC	1998–2004	1	2
Great white egret	*Ardea alba*	LC	2004–2017	2	2
Snowy egret	*Egretta thula*	LC	2007–2017	2	2
Puna ibis	*Plegadis ridgwayi*	LC	1968	1	1
Fasciated tiger heron	*Tigrisoma fasciatum*	LC	2003	1	1
Agami heron	*Agamia agami*	VU	2004	1	1
Green-backed heron	*Butorides striata*	LC	2004	1	1
Green heron	*Mesembrinibis cayennensis*	LC	2004	1	1
American white pelican	*Pelecanus erythrorhynchos*	LC	2017	1	1
Glossy ibis	*Plegadis falcinellus*	LC	2017	1	1
Brown pelican	*Pelecanus occidentalis*	LC	2017	1	1
Bare-throated tiger heron	*Tigrisoma mexicanum*	LC	2017	1	1
Podicipediformes (1)					
Least grebe	*Tachybaptus dominicus*	LC	2017	1	1
Caprimulgiformes (20)					
Speckled hummingbird	*Adelomyia melanogenys*	LC	2012	1	1
Long-tailed syph	*Aglaiocercus kingii*	LC	2012	1	1
Indigo-capped hummingbird	*Amazilia cyanifrons*	LC	2012	1	1
Andean emerald	*Amazilia franciae*	LC	2012	1	1
Rufous-tailed hummingbird	*Amazilia tzacatl*	LC	2012	1	1
Black-throated mango	*Anthracothorax nigricollis*	LC	2012	1	1
Buff-tailed coronet	*Boissonneaua flavescens*	LC	2012	1	1
Gorgeted woodstar	*Chaetocercus heliodor*	LC	2012	1	1
Short-tailed emerald	*Chlorostilbon poortmani*	LC	2012	1	1
Bronzy inca	*Coeligena coeligena*	LC	2012	1	1
Collared inca	*Coeligena torquata*	LC	2012	1	1
Sparkling violet-ear	*Colibri coruscans*	LC	2012	1	1
Brown violet-ear	*Colibri delphinae*	LC	2012	1	1

Green violet-ear	*Colibri thalassinus*	LC	2012	1	1
Green-fronted lancebill	*Doryfera ludovicae*	LC	2012	1	1
Tyrian metaltail	*Metallura tyrianthina*	LC	2012	1	1
Green hermit	*Phaethornis guy*	LC	2012	1	1
Eastern wedge-billed hummingbird	*Schistes geoffroyi*	LC	2012	1	1
Crowned woodnymph	*Thalurania colombica*	LC	2012	1	1
Pauraque	*Nyctidromus albicollis*	LC	2012	1	1
Charadriformes (3)					
Double-striped thick-knee	*Burhinus bistriatus*	LC	2010–2016	1	5
American golden plover	*Pluvialis dominica*	LC	1968	1	1
Long-billed curlew	*Numenius americanus*	LC	1986	1	1
Ciconiiformes (3)					
Wood stork	*Mycteria americana*	LC	2011–2017	3	5
Jabiru	*Jabiru mycteria*	LC	2004	1	1
Wattled jacana	*Jacana jacana*	LC	2017	1	1
Cuculiformes (8)					
Greater roadrunner	*Geococcyx californianus*	LC	1986–2016	1	3
Lesser roadrunner	*Geococcyx velox*	LC	1990–2014	1	3
Squirrel cuckoo	*Piaya cayana*	LC	2004–2008	2	2
Striped cuckoo	*Tapera naevia*	LC	2004–2012	1	2
Yellow-billed cuckoo	*Coccyzus americanus*	LC	2004	1	1
Smooth-billed ani	*Crotophaga ani*	LC	2004	1	1
Little cuckoo	*Piaya minuta*	LC	2004	1	1
Groove-billed ani	*Crotophaga sulcirostris*	LC	2008	1	1
Psittaciformes (64)					
Scarlet macaw	*Ara macao*	LC	1973–2017	4	10
Blue-and-yellow macaw	*Ara ararauna*	LC	1973–2016	4	8
White-fronted parrot	*Amazona albifrons*	LC	2007–2017	1	8
Yellow-crowned parrot	*Amazona ochrocephala*	LC	2003–2016	3	7
Red-and-green macaw	*Ara chloropterus*	LC	1973–2017	4	6
Blue-headed parrot[b]	*Pionus menstruus*	LC	1990–2016	5	6

Yellow-cheeked parrot	*Amazona autumnalis*	LC	1992–2017	3	6
Brown-throated parakeet	*Eupsittula pertinax*	LC	1990–2016	2	6
Orange-chinned parakeet	*Brotogeris jugularis*	LC	2011–2016	3	6
Military macaw	*Ara militaris*	VU	1990–2014	4	5
Orange-winged parrot	*Amazona amazonica*	LC	1990–2016	4	5
Orange-fronted parakeet	*Eupsittula canicularis*	LC	1990–2017	1	5
Chestnut-fronted macaw[b]	*Ara severus*	LC	2003–2016	2	5
Yellow-headed parrot	*Amazona oratrix*	EN	2005–2017	1	5
Monk parakeet[b,c]	*Myiopsitta monachus*	LC	2011–2017	4	5
Olive-throated (Jamaican) parakeet	*Eupsittula nana*	NT	2012–2017	1	5
Yellow-lored (Yucatán) parrot	*Amazona xantholora*	LC	2007–2016	1	4
Lilac-crowned parrot	*Amazona finschi*	EN	1990–2012	1	3
Yellow-naped parrot	*Amazona auropalliata*	EN	1993–2013	2	3
Scarlet-fronted parakeet	*Psittacara wagleri*	NT	1996–2016	2	3
Southern festive amazon	*Amazona festiva*	NT	2003–2017	1	3
Dusky-headed parakeet[b]	*Aratinga weddellii*	LC	2004–2016	2	3
Blue- (Turquoise-) fronted parrot[b]	*Amazona aestiva*	LC	2008–2016	3	3
Blue-winged parrotlet[b]	*Forpus xanthopterygius*	LC	2011–2016	2	3
Red-lored parrot	*Amazona autumnalis*	LC	2011–2017	1	3
Southern mealy amazon	*Amazona farinosa*	NT	1992–2011	3	3
White-eyed parakeet	*Psittacara leucophthalmus*	LC	2004–2011	2	2
Northern mealy parrot	*Amazona guatemalae*	NT	2004–2012	1	2
Spectacled parrotlet	*Forpus conspicillatus*	LC	2004–2016	1	2
Yellow-chevroned parakeet[b]	*Brotogeris chiriri*	LC	2011–2016	2	2
Peach-fronted parakeet[b]	*Eupsittula aurea*	LC	2011–2016	2	2
Blue-crowned parakeet	*Psittacara acuticaudatus*	LC	2011–2016	2	2
Mitred parakeet[b]	*Psittacara mitratus*	LC	2011–2016	2	2
Green-cheeked parakeet[b]	*Pyrrhura molinae*	LC	2011–2016	2	2
Aztec parakeet	*Eupsittula astec*	LC	2012–2016	1	2
Red-crowned parrot	*Amazona viridigenalis*	EN	2012–2017	1	2
White-crowned parrot	*Pionus senilis*	LC	2012–2017	1	2

Green parakeet	*Psittacara holochlorus*	LC	2012–2017	1	2
Budgerigar[c]	*Melopsittacus undulatus*	LC	2016–2017	1	2
Black-headed parrot	*Pionites melanocephalus*	LC	1973	1	1
Green-rumped parrotlet	*Forpus passerinus*	LC	1990	1	1
Red-billed parrot	*Pionus sordidus*	LC	1996	1	1
Tui parakeet	*Brotogeris sanctithomae*	LC	1998	1	1
Red-bellied macaw	*Orthopsittaca manilata*	LC	2003	1	1
Short-tailed parrot	*Graydidascalus brachyurus*	LC	2004	1	1
Hyacinth macaw	*Anodorhynchus hyacinthinus*	VU	2011	1	1
Yellow-faced parrot	*Alipiopsitta xanthops*	NT	2011	1	1
Tucuman parrot	*Amazona tucumana*	VU	2011	1	1
Red-fronted macaw	*Ara rubrogenys*	EN	2011	1	1
Southern red-shouldered macaw	*Diopsittaca cumanensis*	LC	2011	1	1
Western white-bellied (Black-legged) parrot	*Pionites xanthomerius*	LC	2011	1	1
Scaly-headed parrot	*Pionus maximiliani*	LC	2011	1	1
Golden-collared macaw	*Primolius auricollis*	LC	2011	1	1
Great green macaw	*Ara ambiguus*	EN	2012	1	1
Barred parakeet	*Bolborhynchus lineola*	LC	2012	1	1
Mexican parrotlet	*Forpus cyanopygius*	NT	2012	1	1
Bronze-winged parrot	*Pionus chalcopterus*	LC	2012	1	1
Plum-crowned parrot[c]	*Pionus tumultuosus*	LC	2012	1	1
Mountain parakeet	*Psilopsiagon aurifrons*	LC	2012	1	1
Brown-breasted parakeet	*Pyrrhura calliptera*	VU	2012	1	1
Pacific parakeet	*Psittacara strenuus*	NE	2012	1	1
Thick-billed parrot	*Rhynchopsitta pachyrhyncha*	EN	2012	1	1
Cobalt-winged parakeet[b]	*Brotogeris cyanoptera*	LC	2016	1	1
Cockatiel[c]	*Nymphicus hollandicus*	LC	2017	1	1
Coraciformes (3)					
Highland motmot	*Momotus aequatorialis*	LC	2006–2016	1	2
Ringed kingfisher	*Megaceryle torquata*	LC	2004	1	1

