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Social norms shape wild bird hunting: A case study from southwest China

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ABSTRACT

Traditional assumptions that wildlife hunting and consumption vary according to local economic development underlie most efforts to engage tropical forest communities in wildlife conservation, but these assumptions are insufficient for explaining many examples of non-economic and non-subsistence hunting around the world. Thus, there is a recognized need for conservation scientists/practitioners to understand the social and cultural factors governing wildlife hunting and consumption. We contribute to filling a gap in understanding how local culture and, specifically, social norms influence wildlife use and in what ways they could augment economic development models for explaining behavior. We studied illegal wild bird hunting among five villages of Indigenous Dai rubber farmers near Xishuangbanna National Nature Reserve in southwest China, a tropical biodiversity hotspot experiencing defaunation and persistent hunting pressure. Our analyses relied on interviews with nine key informants, four months of ethnographic observation, 120 anonymous self-administered questionnaires and 176 in-person structured surveys. We found that monetary income and nutritional subsistence could not explain most wild bird hunting and consumption. Instead, bird hunting was primarily predicted by cultural preferences for recreation and the desire to consume wild bird meat, and wild bird meat consumption was primarily predicted by cultural preferences for its taste. Social norms were central to the persistence of wild bird hunting; significantly predicting wild bird hunting, rewarding skilled hunters with social affirmation, discouraging cooperation with law enforcement, and discouraging efforts to reduce bird consumption. Cultural factors such as folk stories, village history, and ethnic identity undergird positive attitudes toward hunting. Our findings suggest that through its manifestation in social norms, local culture can influence wildlife hunting and consumption in ways unexplained by rational economic maximization. We discuss the implications of social norms for how common behavioral change strategies (i.e. legislation, governance, and community outreach) may or may not alter wildlife hunting and consumption. Importantly, our findings suggest that changing wildlife use necessarily involves cultural and social change, meaning that wildlife conservation

Abbreviations: SAQ, Self-administered questionnaire; XNNR, Xishuangbanna National Nature Reserve.

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practitioners must cautiously consider the cultural and social values associated with wildlife when deciding whether or how to engage communities in wildlife hunting interventions.

1. Introduction

1.1. Background

Legal and illegal hunting pressure exacerbates the multiple threats to vertebrate biodiversity in tropical forested landscapes (Van Vliet et al., 2016), with harmful consequences for ecosystem services and resilience (Harrison et al., 2013). Concerns about the unsustainability of harvests (Fa et al., 2002; Robinson and Bennett, 2004) have motivated a rich recent history of government and non-governmental organization (NGO) engagement with rural forest communities to reduce hunting pressure. Engaging local communities in sustainable management of local wildlife hunting is necessary to avert defaunation (Dirzo et al., 2014), prevent unintended bycatch of threatened species (Harrison et al., 2016), and maintain the social, cultural, economic, and health benefits wildlife provide for people (van Vliet and Nasi, 2008; Golden et al., 2011).

Effectively engaging communities in conservation requires accurate and comprehensive characterization of the factors shaping wildlife use (Nyaki et al., 2014; Wright et al., 2016). The central challenge for hunting interventions is thus to understand hunting and wild meat consumption as a complex product of internal value systems (Rickenbach et al., 2017), social psychology (St. John et al., 2010), resource governance structures (Smith et al., 2019), cultural norms (van Vliet and Mbazza, 2011), monetary income and wealth (Godoy et al., 2010; Kümpel et al., 2010), and political and historical contexts (Duffy et al., 2016).