Amazonian motmot	*Momotus momota*	LC	2011	1	1
Cathartiformes (4)					
American black vulture	*Coragyps atratus*	LC	2006–2018	2	6
Turkey vulture	*Cathartes aura*	LC	2008–2016	2	4
King vulture	*Sarcoramphus papa*	LC	2010	1	1
Andean condor	*Vultur gryphus*	NT	2012	1	1
Opisthocomiformes (1)					
Hoatzin	*Opisthocomus hoazin*	LC	2003–2010	2	2
Columbiformes (24)					
White-winged dove	*Zenaida asiatica*	LC	1986-2018	2	18
Mourning dove	*Zenaida macroura*	LC	1986-2018	1	10
White-tipped dove	*Leptotila verreauxi*	LC	1990–2018	4	9
Pale-vented pigeon	*Patagioenas cayennensis*	LC	1990–2016	3	8
Inca dove	*Columbina inca*	LC	1986-2018	1	7
Ruddy ground-dove	*Columbina talpacoti*	LC	1996–2016	3	7
Common ground dove	*Columbina passerina*	LC	1986-2018	2	6
Northern band-tailed pigeon	*Patagioenas fasciata*	LC	1996–2014	3	4
Red-billed pigeon	*Patagioenas flavirostris*	LC	2012–2017	1	4
Grey-fronted dove	*Leptotila rufaxilla*	LC	1990–2008	2	3
Lined quail-dove	*Zentrygon linearis*	LC	1990–2012	2	3
Plain-breasted ground-dove	*Columbina minuta*	LC	2011–2012	1	3
Ruddy pigeon	*Patagioenas subvinacea*	VU	1990–1996	1	2
Ruddy quail-dove	*Geotrygon montana*	LC	1990–1996	1	2
Scaled pigeon	*Patagioenas speciosa*	LC	1990–1996	1	2
Blue ground-dove	*Claravis pretiosa*	LC	1990–2005	2	2
Eared dove	*Zenaida auriculata*	LC	2012–2013	2	2
Rock dove	*Columba livia*	LC	2015–2016	1	2
Scaled dove	*Columbina squammata*	LC	1990	1	1
Grey-headed dove	*Leptotila cassini*	LC	1995	1	1
Violaceous quail-dove	*Geotrygon violacea*	LC	1996	1	1
Spot-winged pigeon	*Patagioenas maculosa*	LC	2017	1	1

Plumbeous pigeon	*Patagioenas plumbea*	LC	2017	1	1
African-collared dove[c]	*Streptopelia roseogrisea*	LC	2017	1	1
Strigiformes (9)					
Tropical screech owl	*Megascops choliba*	LC	2004–2012	1	2
Common barn owl	*Tyto alba*	LC	2012–2016	2	2
Great horned owl	*Bubo virginianus*	LC	1986	1	1
Mountain pygmy-owl	*Glaucidium gnoma*	LC	1986	1	1
Spectacled owl	*Pulsatrix perspicillata*	LC	2004	1	1
Elf owl	*Micrathene whitneyi*	LC	2011	1	1
Burrowing owl	*Athene cunicularia*	LC	2011	1	1
Rufous-banded owl	*Ciccaba albitarsis*	LC	2012	1	1
Striped owl	*Asio clamator*	LC	2012	1	1
Piciformes (19)					
Keel-billed toucan	*Ramphastos sulfuratus*	LC	1992–2017	3	13
Collared araçari	*Pteroglossus torquatus*	LC	2004–2014	2	5
Yellow-throated toucan	*Ramphastos ambiguus swainsonii*	NT	2005–2017	3	4
Golden-fronted woodpecker	*Melanerpes aurifrons*	LC	1986–2015	1	3
Emerald toucanet	*Aulacorhynchus prasinus*	LC	2004–2017	2	3
Acorn woodpecker	*Melanerpes formicivorus*	LC	2004–2017	2	3
Yellow-shafted flicker	*Colaptes auratus*	LC	1988	1	1
Ladder-backed woodpecker	*Dryobates scalaris*	LC	1988	1	1
Groove-billed toucanet	*Aulacorhynchus sulcatus*	LC	1996	1	1
Spot-breasted woodpecker	*Colaptes punctigula*	LC	2004	1	1
Lineated woodpecker	*Hylatomus lineatus*	LC	2004	1	1
Red-billed toucan	*Ramphastos tucanus*	VU	2007	1	1
Chestnut-eared araçari	*Pteroglossus castanotis*	LC	2009	1	1
Gray-breasted mountain toucan	*Andigena hypoglauca*	NT	2012	1	1
Southern Andean flicker	*Colaptes rupicola*	LC	2012	1	1
Stripe-billed araçari	*Pteroglossus sanguineus*	LC	2017	1	1
Cuvier's toucan	*Ramphastos cuvieri*	LC	2017	1	1
Choco toucan	*Ramphastos brevis*	LC	2017	1	1

Gray-breasted woodpecker	*Melanerpes hypopolius*	LC	2017	1	1
Eurypygiformes (1)					
Sunbittern	*Eurypyga helias*	LC	2017	1	1
			1968–2018	**12**	**103**[e]

[a]Common and Latin names and statuses were cross-referenced with current taxonomic and status updates from the IUCN Red List (2018) and the Catalogue of Life (2018).
[b]Total study and country counts for these species were adjusted to account for studies in multiple countries.
[c]Non-native species to the country of capture and their associated study.
[d]Species reported range from IUCN (2018) does not overlap with one or several study locations or countries.
[e]Totals represent the absolute number of countries and studies from which species were documented.

Table A-18 List of reptiles hunted by campesinos from 98 studies published from 1966-2018. IUCN statuses are least concern (LC), lower risk/least concern (LR/LC), lower risk/conservation dependent (LR/CD), lower risk/near threatened (LR/NT), near threatened (NT), vulnerable (VU), endangered (EN), critically endangered (CD), extinct in the wild (EW), data deficient (DD), and not evaluated (NE).

Hunted taxa[a]	Species[a]	IUCN status	Study years	Study countries	Total studies
***Reptiles* (89)**					
Testudines (32)					
Yellow-footed tortoise[b]	*Chelonoidis denticulata*	VU	1966–2018	5	21
Yellow-spotted (Taricaya) river turtle[b]	*Podocnemis unifilis*	VU	1966–2018	6	17
South American river turtle	*Podocnemis expansa*	LR/CD	1976–2017	4	13
Colombian slider (Jicotea)	*Trachemys callirostris*	NE	2011–2018	1	8
Red-eared slider	*Trachemys scripta*	LC	1992–2017	3	8
Red-footed tortoise	*Chelonoidis carbonaria*	NE	1990–2017	2	7
Mexican mud turtle	*Kinosternon integrum*	LC	1986–2018	1	7
Colombian wood turtle	*Rhinoclemmys melanosterna*	NE	2011–2017	1	6
Central American river turtle	*Dermatemys mawii*	CE	1992–2017	1	5
Magdalena river turtle	*Podocnemis lewyana*	CE	2011–2018	1	5
Scorpion mud turtle	*Kinosternon scorpioides*	LR/NT	2013–2017	1	4
Chaco tortoise	*Chelonoidis chilensis*	VU	1999–2016	1	2
Matamata turtle	*Chelus fimbriata*	NE	1976–1998	1	2
Central American snapping turtle	*Chelydra rossignonii*	VU	2011–2017	1	2