Most current literature suggests that wildlife hunting and consumption change along a gradient of economic development, transitioning from subsistence behaviors to socially or culturally motivated practices as communities transition from poor to wealthy, rural to urban (Brashares et al., 2011). Studies in tropical rural communities are thus heavily influenced by discourses situating bushmeat within international development (Brown and Williams, 2003; Bennett et al., 2007) and tend to research wildlife hunting and consumption in relation to nutritional needs (Brashares et al., 2004) and household economics (De Merode et al., 2004; Godoy et al., 2010; de la Montaña et al., 2015). This literature has resulted in decades of interventions rooted in assumptions that rational economic considerations determine hunters' behavior, such as community-based natural resource management and integrated conservation and development projects (Adams and Hulme, 2001; Taylor, 2009; Schnegg and Kiaka, 2018). Where governance institutions for sustainable use are absent, wildlife ecotourism and alternative livelihood schemes dominate programs to engage rural tropical communities with wildlife conservation (Kiss, 2004; Nilsson et al., 2016; Wright et al., 2016). Research on social and cultural motivations is more common in studies of recreational hunting in western countries (Shrestha et al., 2012; Kramer et al., 2016), and among urban consumers of wild meat in Asia, Africa, and Latin America, for whom wildlife serves traditional medicinal purposes or conveys social status as a luxury good (Parry et al., 2014; Shairp et al., 2016; Chausson et al., 2019).

Community engagement represents an ethical and humanitarian advancement from exclusionary wildlife conservation practices (Lele et al., 2010), however its utility depends on incorporation of diverse behavioral components beyond poverty (Duffy et al., 2016). Acknowledging the cultural and social basis of behavior often challenges the adequacy of rational economic models for explaining hunting behavior in tropical rural communities. For example, recreationally-motivated Indigenous hunters may still continue hunting even when the activity is strictly outlawed, depleted stocks have driven down catch rates, and harvests are not sold (Chang et al., 2017). Worldwide, the local socio-cultural functions of wildlife hunting are often placed in conflict with national or global governance institutions that only target ecological or economic functions (Fischer et al., 2013). For example, assertion of cultural identity drives controversial indigenous hunting of near-threatened Bar-tailed Godwit (*Limosa lapponicus*) in the Yukon Delta of Alaska (Naves et al., 2019), and intangible cultural benefits from hunting endangered Green Turtle (*Chelonia mydas*) and vulnerable Dugong (*Dugong dugon*), both social and spiritual, are more important to Torres Strait Islanders than their subsistence uses of the meat (Delisle et al., 2018). Understanding local social and cultural contexts has been shown to be central to conservation success globally (Waylen et al., 2010).

Wildlife hunting provides many socio-cultural services for communities around the world. Examples include social gifting and barter exchange of wild meat among forest foragers in central Africa (Lupo and Schmitt, 2017) and social recreational hunting in Europe (Fischer et al., 2013). Research on the hunting culture of Ethiopian pastoralists has described how social norms encourage illegal hunting of large mammals by linking men's hunting success to valued social relationships (Tadie and Fischer, 2013) and acceptance by women (Lowassa et al., 2012). The skill and fitness required to harvest wildlife has resulted in social prestige and respect for successful hunters being documented in cultures worldwide (Lowassa et al., 2012; Sirén, 2012; MacMillan and Nguyen, 2014). Wildlife hunting and consumption are also central to many Indigenous rituals and festivities through which people express cultural identity and social cohesion, such as the *hista* festival of the Kichwa in the Ecuadorian Amazon (Sirén, 2012).

Social norms governing wildlife hunting and consumption vary markedly between cultures even in the same region (Aiyadurai et al., 2010), and they often guide behavior through complex and dynamic systems of taboos (Jones et al., 2008; Nijhawan and Mihu, 2020). Preferences for or avoidance of eating various wildlife species varies culturally, and urban wild meat consumption often differs by ethnicity and childhood experience (van Vliet and Mbazza, 2011; Chausson et al., 2019). Informal taboos and the importance of wild meat to cultural identity, family life, and social relations were better predictors of urban wild meat consumption than income, wealth, or formal laws for Indigenous and non-Indigenous Amazonian townspeople (Morsello et al., 2015). Frequently, people prefer wild meat for the taste it derives from a wild diet or for its perceived healthiness and freshness, yet these preferences are embedded in

and mediated by rich socio-cultural meanings (Doolittle, 2001; Singh, 2010; Chausson et al., 2019).