Llanos side-necked turtle	*Podocnemis vogli*	NE	2003–2013	1	2
Brown wood turtle	*Rhinoclemmys annulata*	LR/NT	2005–2008	1	2
Furrowed wood turtle	*Rhinoclemmys areolata*	NT	2011–2012	1	2
Mexican giant musk turtle	*Staurotypus triporcatus*	LR/NT	2011–2017	1	2
Black-bellied slider	*Trachemys nebulosa hiltoni*	NE	2013–2014	1	2
Creaser's mud turtle	*Kinosternon creaseri*	LC	2012	1	1
Yucatán box turtle	*Terrapene carolina yucatana*	VU	2012	1	1
Mexican spotted wood turtle	*Rhinoclemmys rubida*	NT	2015	1	1
South American snapping turtle	*Chelydra acutirostris*	NE	2017	1	1
Narrow-bridged musk turtle	*Claudius angustatus*	LR/NT	2017	1	1
Berlandier's tortoise	*Gopherus berlandieri*	LR/LC	2017	1	1
White-lipped mud turtle	*Kinosternon leucostomum*	NE	2017	1	1
Tabasco mud turtle	*Kinosternon acutum*	LR/NT	2017	1	1
Yellow mud turtle	*Kinosternon flavescens*	LC	2017	1	1
Herrera's mud turtle	*Kinosternon herrerai*	NT	2017	1	1
Dunn's mud turtle	*Kinosternon dunni*	VU	2017	1	1
Large-nosed wood turtle	*Rhinoclemmys nasuta*	LR/NT	2017	1	1
Mesoamerican slider	*Trachemys venusta*	NE	2017	1	1
Crocodilia (8)					
Spectacled caiman	*Caiman crocodilus*	LR/LC	1967–2017	7	18
Black caiman	*Melanosuchus niger*	LR/CD	1967–2011	4	9
Morelet's crocodile	*Crocodylus moreletii*	LC	1992–2017	1	8
Brown caimain	*Caiman crocodilus fuscus*	NE	2011–2017	2	7
American crocodile	*Crocodylus acutus*	VU	1974–2016	3	6
Schneider's smooth-fronted caiman	*Paleosuchus trigonatus*	LR/LC	1986–1998	2	2
Dwarf caiman	*Paleosuchus palpebrosus*	LR/LC	1986	1	1
Yacaré	*Caiman yacare*	LR/LC	1992	1	1
Squamata (49)					
Green iguana[b]	*Iguana iguana*	LC	1974-2017	10	30
Boa	*Boa constrictor*	NE	1990–2018	5	17
Mexican spiny-tailed iguana	*Ctenosaura pectinata*	NE	1990–2018	1	13

Black spiny-tailed iguana[b]	*Ctenosaura similis*	LC	1982–2017	8	9
South American rattlesnake	*Crotalus durissus*	LC	1990–2018	3	8
Gold tegu	*Tupinambis teguixin*	NE	1986–2016	3	7
Argentine red tegu	*Salvator rufescens*	NE	1987–2017	2	6
Black-and-white tegu	*Salvator merianae*	LC	2006	2	2
Mesquite lizard	*Sceloporus grammicus*	LC	1986–2006	1	2
Black-tailed rattlesnake	*Crotalus estebanensis* or *C. molossus*	LC	1986–2016	1	2
Rock rattlesnake	*Crotalus lepidus*	LC	1986–2016	1	2
Mojave rattlesnake	*Crotalus scutulatus*	LC	1986–2016	1	2
Mexican lance-headed rattlesnake	*Crotalus polystictus*	LC	1999–2016	1	2
Western coral snake	*Micruroides euryxanthus*	LC	2013–2014	1	2
Western indigo snake	*Drymarchon melanurus*	LC	2013–2015	1	2
Northwestern neotropical rattlesnake	*Crotalus culminatus*	NE	2015–2018	1	2
Many-colored bush anole	*Polychrus marmoratus*	NE	2006–2016	1	2
Mexican horned lizard	*Phrynosoma taurus*	LC	2013–2015	1	2
Middle American rattlesnake	*Crotalus simus*	LC	2013–2016	1	2
Round-tailed horned lizard	*Phrynosoma modestum*	LC	1986	1	1
Red worm lizard	*Amphisbaena alba*	LC	1986	1	1
Mexican moccasin (cantil)	*Agkistrodon bilineatus*	LC	1990	1	1
Speckled worm lizard	*Amphisbaena fuliginosa*	NT	1990	1	1
Cross-banded mountain rattlesnake	*Crotalus transversus*	LC	1999	1	1
Mexican dusky rattlesnake	*Crotalus triseriatus*	LC	1999	1	1
Longtail alpine gartersnake	*Thamnophis scalaris*	LC	1999	1	1
Common gartersnake	*Thamnophis sirtalis*	LC	1999	1	1
Guatemalan spiny-tailed iguana	*Ctenosaura palearis*	EN	2008	1	1
Green (Plumed) basilisk	*Basiliscus plumifrons*	LC	2008	1	1
Green anaconda	*Eunectes murinus*	NE	2010	1	1
Mexican pine snake	*Pituophis deppei*	LC	2011	1	1
Yucatan neotropical rattlesnake	*Crotalus tzabcan*	LC	2012	1	1
Peru slender snake	*Tachymenis peruviana*	LC	2012	1	1
Western rat snake[d]	*Pantherophis obsoletus*	LC	2013	1	1

Hoffmann's Earth snake[d]	*Geophis hoffmanni*	LC	2013	1	1
Brown vine snake	*Oxybelis aeneus*	NE	2013	1	1
Aguán Valley spiny-tailed iguana	*Ctenosaura melanosterna*	EN	2014	1	1
Common house gecko	*Hemidactylus frenatus*	LC	2014	1	1
Beaded lizard	*Heloderma horridum*	LC	2015	1	1
Speckled anole	*Anolis ventrimaculatus*	NT	2016	1	1
Turniptail gecko	*Thecadactylus rapicauda*	NE	2016	1	1
Mountain sipo	*Chironius monticola*	LC	2016	1	1
Lined Tolucan ground snake	*Conopsis lineata*	LC	2016	1	1
Querétero dusky rattlensnake	*Crotalus aquilus*	LC	2016	1	1
Western diamond-backed rattlesnake	*Crotalus atrox*	LC	2016	1	1
Twin-spotted rattlesnake	*Crotalus pricei*	LC	2016	1	1
Night snake	*Hypsiglena torquata*	LC	2016	1	1
Coral snake	*Micrurus dumerilii*	NE	2016	1	1
Mexican burrowing python	*Loxocemus bicolor*	LC	2018	1	1
Indigo snake	*Drymarchon corais rubidus*	NE	2018	1	1
			1966–2018	**16**	**98**[e]

[a]Common and Latin names and statuses were cross-referenced with current taxonomic and status updates from the IUCN Red List (2018) and the Catalogue of Life (2018).
[b]Total study and country counts for these species were adjusted to account for studies in multiple countries.
[c]Non-native species to the country of capture and their associated study.
[d]Species reported range from IUCN (2018) does not overlap with one or several study locations or countries.
[e]Totals represent the absolute number of countries and studies from which species were documented.

Table A-19 List of amphibians hunted by campesinos from 16 studies published from 1968-2016. IUCN statuses are least concern (LC), lower risk/least concern (LR/LC), lower risk/conservation dependent (LR/CD), lower risk/near threatened (LR/NT), near threatened (NT), vulnerable (VU), endangered (EN), critically endangered (CD), extinct in the wild (EW), data deficient (DD), and not evaluated (NE).

Hunted taxa[a]	**Species**[a]	**IUCN status**	**Study years**	**Study countries**	**Total studies**
***Amphibians* (1 order, 18 species)**					
Anura					
Montezuma leopard frog	*Lithobates montezumae*	LC	1999–2013	1	2
Showy leopard frog	*Lithobates spectabilis*	LC	1999–2013	1	2
Southern roundgland toad	*Incilius coccifer*	LC	2011–2014	1	2
Cane toad	*Rhinella marina*	LC	2015	1	2
Mountain treefrog	*Dryophytes eximius*	LC	2016	1	2
Lake Junín frog	*Telmatobius macrostomus*	EN	1968	1	1
American bullfrog	*Lithobates catesbeianus*	LC	1986	1	1
Northern leopard frog	*Lithobates pipiens*	LC	1986	1	1
Southern Gulf Coast toad	*Incilius valliceps*	LC	1999	1	1
Rio Grande leopard frog	*Lithobates berlandieri*	LC	1999	1	1
South American bullfrog	*Leptodactylus pentadactylus*	LC	2003	1	1
Mexican giant tree frog	*Agalychnis dacnicolor*	LC	2013	1	1
Zweifel's frog	*Lithobates zweifeli*	LC	2015	1	1
Pine toad	*Incilius occidentalis*	LC	2016	1	1
Transverse volcanic leopard frog	*Lithobates neovolcanicus*	NT	2016	1	1
Plateau toad	*Anaxyrus compactilis*	LC	2016	1	1
Baird's spotted toad	*Anaxyrus punctatus*	LC	2016	1	1
Canyon treefrog	*Dryophytes arenicolor*	LC	2016	1	1
			1968–2016	**3**	**11**[e]

[a]Common and Latin names and statuses were cross-referenced with current taxonomic and status updates from the IUCN Red List (2018) and the Catalogue of Life (2018).

[b]Total study and country counts for these species were adjusted to account for studies in multiple countries.

[c]Non-native species to the country of capture and their associated study.

[d]Species reported range from IUCN (2018) does not overlap with one or several study locations or countries.

[e]Totals represent the absolute number of countries and studies from which species were documented.

Table A-20 List of insects hunted by campesinos from 14 studies published from 1976-2012. IUCN statuses are least concern (LC), lower risk/least concern (LR/LC), lower risk/conservation dependent (LR/CD), lower risk/near threatened (LR/NT), near threatened (NT), vulnerable (VU), endangered (EN), critically endangered (CD), extinct in the wild (EW), data deficient (DD), and not evaluated (NE).

Hunted taxa[a]	**Species**[a]	**IUCN status**	**Study years**	**Study countries**	**Total studies**
***Insects* (6 orders, 59 species)**					
Coleoptera (9)					
South American palm weevil larvae (mojojoi) [b]	*Rhynchophorus palmarum*	NE	1976–2015	3	4
Green june beetle	*Cotinis nitida*	NE	1986	1	1
Jewel beetle	*Thrincopyge alacris*	NE	1986	1	1
Dung beetle	*Phanaeus quadridens*	NE	1986	1	1
May beetle	*Isonychus ocellatus*	NE	2008	1	1
Scarab beetle	*Phyllophaga* sp *af lenis*	NE	2008	1	1
Scarab beetle	*Goliathus goliathus*	NE	2008	1	1
Rose chafer	*Macrodactylus dimidiatus*	NE	2008	1	1
Rose chafer	*Macrodactylus lineatus*	NE	2008	1	1
Blattodea (3)					
American cockroach	*Periplaneta americana*	NE	2008–2013	1	2
Australian cockroach	*Periplaneta australasiae*	NE	2008	1	1
Death's head cockroach	*Blaberus craniifer*	NE	2008	1	1
Hymenoptera (16)					
Honey bee	*Apis mellifera*	NE	1986–2012	4	7
Leafcutter ant	*Atta cephalotes*	NE	2008	1	1
Leafcutter ant	*Atta mexicana*	NE	2008	1	1
Stingless bee	*Partamona bilineata*	NE	2008	1	1
Paper wasp	*Polistes (Polisotius) major*	NE	2008	1	1
Wasp	*Polybia (Myrametra) diguetana*	NE	2008	1	1
Camaoti	*Polybia (Myrametra) occidentalis nigratella*	NE	2008	1	1
Wasp	*Agelaia multipicta*	NE	2010	1	1

Robber bee	*Lestrimelitta limao*	NE	2010	1	1
Stingless bee	*Tetragona clavipes*	NE	2010	1	1
Stingless bee	*Tetragonisca angustula*	NE	2010	1	1
Stingless bee	*Trigona spinipes*	NE	2010	1	1
Paper wasp	*Brachygastra lecheguana*	NE	2012	1	1
Social wasp	*Polybia ignobilis*	NE	2012	1	1
Social wasp	*Polybia ruficeps*	NE	2012	1	1
Social wasp	*Polybia sericea*	NE	2012	1	1
Hemiptera (6)					
Cicada	*Fidicinoides picea*	NE	2008	1	1
Jamaican field cricket	*Gryllus assimilis*	NE	2008	1	1
Treehopper	*Umbonia orizabae*	NE	2008	1	1
Treehopper	*Umbonia reclinata*	NE	2008	1	1
Stink bug	*Edessa fuscidorsata*	NE	2018	1	1
Stink bug	*Euschistus taxcoensis*	NE	2018	1	1
Orthoptera (15)					
Aztec spur-throat	*Aidemona azteca*	NE	2008	1	1
Grasshopper	*Chromacris colorata*	NE	2008	1	1
Caribbean meadow katydid	*Conocephalus cinereus*	NE	2008	1	1
Katydid	*Conocephalus ictus*	NE	2008	1	1
Red-legged grasshopper	*Melanoplus femurrubrum*	NE	2008	1	1
Totonaca katydid	*Microcentrum totonacum*	NE	2008	1	1
Broad-tipped katydid	*Neoconocephalus triops*	NE	2008	1	1
Grasshopper	*Osmilia (Abracris) flavolineata*	NE	2008	1	1
Mexican bush katydid	*Scudderia mexicana*	NE	2008	1	1
Katydid	*Stilpnochlora azteca*	NE	2008	1	1
Katydid	*Stilpnochlora quadrata*	NE	2008	1	1
Katydid	*Stilpnochlora thoracica*	NE	2008	1	1
Lubber grasshopper	*Taeniopoda auricornis*	NE	2008	1	1
Grasshopper	*Taeniopoda bicristata*	NE	2008	1	1
Grasshopper	*Sphenarium rugosum*	NE	2018	1	1

Lepidoptera (10)					
Giant silk moth	*Arsenura armida*	NE	2008–2018	1	2
Tussock moth	*Amastus ochraceator*	NE	2008	1	1
Tussock moth	*Elysius superba*	NE	2008	1	1
Salt marsh moth	*Estigmene acraea*	NE	2008	1	1
Corn earworm	*Helicoverpa zea*	NE	2008	1	1
Moth	*Latebraria amphipyroides*	NE	2008	1	1
Carolina sphinx moth	*Manduca sexta*	NE	2008	1	1
Tussock moth	*Pelochyta cervina*	NE	2008	1	1
Moth	*Phasus triangularis*	NE	2008	1	1
Silk moth	*Pseudodirphia mexicana*	NE	2008	1	1
			1976–2012	**6**	**14**[e]

[a]Common and Latin names and statuses were cross-referenced with current taxonomic and status updates from the IUCN Red List (2018) and the Catalogue of Life (2018).

[b]Total study and country counts for these species were adjusted to account for studies in multiple countries.

[c]Non-native species to the country of capture and their associated study.

[d]Species reported range from IUCN (2018) does not overlap with one or several study locations or countries.

[e]Totals represent the absolute number of countries and studies from which species were documented.

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APPENDIX B

CAMPESINO IDENTITY AND HUNTING INTERVIEW SCRIPTS

Figure B-1 Semistructured interview script.

Entrevista de Conocimiento y Cultura Campesino

Código de entrevista:__ **Entrevista fotográfica**:____________ **Grupo de discusión**:_______________

Comunidad:____ □ Adulto □ Niño

ONG: Sí__ No___ Grupo: ___________ **Gobierno**: Sí___ No_____ Grupo: ________________________

Nombre (seudónimo o sobrenombre):____

Sección I: Identidad Campesina e Indígena: Fecha:_____________ **Grabación**:____________

1) ¿Se identifica como un miembro de un grupo indígena? Sí__ No__________ NR__________
   a. Si sí: ¿Cuál grupo?____________________
   b. ¿Habla usted el idioma de esto grupo indígena? Sí__ No__________ NR__________

2) ¿Se identifica como un/a campesino/a? Sí____ No__ NR____ ¿Por qué o por qué no?

3) ¿Para usted, qué significa ser indígena o pertenecer a [nombre de grupo indígena]? (Si es indígena, pregúntale sobre el grupo específico).

4) ¿Para usted, qué significa ser un/a campesino/a? ¿En esta comunidad, Santa Ana El Carmen?

Sección II: Conocimiento Ambiental y La Cacería: Fecha:______________ **Grabación**:______

1) ¿Cuáles conocimientos (se siente que) tiene usted del medio ambiente aquí?

2) ¿Cuáles son los valores de la vida silvestre para usted? ¿Para su comunidad?

3) ¿Cómo usan/se interactúan con los animales silvestres en Santa Ana El Carmen?

4) ¿Cazan la vida silvestre en su comunidad los campesinos? ¿En otras comunidades?
   a. Si sí, ¿Por qué, qué, cuando, y como cazan aquí los campesinos? ¿Allí?
   b. Si no, ¿Por qué no cazan aquí los campesinos? ¿Allí?

5) ¿Cómo aprende o había aprendido de la cacería aquí usted? ¿De quién?

6) ¿Cómo aprenden de la cacería los/las cazadores campesinos/as y de quién?

7) ¿Cómo es importante o no es importante la cacería para su cultura/la cultura aquí?

8) ¿Qué significa la cacería para campesinos? ¿Para los cazadores campesinos?

9) ¿Qué significa ser una cazador campesino/a?

10) ¿Se considera usted un/a cazador/a? Sí______ No___NR____ Si sí: Pasado ______ Presente_____

11) ¿Cuánto tiempo hace que ha cazado?

12) ¿Cuáles animales ha/había cazado usted?

Animales	Estrategias			Cuando	#Animal/Viaje	Detalles/Viaje	Frecuencia/Viaje
	Armas	Perros	Otras				
Venado						Gente:	#/mes:
						Horas:	#/año:
Guarda						G:	#/m:
						H:	#/a:
Guatusa						G:	#/m:
						H:	#/a:
						G:	#/m:
						H:	#/a:
						G:	#/m:
						H:	#/a:
						G:	#/m:
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						G:	#/m:
						H:	#/a:
						G:	#/m:
						H:	#/a:
						G:	#/m:
						H:	#/a:
						G:	#/m:
						H:	#/a:

13) ¿Qué significa la cacería sostenible para usted? ¿Qué viene a su mente cuando digo las palabras *la cacería sostenible*?