Our study contributes toward filling a gap in the wildlife conservation literature concerning how culture and social norms shape non-economically motivated wildlife hunting and consumption in a southeast Asian rural tropical landscape. We examine how social norms influence illegal bird hunting and consumption in five Dai ethnic minority communities near Xishuangbanna National Nature Reserve (XNNR) in Xishuangbanna Dai Autonomous Prefecture of southwest China (Fig. 1). Wildlife hunting has been relatively understudied in southeast Asia (Corlett, 2007) and to date the literature has focused mostly on the commercial trade of and demand for medicinal and luxury wildlife products (Coals et al., 2020; Davis and Glikman, 2020), with studies of rural hunting communities focusing on economic and subsistence use (Rao et al., 2010; Evans et al., 2020). Singh's (2010) ethnography in Laos has provided some insight on the role of culture by showing the connection between wild meat consumption and Lao distinctions between civilization and forest, which underlie wild meat's perceived cleanness for rural villagers and its vital potency for townspeople. However, there is a scarcity of quantitative research linking wildlife hunting to non-economic predictors, and that which exists has either shown the importance of recreation in China without investigating the role of social norms (Chang et al., 2019) or has found that social norms are significant predictors of hunting intentions in Sumatra (St John et al., 2018) and behaviors in Taiwan (St. John et al., 2015) without investigating the cultural basis for those social norms. Research into the cultural context for hunting social norms is sparse in southeast Asia, except for brief descriptions of religious and ritual reasons for hunting and not hunting in Arunachal Pradesh (Aiyadurai et al., 2010) and recent ethnographic descriptions of wildlife hunting taboos among the Mishma of the same region (Nijhawan and Mihu, 2020). MacMillan and Nguyen (2014) documented hunting as contributing not only to monetary income but also to social goals such as prestige and respect among the Katu of Vietnam, for whom wedding ceremonies often involved social hunts. However, Chang et al.'s (2017) study on the recreational motivations of non-economic hunting in China seems to be the region's only socio-cultural hunting research in relatively wealthy farming communities. Because wildlife biomass offtake in the region is now mostly directed toward non-subsistence local consumption (Harrison et al., 2016), socio-cultural research on non-economic wildlife hunting and consumption in wealthier rural communities seems to be increasingly important—though strikingly absent—for southeast Asian wildlife conservation. Our study adds to Chang et al.'s (2017, 2019) previous research on hunting in Xishuangbanna by investigating the influence of social norms and their cultural underpinnings through a statistically representative survey of households and by adding ethnographic observation to support quantitative results. Unlike these previous studies, our methods allow analysis of how social and cultural variables are related to wildlife hunting and consumption.

We follow cultural evolutionists' definition of *culture* as "information capable of affecting individuals' behavior that they acquire from other members of their species through teaching, imitation, and other forms of social transmission" (Richerson and Boyd, 2008, p. 5), wherein social norms are some of the micro-scale processes through which cultural information guides behavior (Morris et al., 2015) and through which culture evolves (Mesoudi, 2009). We draw on social psychology to define *social norms* as "rules and standards that are understood by members of a group and that guide and or constrain human behavior" (Cialdini and Trost, 1998, p. 152). As expectations of others' beliefs and actions, social norms are distinct from *personal norms,* which are self-expectations reflecting

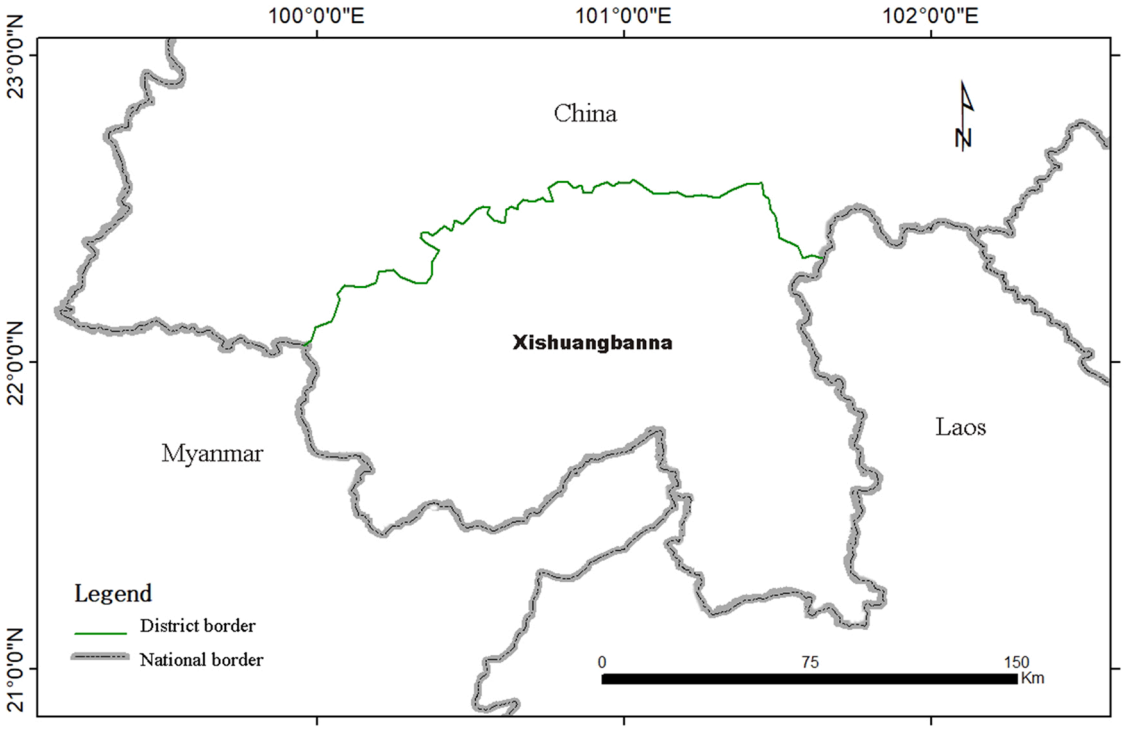

Fig. 1. Map of Xishuangbanna Dai Autonomous Prefecture, Yunnan, China.

personal values (Schwartz, 1977, p. 223). Our measurement of social norms focuses on people's subjective perceptions of such rules and standards (Schultz et al., 2008), and we delineate between *injunctive norms*, which are perceptions of what others approve or disapprove of, and *descriptive norms*, which are perceptions of other people's beliefs and behaviors (Cialdini et al., 1991). Also known as *normative expectations*, injunctive norms are thought to mediate behavior externally to rational utility maximization (Sugden, 2000), making them particularly relevant for understanding non-economic wildlife hunting and consumption. Social norms are comparatively understudied in conservation social psychology (Wallen and Landon, 2020) and have received little attention for their role in pro-environmental behaviors outside the developed world (Farrow et al., 2017), particularly in wildlife conservation (St. John et al., 2010). Our study contributes to filling this gap.

Recognizing the relative scarcity of psychological and human behavioral research in non-western countries (Henrich et al., 2010) and the multitude of approaches for understanding social norms across disciplines (Schultz et al., 2008; Bicchieri and Muldoon, 2011), we adopted an exploratory approach using mixed methods to assess the role social norms and cultural preferences may play in wildlife hunting and consumption among the Dai of Xishuangbanna. We add to the wild meat literature by exploring (1) how social norms shape contemporary wildlife hunting and consumption behavior in a rural tropical forest community in southwest China, (2) how Dai culture may influence wildlife hunting and consumption, and (3) how social and cultural factors can augment economic explanations for wildlife hunting and consumption.