14) ¿En su opinión, por qué esta sostenible o no esta sostenible la cacería por campesinos? ¿Aquí?
    a. Si no está mencionado anteriormente: ¿Cómo debe cazar para estar sostenible?

15) ¿Hay algunas restricciones de la cacería? ¿Algunas reglas? ¿Qué son? *

16) ¿Cuándo estuvieron creadas estas reglas? *

17) ¿Está de acuerdo con estas reglas usted? *

Respuestas	Notas
0=Muy en desacuerdo	
1=En desacuerdo	
2=ni de acuerdo no en desacuerdo	
3= de acuerdo	

4=muy de acuerdo	

18) ¿Qué porcentaje de la gente en Santa Ana El Carmen sabe estas reglas? * ¿Cárdenas? ¿Rivas?

SAEC	Cárdenas (Muni)	Rivas (Dept)	Notas
1=0-25%	1	1	
2=26-50%	2	2	
3=51-75%	3	3	
4=76-100%	4	4	

19) ¿Qué tan frecuentemente cumplen con estas reglas la gente aquí? * ¿Cárdenas? ¿Rivas?

SAEC	Cárdenas (Muni)	Rivas (Dept)	Notas
0=Nunca	0	0	
1=Casi nunca	1	1	
2=Generalmente	2	2	
3=Casi siempre	3	3	
4=Siempre	4	4	

Sección III: Consenso Cultural: Fecha:___________________________ **Grabación**:_________________

Conocimiento Social	*Sí*	*No*
1. Los cazadores campesinos aquí están orgullosos de estar llamados cazadores		
2. No podemos cazar aquí porque no tenemos el dinero		
3. Denunciaríamos un cazador si viéramos uno		
4. Los cazadores comparten sus historias de caza con otros miembros de la comunidad		
5. La cacería viola la palabra de Dios		
6. Todo el mundo conoce al menos uno/a cazador/a		
7. La uña de colas del cusuco son buena suerte para la cacería		
8. Solamente los hombres cazan aquí		
9. La cacería es una fuente principal de conocimiento sobre la naturaleza en nuestra comunidad		
10. Campesinos aquí cazan para alimentarse y sus familias		
11. Las piedras de venado se da a un/a cazador/a buena suerte para la cacería		

Conocimiento Político	*Sí*	*No*
1. Toda la cacería está prohibida aquí		
2. La mayoría de los cazadores campesinos tienen permisos de cacería		
3. Cazadores campesinos siguen estaciones de caza de MARENA		
4. El gobierno monitorea la cacería por campesinos aquí		
5. Cazadores campesinos aquí no siguen las cuotas de cacería del gobierno		
6. Las organizaciones de conservación denuncian los cazadores a las autoridades		
7. El gobierno lleva a cabo talleres sobre la cacería en esta comunidad		
8. Las organizaciones de conservación son nuestras principales fuentes de conocimiento sobre las leyes de caza		
9. MARENA actualiza la lista de animales con las vedas de caza indefinidas y parciales cada año		
10. No estamos permitido cazar en áreas protegidas		
11. El Poder Ciudadano nos dice que la cacería no está permitida aquí		

Conocimiento Sobre La Vida Silvestre Cazada	*Sí*	*No*
1. De medio, vemos la mayoría de animales cazados en las fincas		
2. Los cazadores tienen que saber cómo identificar huellas de animales		
3. Guardatinaja es la más sabrosa carne silvestre		
4. Ojos de agua son los mejores lugares para encontrar los animales cazados		
5. Hay más animales para cazar en el invierno que en cualquier otra estación		
6. Campesinos cazan las culebras aquí porque hay tantas		
7. Los cazadores evitan matando los animales embarazadas		
8. Guatusa se reproducen durante todo el año		
9. No cazamos venados porque no están abundantes		
10. Caminos de animales nos indican dónde encontrar los animales cazados		

Conocimiento Práctico de la Cacería	*Sí*	*No*
1. Los campesinos aquí usan perros para cazar		
2. La cacería por campesinos es sostenible porque poca gente la hace		
3. La cacería normalmente sucede en propiedad privada		
4. Los campesinos cazan cada vez que tienen la oportunidad		
5. La cacería significa matar al animal		
6. Cazaríamos si hubieran más animales		
7. La cacería por campesinos es malo para la conservación		
8. La mayoría de los cazadores campesinos venden su carne a los restaurantes en el Departamento de Rivas		
9. Los cazadores campesinos cazan principalmente por la noche		
10. Campesinos aquí cazan en grupos (de 3 o más)		

Conocimiento Histórico	*Sí*	*No*
1. Los cazadores campesinos son una parte importante de la historia de Nicaragua		
2. La gente ha cazado aquí por generaciones		
3. Conocimiento de la cacería pasa de generación en generación.		
4. La cacería era más común antes la revolución		
5. Cuando pienso en la historia campesino en Nicaragua, pienso en la cacería		
6. La cacería aquí siempre estaba escondida		
7. La cacería es una tradición cultural en nuestra comunidad		
8. El gobierno regulaba la cacería en esta región antes de la revolución		
9. Hay menos cazadores campesinos aquí ahora que en el pasado		
10. Hay menos animales cazados ahora que los que había en el pasado		

Sección IV: Demográficos: Fecha:________________________ **Grabación**:________________________

1. ¿Cuántos años tiene usted? __________ NR
2. ¿Cuál es su género?: Mujer___________ Barrón_ Otro/a________ NR__________
3. ¿Es nicaragüense usted? Sí__________ No__________NR__________
4. ¿Dónde nació usted? Ciudad________________________ País______________________
5. ¿Cuánto tiempo ha vivido usted en Nicaragua?___________________________(días/mes/año)

6. ¿Cuánto tiempo ha vivido usted en esta comunidad? ____________________(días/mes/año)

7. ¿Qué es su trabajo actual? ____ NR

8. ¿Dónde trabaja usted?____NR

9. ¿Qué es su nivel de educación?_______________________________________ NR

10. ¿Tiene usted hijos? Sí__ No__________ NR__________
    a. Si sí: ¿Cuántos hijos tiene usted?________________________NR
    b. Si sí: ¿Participan sus hijos [su hijo/a] en el Programa de Guardabosque Junior? Sí_____ No____NR____
    c. Si no: ¿Va a participar en el futuro su hijo/a? Sí_ No_____NR___

11. ¿Es usted el/la dueño/a de su propia tierra aquí? Sí ____ No___NR____
    a. ¿Hace cuánto tiempo es el/la dueño/a?:________________________ (días/mes/año)

12. ¿Es usted un veterano[a] de una guerra, cualquiera de los dos: la revolución o la Guerra Contra? Sí_____ No____ NR____ Si sí: ¿Cuál?:______________________________________

Sección V: Recomendaciones de Entrevistados: Fecha:____________ **Grabación**:________
1. Nombres de otros personas con bastante conocimiento del bosque y la cacería:__________________
____
____
____
____
____
____

Figure B-2 Photo-elicitation interview script.

<u>Entrevista Fotográfica</u> **Fecha**:__________________

Código de entrevista fotográfica:_____________ **Código de entrevista completa**:________

Comunidad:____ ☐ Adulto ☐ Niño

ONG: Sí__ No___ Grupo: ______________ **Gobierno**: Sí___ No___ Grupo: _______________

Nombre (seudónimo):____

Sección I: Pasos y preguntas de entrevista: Fecha:________________ **Grabación**:_______

1. ¿Según nuestras metas/preguntas orientadoras, cuales (6) fotos son las más importantes para usted?

   # Foto:_____________ # Foto:______________ # Foto:_______________

Foto:______________ # Foto:_______________ # Foto:________________

Foto:______________ # Foto:_______________ # Foto:________________

Foto:______________ # Foto:_______________ # Foto:________________

2. ¿Porque eligió estas fotos?

3. ¿Me puede contar de estas fotos?

4. ¿Qué significan los usos de biodiversidad (y la cacería) y ser alguien quien usa la biodiversidad (y un cazador) para usted, su comunidad campesina, y su cultura?"

5. ¿Que, por qué, y como aprende o ha aprendido usted y/o otra gente de usar los animales (y de cazar)?

6. ¿Por qué son buenas o malas para el medio ambiente las formas de usar los animales del monte (incluyendo la cacería de esos animales)? ¿Cómo se relacionan las fotos con conservación?

7. ¿Cómo se relacionan las fotos con conocimiento del campo/medio ambiente circundante de su comunidad?

8. ¿Cómo se relacionan las fotos con ser campesino/a?

Sección II: Demográficos: Fecha:___________________ **Grabación**:____________________

13. ¿Cuántos años tiene usted? _______ NR

14. ¿Cuál es su género?: Mujer________ Barrón______ Otro/a_______ NR___

15. ¿Es nicaragüense usted? Sí_______ No_________NR_________

16. ¿Dónde nació usted? Ciudad___________________ País____________________

17. ¿Cuánto tiempo ha vivido usted en Nicaragua?______________________ (días/mes/año)

18. ¿Cuánto tiempo ha vivido usted en esta comunidad? ________________ (días/mes/año)

19. ¿Qué es su trabajo actual? ____ NR

20. ¿Dónde trabaja usted?____ NR

21. ¿Qué es su nivel de educación?____ NR

22. ¿Tiene usted hijos? Sí______ No__________ NR_________
    a. Si sí: ¿Cuántos hijos tiene usted?_____________________NR
    b. Si sí: ¿Participan sus hijos [su hijo/a] en el Programa de Guardabosque Junior? Sí_____ No___NR___
    c. Si no: ¿Va a participar en el futuro su hijo/a? Sí____ No____NR__

23. ¿Es usted el/la dueño/a de su propia tierra aquí? Sí ____ No_____NR___
    a. ¿Hace cuánto tiempo es el/la dueño/a?:______________________ (días/mes/año)

24. ¿Es usted un veterano[a] de una guerra, cualquiera de los dos: la revolución o la Guerra Contra?
    Sí____ No___ NR___ Si sí: ¿Cuál?:____

APPENDIX C

CULTURAL CONSENSUS QUESTIONS, DESCRIPTIVE RESULTS, AND R SCRIPT

Table B-1 Cultural Consensus descriptive results and the culturally correct (CC) answers to 52 propositions about campesino local and traditional knowledge (LTK) about hunting.

LTK domains and propositions[a]	Response		
Social Knowledge	*Yes*	*No*	*CC Answer*
1. Campesino hunters here are proud to be called hunters.[k]	24	12	Yes
2. We cannot hunt here because we do not have the money.[c]	13	23	Yes
3. We would report a hunter if we saw one.[p]	20	16	Yes
4. Campesino hunters share their hunting stories with other members of the community.[k]	33	3	Yes
5. Hunting violates the word of God.[k]	23	13	Yes
6. Everyone knows at least one hunter.[c]	32	4	Yes
7. The nail on an armadillo tail is good luck for hunting.[k]	31	5	Yes
8. Only the men hunt here.[p]	34	2	Yes
9. Hunting is a main source of knowledge about nature in our community.[k]	30	6	Yes
10. Campesinos here hunt to feed themselves and their families.[k]	35	1	Yes
11. Deer “stones” give hunters good luck for hunting.[k]	32	4	Yes
Political Knowledge			
1. Hunting is completely prohibited here.[p]	34	2	Yes
2. The majority of campesino hunters have hunting permits.[p]	1	35	No
3. Campesino hunters follow the MARENA’s[b] hunting seasons.[p]	13	23	No
4. The government monitors hunting by campesinos here.[c]	17	19	No
5. Campesino hunters do not follow MARENA’s hunting quotas.[p]	21	15	Yes
6. Conservation organizations report hunters to the authorities.[p]	23	13	Yes
7. The government carries out hunting workshops in this community.[p]	16	20	No
8. Conservation organizations are our main sources of knowledge about hunting laws.[c]	29	7	Yes
9. MARENA updates the list of animals with indefinite and partial hunting bans each year.[c]	26	10	Yes
10. We are not allowed to hunt in protected areas.[p]	30	6	Yes
11. The Citizens’ Power Council tells us that hunting is not allowed here.[c]	23	13	Yes
Biological/Wildlife Knowledge			
10. In general, we see the majority of hunted animals on farms.[p]	28	8	Yes
11. Campesino hunters have to know how to identify animal prints.[p]	36	0	Yes
12. Paca is the tastiest wild meat.[p]	33	3	Yes
13. Watering holes are the best places to find hunted animals.[p]	35	1	Yes
14. There are more animals to hunt in the winter that any other season.[c]	24	12	Yes
15. Campesinos hunt snakes because there are so many.[p]	21	15	Yes
16. Campesino hunters avoid killing pregnant animals.[p]	20	16	Yes
17. Agoutis reproduce during the entire year.[c]	29	7	Yes
18. We do not hunt deer because they are not abundant.[c]	32	4	Yes
10. Animal trails indicate to us where to find hunted animals.[c]	34	2	Yes
Practical Hunting Knowledge			

10. Campesinos here use dogs to hunt.[p]	35	1	Yes
11. Hunting by campesinos is sustainable because few people do it.[k]	30	6	Yes
12. Hunting usually occurs on private property.[p]	29	7	Yes
13. The campesinos hunt whenever they have the opportunity.[p]	32	4	Yes
14. "Hunting" means to kill an animal.[k]	35	1	Yes
15. We would hunt if there were more animals.[c]	31	5	Yes
16. Campesino hunting is bad for conservation.[k]	31	5	Yes
17. The majority of campesino hunters sell their meat to restaurants in Rivas Department.[p]	17	19	Yes
18. Campesino hunters primarily hunt at night.[p]	31	5	Yes
19. Campesinos here hunt in groups (of 3 or more).[p]	35	1	Yes
Historical Knowledge			
1. Campesino hunters are an important part of the history of Nicaragua.[k]	36	0	Yes
2. The people here have hunted for generations.[k]	34	2	Yes
3. Hunting knowledge passes from generation to generation.[k]	35	1	Yes
4. Hunting was more common before the (1979) Revolution.[p]	32	4	Yes
5. When I think about campesino history in Nicaragua, I think about hunting.[p]	31	5	Yes
6. Hunting was always hidden here.[p]	27	9	Yes
7. Hunting is a cultural tradition in our community.[k]	30	6	Yes
8. The government regulated hunting in this region before the (1979) Revolution.[p]	16	20	Yes
9. There are fewer campesino hunters here now than there were in the past.[c]	32	4	Yes
10. There are fewer hunted animals here than there were in the past.[c]	34	2	Yes

[a]LTK domains and propositions corresponded to the *kosmos-corpus-praxis* (K-C-P) complex of ethnoecology.

[b]The Spanish acronym for Nicaragua's Ministry of the Environment and Natural Resources (*Ministerio del Ambiente y Recursos Naturales*).

[k]Kosmos

[c]Corpus

[p]Praxis

Figure C-2 CCTpack Cultural consensus analysis script and results.

```
# First, install CCTpack

install.packages(CCTpack, dependencies=TRUE)

# Second, load CCTpack

library(CCTpack)

# Third, load data

data(CCA2019completewithblanks)

# Fourth, produce scree plot to determine number of cultures, looks like one here.

dat <- cctscree(CCA2019completewithblanks)

# Fifth, retrieve factors from the scree plot

cctfac(dat)    # dat$factors
```