2. Methods

2.1. Study area

Xishuangbanna is an area of high conservation importance characterized by tropical seasonal and montane rainforests (Zhang and Cao, 1995). Intense hunting pressure contributes to defaunation even in large, intact forest patches (Kai et al., 2014; Sreekar et al., 2015b). In one township representative of the region, hunting may have helped drive extirpations of up to 44% of mammals $>$ 1 kg (Huang et al., 2020) and 34% of birds (Sreekar et al., 2015a). Nearly all forms of hunting are illegal under Chapter 3, Articles 20–24 of the Wildlife Protection Law of the People's Republic of China, which bans hunting of protected species, prohibits hunting with snares or traps, and restricts hunting in the nature reserves. Enforcement of hunting laws is weak, though communities are highly aware of them (Chang et al., 2019; Chen et al., 2019). Ownership of guns, traditionally the primary tool for hunting in Xishuangbanna, is illegal under the Chapter 1, Article 3 of the Law of the People's Republic of China on the Control of Firearms, and firearms are regularly confiscated in villages by the police. Because of the illegality of the behavior under study, we do not provide names or exact locations of study communities. We acknowledge that formal distinctions between legal and illegal behavior do not always reflect the moral distinctions made by Indigenous communities or the harm to wildlife caused by different practices (Xu and Melick, 2007a; Sollund, 2016).

Eighteen percent of Xishuangbanna falls under protected areas (Sarathchandra et al., 2018), although their management has sometimes conflicted with local values and perspectives (Xu and Melick, 2007a). XNNR, created in 1958, involved relocation of some Indigenous communities, though it now allows non-timber forest product (NTFP) collection in buffer areas (Zhang and Cao, 1995). Communities also gather NTFPs in communally-managed collective forests (He et al., 2020). Throughout the prefecture, biodiversity loss is primarily linked with historically-subsidized conversion of forest to cash crops, especially monoculture rubber plantations on private smallholdings (Li et al., 2007; Zhang et al., 2019).

As one of Xishuangbanna's 13 officially recognized ethnic minority groups (Xu, 2006), the Dai (Tai-Lue) people governed Xishuangbanna semi-autonomously beginning in the twelfth century, maintaining a complex system of administration, trade, and agriculture based on irrigated lowland paddy rice (Coward, 2006; Giersch, 2006). Dai livelihoods incorporated orchards, home gardens, fuelwood forests, NTFP collection, and wildlife hunting (Wu et al., 2001; Xu et al., 2011). Dai livelihoods and the landscape of Xishuangbanna were fundamentally transformed by the widespread adoption of smallholder rubber plantations beginning in the 1980s (Xu, 2006). Expansion of natural rubber cultivation caused net income in the prefecture to increase eleven-fold between 1983 and 2003 (Liu et al., 2006), leading to greatly increased cash incomes and material wealth for most farmers, though major fluctuations in global rubber prices have led to income insecurity (Xu et al., 2014). Most Dai people now tap rubber as their primary livelihood. Average annual household incomes among the Dai have risen to about $11,600 with poverty rates of only six percent. Metrics of wealth such as car and TV ownership are high, and internet access and cell phone use are widespread. Average life expectancy is 71 years. Government statistics indicate that 61% of the adult Dai population has only achieved a primary school education and 28% are illiterate (Hammond et al., 2015). National legislation in 1987 instituted democratically-elected village committees who resolve village issues and who mediate community relationships with government and external private actors (Taylor, 2004). Dai religion, which combines polytheistic and Buddhist beliefs, underlies traditional institutions for natural resource governance (Zeng and Reuse, 2016).