Sixth, first test attempt to fit the model with 1 cluster based on scree plot

```
cctfit <- cctapply(data = CCA2019completewithblanks,
            clusters = 1,itemdiff = F, seed = 1,
            samples = 10000,chains = 3,burnin = 2000)
# Seventh, second test attempt to fit the model with 1 cluster and heterogenous item difficulty
because of high DIC values from the sixth step

cctfit <- cctapply(data = CCA2019completewithblanks,
            clusters = 1,itemdiff = T, seed = 1,
            samples = 10000,chains = 3,burnin = 2000)

# Eighth, conduct culture number check and item difficulty check diagnostics, they fit the criteria

cctfit <- cctppc(cctfit)

# Ninth, generate figures of model's posterior results

cctresults(cctfit)

#Tenth, create tabular list of data from ninth step: competencies, biases, and Bayesian credible intervals

cctitem(cctfit) #item difficulty list

cctitemhdi(cctfit) #posterior highest density intervals (HDIs = lower and upper bounds of item difficulties)

cctsubj(cctfit) #competence score list

cctsubjhdi(cctfit) #posterior highest density intervals (HDIs = lower and upper bounds of competence levels)

#Eleventh, export these data and play around afterwards

cctexport(cctfit,filename="CCA2019completewithblanks.Rdata")

#Twelfth, show missing value model estimates

cctmvest(cctfit)

> library("CCTpack", lib.loc="/Library/Frameworks/R.framework/Versions/3.4/Resources/library")
Loading required package: R2jags
Loading required package: rjags
Loading required package: coda
Linked to JAGS 4.3.0
Loaded modules: basemod,bugs

Attaching package: ‘R2jags’

The following object is masked from ‘package:coda’:

   traceplot

xcrun: error: invalid active developer path (/Library/Developer/CommandLineTools), missing xcrun at:
/Library/Developer/CommandLineTools/usr/bin/xcrun
Warning messages:
1: package ‘CCTpack’ was built under R version 3.4.2
2: running command ''/usr/bin/otool' -L '/Library/Frameworks/R.framework/Resources/library/tcltk/libs//tcltk.so'' had status 1
```

```
> library(readxl)
> CCA2019completewithblanks <- read_excel("Documents/Research and Projects/Nicaragua 2014-2017/Nicaragua 2014-2017 Data/Nicaragua 2016-2017 Data/CCA2019completewithblanks.xlsx")
Warning message:
In strptime(x, format, tz = tz) :
  unknown timezone 'zone/tz/2018i.1.0/zoneinfo/America/Chicago'
> View(CCA2019completewithblanks)
> View(CCA2019completewithblanks)
> View(CCA2019completewithblanks)
> data(CCA2019completewithblanks)
Warning message:
In data(CCA2019completewithblanks) :
  data set ‘CCA2019completewithblanks’ not found
> View(CCA2019completewithblanks)
> dat <- cctscree(CCA2019completewithblanks)

 ...Binary (dichotomous) data detected

 ...36 respondents and 52 items

 ...Data has 33 missing values out of 1872

 ...Producing Scree Plot, missing data handled by mode of respective columns
> cctfac(dat) Scree plot values
[1] 9.62 1.85 1.52 1.31 1.21 1.08 0.81 0.68

> cctfit <- cctapply(data = hotcold,
+                 clusters = 1,itemdiff = F, seed = 1,
+                 samples = 10000,chains = 3,burnin = 2000)
Error in loadfilefunc(data) : object 'hotcold' not found
> cctfit <- cctapply(data = hotcold,
+                 clusters = 1,itemdiff = F, seed = 1,
+                 samples = 10000,chains = 3,burnin = 2000)
Error in loadfilefunc(data) : object 'hotcold' not found
> cctfit <- cctapply(data = CCA2019completewithblanks,
+                 clusters = 1,itemdiff = F, seed = 1,
+                 samples = 10000,chains = 3,burnin = 2000)

 ...Binary (dichotomous) data detected

 ...36 respondents and 52 items

 ...Data has 33 missing values out of 1872
module glm loaded
Compiling model graph
   Resolving undeclared variables
   Allocating nodes
Graph information:
   Observed stochastic nodes: 1839
   Unobserved stochastic nodes: 128
   Total graph size: 9592

Initializing model

  |++++++++++++++++++++++++++++++++++++++++++++++++++| 100%
  |**************************************************| 100%
```

```
 ...Performing final calculations

For Continuous Parameters
Number of Rhats above 1.10 :  0 / 79
Number of Rhats above 1.05 :  0 / 79

For Discrete Parameters:
Use function 'dtraceplot()' to see their trace plots

 ...Calculating DIC
DIC : 1616.13   pD : 80.86
> cctfit <- cctapply(data = CCA2019completewithblanks,
+                clusters = 1,itemdiff = T, seed = 1,
+                samples = 10000,chains = 3,burnin = 2000)

 ...Binary (dichotomous) data detected

 ...36 respondents and 52 items

 ...Data has 33 missing values out of 1872
Compiling model graph
   Resolving undeclared variables
   Allocating nodes
Graph information:
   Observed stochastic nodes: 1839
   Unobserved stochastic nodes: 181
   Total graph size: 20516

Initializing model

  |++++++++++++++++++++++++++++++++++++++++++++++++++| 100%
  |**************************************************| 100%

 ...Performing final calculations

For Continuous Parameters
Number of Rhats above 1.10 :  0 / 133
Number of Rhats above 1.05 :  0 / 133

For Discrete Parameters:
Use function 'dtraceplot()' to see their trace plots

 ...Calculating DIC
DIC : 1546.16   pD : 121.45
> cctfit <- cctppc(cctfit)

 ...One moment, calculating posterior predictive checks

Likely variables with missing values are

Likely variables with missing values are

Likely variables with missing values are

 ...Use function 'cctmvest()' to view model estimates for missing data

 ...Posterior predictive checks complete
```

```
[1] "VDI Culture 1 :  40  percentile"
> cctresults(cctfit)
> cctitem(cctfit)
   item ans_Z diff_lam
1     1  1.00     0.75
2     2  0.81     0.95
3     3  0.99     0.90
4     4  1.00     0.31
5     5  1.00     0.80
6     6  1.00     0.38
7     7  1.00     0.44
8     8  1.00     0.24
9     9  1.00     0.50
10   10  1.00     0.16
11   11  1.00     0.16
12   12  1.00     0.24
13   13  0.00     0.18
14   14  0.59     0.92
15   15  0.94     0.95
16   16  0.99     0.87
17   17  1.00     0.80
18   18  0.93     0.95
19   19  1.00     0.55
20   20  1.00     0.71
21   21  1.00     0.52
22   22  1.00     0.78
23   23  1.00     0.61
24   24  1.00     0.08
25   25  1.00     0.24
26   26  1.00     0.17
27   27  1.00     0.77
28   28  0.99     0.88
29   29  0.99     0.88
30   30  1.00     0.45
31   31  1.00     0.38
32   32  1.00     0.24
33   33  1.00     0.17
34   34  1.00     0.50
35   35  1.00     0.55
36   36  1.00     0.37
37   37  1.00     0.16
38   38  1.00     0.45
39   39  1.00     0.44
40   40  0.95     0.94
41   41  1.00     0.44
42   42  1.00     0.16
43   43  1.00     0.08
44   44  1.00     0.23
45   45  1.00     0.17
46   46  1.00     0.16
47   47  1.00     0.45
48   48  1.00     0.60
49   49  1.00     0.44
50   50  0.90     0.95
51   51  1.00     0.31
52   52  1.00     0.16
```

```
> cctitemhdi(cctfit)
  item l_ans1 u_ans1 l_diff1 u_diff1
1    1     1     1 5.2e-01   0.96
2    2     0     1 8.3e-01   1.00
3    3     1     1 7.5e-01   1.00
4    4     1     1 7.9e-02   0.58
5    5     1     1 6.0e-01   0.99
6    6     1     1 1.3e-01   0.65
7    7     1     1 1.8e-01   0.72
8    8     1     1 2.9e-02   0.47
9    9     1     1 2.3e-01   0.76
10   10     1     1 2.0e-03   0.37
11   11     1     1 2.3e-03   0.38
12   12     1     1 3.0e-02   0.48
13   13     0     0 4.0e-03   0.42
14   14     0     1 7.4e-01   1.00
15   15     0     1 8.5e-01   1.00
16   16     1     1 7.1e-01   1.00
17   17     1     1 6.1e-01   1.00
18   18     0     1 8.5e-01   1.00
19   19     1     1 2.8e-01   0.80
20   20     1     1 4.6e-01   0.93
21   21     1     1 2.5e-01   0.80
22   22     1     1 5.6e-01   0.98
23   23     1     1 3.5e-01   0.86
24   24     1     1 2.8e-08   0.24
25   25     1     1 3.0e-02   0.48
26   26     1     1 2.6e-03   0.39
27   27     1     1 5.4e-01   0.97
28   28     1     1 7.2e-01   1.00
29   29     1     1 7.2e-01   1.00
30   30     1     1 1.7e-01   0.71
31   31     1     1 1.3e-01   0.65
32   32     1     1 3.0e-02   0.49
33   33     1     1 3.6e-03   0.39
34   34     1     1 2.3e-01   0.77
35   35     1     1 2.8e-01   0.80
36   36     1     1 1.1e-01   0.63
37   37     1     1 3.7e-03   0.38
38   38     1     1 1.9e-01   0.72
39   39     1     1 1.8e-01   0.71
40   40     0     1 8.3e-01   1.00
41   41     1     1 1.8e-01   0.71
42   42     1     1 3.9e-03   0.37
43   43     1     1 3.9e-09   0.24
44   44     1     1 3.5e-02   0.48
45   45     1     1 2.3e-03   0.38
46   46     1     1 3.0e-03   0.38
47   47     1     1 1.8e-01   0.72
48   48     1     1 3.4e-01   0.85
49   49     1     1 1.8e-01   0.71
50   50     0     1 8.5e-01   1.00
51   51     1     1 7.0e-02   0.57
52   52     1     1 2.3e-03   0.37

> cctsubj(cctfit)
  participant group_Om comp_th bias_g
```