Although other studies on hunting in Xishuangbanna have included some Dai respondents in their samples (Chang et al., 2019), this is the first such study to focus entirely on this group. This controls for differences between cultures and enables a specific understanding of the meaning of wildlife hunting and wild meat for the most numerous and affluent people of Xishuangbanna (Hammond et al., 2015), with implications for understanding similar questions among culturally related Tai-speaking peoples in neighboring Laos, Myanmar, and northern Thailand (Keyes, 1995).

2.2. Ethnographic observation and key informant interviews

During June – July 2017 and January 2018, the first author (hereafter FAC) lived with a Dai host family in a Dai village not included among the five systematically surveyed in this study (Section 2.6). He engaged in most aspects of village life, including religious and social gatherings as well as numerous forays into the forests and fields with villagers for collecting NTFPs and/or recreation. At this time, he was learning the local Dai language and customs. He explained to the community that he was a student of wildlife conservation at a nearby ecological research institution, which employed many members of the community. During this time, he took field notes about experiences and observations related to wildlife use in Dai culture, and he gained insight into villagers' relationship with wildlife through informal interviews with key informants who were both men (n = 6) and women (n = 3). Informants were often willing to talk about both mammal as well as bird hunting. Although our household surveys (Sections 2.3 and 2.4) focused on bird hunting, we report some ethnographic observations related to mammal hunting because we found they added clarity to our understanding of broader social processes and because ethnographic observations indicated that social norms governing mammal and bird hunting were similar.

Field notes and key informant interviews guided survey development and also provided qualitative results (Sections 3.3.1, 3.4.1, and 3.5.1). FAC discussed results from self-administered questionnaires (Section 2.4) and in-person surveys (Section 2.3) with key informants to guide interpretation of findings (Bernard, 2011).

2.3. In-person structured surveys

In-person structured surveys (hereafter "in-person surveys") collected data on socio-demographics and asked about respondents' perceptions of the major motivations for wild bird hunting and consumption. We explored social norms through questions concerning how most people would react to others who advocated against bird consumption or who reported illegal hunters and whether others would listen if the respondent told them not to hunt/eat wild birds. Survey questions were refined through piloting in two villages prior to data collection. We focused questions on the hunting and consumption of birds specifically, because they are widely caught and can thus elucidate general patterns of hunting while also enabling accurate responses about specific behaviors (Chang et al., 2019). Furthermore, in concurrence with Chang et al. (2019), we found that asking about bird hunting, which is often conducted with snares and mist nets, was less sensitive and therefore more feasible than asking about mammal hunting, which is more connected to illegal gun ownership.

2.4. Self-administered questionnaires (SAQs)

Asking and receiving information about non-compliant hunting behavior is often sensitive (Gavin et al., 2010), particularly so in Xishuangbanna due to firearm prohibitions (Chang et al., 2017, 2019). In order to increase the truthfulness of responses, we collected data on hunting behavior with self-administered anonymous questionnaires (SAQs) that respondents completed in private, away from the interviewer, and inserted randomly among the responses of previous respondents in a large file folder. The first respondents during a day of surveying were presented with a file folder containing six pre-filled "dummy" questionnaires which had been completed by a colleague and were discernible to the researcher only through photos made available after surveying had ended. Respondents were assured that the researcher could not know how they answered. This method mimics the "ballot box method," which has been successfully employed for sensitive questioning in conservation research (Bova et al., 2018). This method allows both behavioral predictors and response variables to be measured via sensitive questioning techniques, which has not been done in Xishuangbanna (Chang et al., 2019).

Because hunting is considered a man's activity in Dai culture, SAQs for men asked men directly about their own bird hunting and bird consumption behavior. In contrast, it was more appropriate that SAQs for women asked women about the bird hunting behavior of the member of their household who hunted most frequently, who could be the woman herself or a household member. However, SAQs for women did ask women about their own bird consumption behavior. Therefore, results pertaining to hunting are reported at the household level, while results pertaining to wild bird meat consumption are reported at the individual level.