1	1	1	0.65	0.73
2	2	1	0.71	0.40
3	3	1	0.66	0.42
4	4	1	0.70	0.75
5	5	1	0.65	0.58
6	6	1	0.56	0.35
7	7	1	0.76	0.43
8	8	1	0.73	0.71
9	9	1	0.73	0.55
10	10	1	0.72	0.60
11	11	1	0.67	0.48
12	12	1	0.66	0.34
13	13	1	0.71	0.41
14	14	1	0.69	0.56
15	15	1	0.62	0.21
16	16	1	0.71	0.42
17	17	1	0.71	0.32
18	18	1	0.65	0.31
19	19	1	0.53	0.24
20	20	1	0.70	0.41
21	21	1	0.71	0.43
22	22	1	0.62	0.26
23	23	1	0.66	0.54
24	24	1	0.72	0.48
25	25	1	0.65	0.26
26	26	1	0.76	0.81
27	27	1	0.75	0.38
28	28	1	0.67	0.50
29	29	1	0.56	0.32
30	30	1	0.64	0.44
31	31	1	0.68	0.71
32	32	1	0.75	0.57
33	33	1	0.76	0.55
34	34	1	0.65	0.27
35	35	1	0.73	0.57
36	36	1	0.71	0.42

```
> cctsubjhdi(cctfit)
```

	participant	l_th	u_th	l_g	u_g
1	1	0.41	0.88	0.53	0.91
2	2	0.51	0.90	0.15	0.64
3	3	0.45	0.87	0.17	0.66
4	4	0.46	0.92	0.54	0.93
5	5	0.41	0.86	0.36	0.80
6	6	0.33	0.80	0.12	0.57
7	7	0.56	0.93	0.15	0.69
8	8	0.51	0.94	0.47	0.92
9	9	0.52	0.93	0.28	0.79
10	10	0.51	0.92	0.36	0.84
11	11	0.45	0.88	0.24	0.72
12	12	0.46	0.86	0.11	0.57
13	13	0.50	0.90	0.15	0.66
14	14	0.47	0.90	0.31	0.80
15	15	0.42	0.82	0.02	0.41
16	16	0.50	0.90	0.17	0.68
17	17	0.52	0.89	0.08	0.56
18	18	0.43	0.84	0.08	0.54

```
19        19 0.31 0.74 0.06 0.43
20        20 0.49 0.90 0.14 0.67
21        21 0.50 0.90 0.17 0.68
22        22 0.42 0.81 0.05 0.46
23        23 0.44 0.87 0.31 0.75
24        24 0.52 0.91 0.23 0.72
25        25 0.45 0.84 0.04 0.47
26        26 0.53 0.98 0.59 0.99
27        27 0.57 0.93 0.11 0.65
28        28 0.44 0.87 0.26 0.73
29        29 0.33 0.78 0.11 0.54
30        30 0.41 0.84 0.21 0.67
31        31 0.45 0.90 0.49 0.90
32        32 0.54 0.95 0.30 0.83
33        33 0.55 0.95 0.27 0.82
34        34 0.44 0.84 0.04 0.49
35        35 0.51 0.93 0.29 0.82
36        36 0.50 0.90 0.14 0.68

> cctfit$ppeig
          [,1]     [,2]     [,3]     [,4]      [,5]
 [1,]  7.986682 1.590629 1.539927 1.255118 1.0993266
 [2,]  7.804008 1.986974 1.851590 1.532914 1.3371398
 [3,] 10.018996 2.358152 1.522284 1.187986 0.9845468
 [4,]  8.738025 1.663685 1.380877 1.205132 1.0853635
 [5,]  7.567525 1.889299 1.635672 1.269709 0.9468713
 [6,]  9.286555 1.899908 1.746924 1.467428 1.1491290
 [7,]  7.718141 2.036158 1.823731 1.624238 1.1036173
 [8,]  8.616239 1.858121 1.486915 1.149068 1.0412124
 [9,]  9.746304 2.023486 1.585455 1.405165 1.0425852
[10,]  9.945590 2.192067 1.543788 1.416673 1.2778765
[11,]  9.091764 2.111296 1.256810 1.186892 0.9930839
[12,]  9.584284 1.632755 1.409393 1.253013 1.2066662
[13,]  8.471913 1.712584 1.525848 1.488331 1.1382608
[14,]  6.475692 1.957704 1.867761 1.350858 1.1950249
[15,]  8.175177 1.870561 1.504675 1.397321 1.2680409
[16,] 10.409958 2.224179 1.799333 1.332804 1.2055858
[17,]  9.280249 1.925233 1.869839 1.392280 1.3404356
[18,]  8.193371 1.785289 1.533954 1.468849 1.2208875
[19,]  8.270475 1.990467 1.603538 1.357539 1.0718019
[20,]  8.832837 1.963146 1.575631 1.395468 1.0540569
[21,]  8.694579 2.002321 1.509256 1.273963 1.0952729
[22,]  9.055851 1.852124 1.743256 1.364613 1.0729896
[23,]  9.634108 2.197635 1.557895 1.425083 1.1405978
[24,]  7.983682 2.200510 1.489553 1.286006 1.2340632
[25,]  8.287549 1.970979 1.450924 1.274564 1.1612231
[26,]  9.869325 1.911248 1.796021 1.327522 1.2033414
[27,]  9.946648 1.925622 1.490377 1.240210 1.0988078
[28,] 10.926782 1.836973 1.463949 1.287129 1.1507749
[29,]  8.849219 1.985749 1.583734 1.309697 1.1513141
[30,]  8.962591 1.926067 1.605309 1.395739 1.0718885
[31,]  7.142940 2.277411 1.745939 1.431537 1.3528842
[32,]  9.211999 1.730302 1.395713 1.242354 1.0792896
[33,]  9.714613 1.915477 1.475622 1.201961 1.0215658
[34,] 11.011830 2.032418 1.415505 1.273888 1.1777198
[35,]  9.661480 2.158241 1.511599 1.278765 1.2491951
[36,]  9.337608 1.804834 1.656930 1.527146 1.1431446
```

```
[37,]  9.819737 1.638233 1.512915 1.373811 1.2440791
[38,]  9.874903 1.817898 1.662062 1.456201 1.1214651
[39,]  8.939627 1.693470 1.434502 1.311001 1.0435554
[40,]  9.135120 1.600750 1.455298 1.412251 1.2148139
[41,]  8.352706 1.993731 1.676925 1.279883 1.1348805
[42,]  7.380029 1.763457 1.587658 1.547248 1.1150295
[43,]  9.975138 2.060885 1.341164 1.339343 1.0433866
[44,]  8.107463 2.034197 1.688860 1.298544 1.1906573
[45,]  8.906852 1.879793 1.688881 1.507741 1.0415034
[46,]  7.802071 2.061676 1.717008 1.564009 1.2885060
[47,] 10.080784 2.020327 1.574655 1.337761 1.1444581
[48,] 10.221481 2.048357 1.683714 1.427787 1.1545922
[49,]  8.890642 1.735376 1.372994 1.197827 1.0689665
[50,]  8.080582 1.909185 1.495723 1.177528 1.1703308
[51,]  8.300974 1.821909 1.641119 1.481350 1.2175483
[52,]  9.856506 2.086277 1.413089 1.156094 1.1355110
[53,]  8.664337 2.114182 1.563826 1.432999 1.3323456
[54,]  9.759429 1.994179 1.571476 1.478206 1.2908630
[55,]  8.722430 1.831944 1.749576 1.321283 1.1803297
[56,]  9.817906 1.865561 1.635360 1.441867 1.2717924
[57,]  9.397542 1.819259 1.712373 1.403875 1.0190770
[58,] 10.500137 1.948436 1.760217 1.297666 1.0740957
[59,]  8.470291 2.102107 1.483794 1.328976 1.2160917
[60,]  9.020140 1.962979 1.644979 1.336628 1.0615876
[61,]  7.798085 1.849782 1.528820 1.217010 1.1295511
[62,]  9.113316 1.736446 1.406621 1.278778 1.1853719
[63,]  9.066014 1.874657 1.433667 1.198391 1.0749634
[64,] 10.059272 2.004233 1.596881 1.171197 1.1397091
[65,]  9.371958 1.872863 1.442106 1.270872 1.1664760
[66,]  8.821324 2.208457 1.659847 1.046773 0.9708302
[67,]  8.082541 2.176618 1.614873 1.420507 1.2076980
[68,]  9.300024 1.999609 1.407924 1.261350 0.9385507
[69,]  9.510375 1.756634 1.615862 1.172073 1.0637751
[70,]  8.867639 1.883417 1.751800 1.276677 1.0808314
[71,]  9.392309 2.184818 1.711558 1.592362 1.3355955
[72,] 11.003740 1.910984 1.324805 1.199836 0.9913561
[73,]  8.391664 1.878769 1.791281 1.272593 1.1769133
[74,]  8.565181 1.828092 1.545694 1.333919 1.2129412
[75,]  9.964822 1.692561 1.519085 1.298383 1.2207035
[76,]  7.633151 2.159919 1.605799 1.423298 1.0704144
[77,]  9.476159 1.862880 1.740919 1.441350 1.2493984
[78,]  7.480353 1.929157 1.651279 1.364619 1.1340891
[79,]  7.425613 2.041422 1.626357 1.497547 1.1106255
[80,]  9.645115 1.854577 1.648749 1.428527 1.1446750
[81,]  9.091916 2.261265 1.687738 1.344256 1.0106054
[82,]  9.431957 2.223798 1.966833 1.409341 1.1411441
[83,]  9.154115 1.756017 1.710987 1.605527 1.2998313
          [,6]      [,7]      [,8]      [,9]     [,10]
 [1,] 1.0307923 0.8357891 0.7449501 0.6024390 0.4766617
 [2,] 1.1082894 0.8075343 0.6924659 0.5301794 0.3406031
 [3,] 0.8601098 0.7998948 0.5429208 0.4790650 0.3705935
 [4,] 0.9438911 0.8706520 0.6695477 0.5818166 0.5374937
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