Items asked about past-year frequency of hunting for small birds (bulbul-sized), six commonly hunted species of large birds, *Arborophila* partridges, bats, and five species of mammal (Appendix A Figs. A.4–A.7). Respondents checked boxes to indicate hunting tools they or their family member had used in the past. Men were asked to mark their primary purpose for being in the forest during the last time they hunted birds, selecting from a set of potential forest-related activities. When no one in a household hunted birds, respondents could indicate as such.

The SAQ measured variables hypothesized to be correlated with hunting behavior, including injunctive norms, descriptive norms, recreational value of hunting, and cash income over the previous month and year. Injunctive norm and recreation questions allowed for yes/no/neutral type answers, appropriate for respondents with limited education (Chachamovich et al., 2009), and the other three elicited numerical estimates. The question on injunctive norm asked specifically about whether the respondent's friends would approve or disapprove of their hunting (Table 2), because we expected friends to be "important reference individuals" for hunting behavior (Fishbein and Ajzen, 2009, p. 131). The SAQ measured cultural preference for wild meat through ranking exercises in which respondents ranked (1 = best, 4 = worst) wild bird meat alongside three common domestic alternatives (chicken, pork, and beef) in terms of taste, nutrition, and safety (likelihood of diseases or parasites). Respondents were also asked about their wild bird eating behavior in the previous year (location, frequency, and social context). Respondents were also asked how many times they or a household member had sold wild bird meat in the previous year. Finally, personal norms were measured by asking men and women if

they thought hunting birds was right or wrong and by asking women if they would approve of others hunting wild birds (both including a "no opinion" option).

The SAQ consisted of limited, simple wording and abundant pictorial illustrations which were piloted to be comprehensible to those with low literacy (Appendix A Figs. A.4–A.7). Questions were guided by four months of ethnographic observation prior to initiating the study. We evaluated literacy by observing whether respondents could independently complete a nearly identical practice questionnaire concerning mushroom collection and fishing behavior. Approximately 2% of respondents were not literate enough to complete the SAQ and were not asked to complete it (Appendix A Table A.1).

2.5. Sampling

In July and August, 2017, FAC and seven paid local assistants interviewed respondents in five Dai villages (referred to as Village #1-#5 below). We focused on one section of XNNR in a township selected because it has strong evidence of declining wildlife trends. Villages were selected for study based on location within 2 km of XNNR and for having a majority Dai population. Free, prior, and informed consent was obtained according to Colorado State University IRB approved protocol 17-7090H. Respondents were told the nature of questions in each section of the survey and informed of their right to withdraw their participation at any time.

Sampling began from a randomly selected house and continued with every second or third house along predetermined walking routes through each village. Villages ranged from 38 to 116 households. We interviewed one person between 18 and 45 years old in each house, with the upper age limit chosen to maximize respondent literacy. Surveys were administered in either Mandarin or the local Dai language. All respondents (n = 176) completed the in-person structured survey, and 120 respondents also completed the SAQ. SAQ responses were representative of the population at the household level, with either one man or one woman per household responding in Villages 2–4 and only men responding in Village 5. This was because the men surveyed in Village 5 formed a representative sample of households in that community. The women surveyed in Village 5, none of whom completed the SAQ, account for the number of in-person survey responses being greater than the number of SAQ responses.

2.6. Data analysis

We used R version 3.5.3 (R Core Team, 2019) to conduct simple logistic regression models that predicted bivariate hunting behavior as a function of hypothesized variables: injunctive norm, descriptive norm, recreational value of hunting, cash income, bird eating frequency, and interactions of income with social norm and recreational belief. We also conducted logistic regressions predicting bivariate wild bird eating behavior as a function of taste, safety, and nutrition rankings for wild bird meat. Recreational belief, taste, safety, and nutritional ranking were analyzed as categorical variables, and their model coefficients were estimated through Tukey post hoc pairwise comparisons. Regression models used data from men's SAQs. Qualitative responses by both men and women to two open-ended questions (Table 1) were analyzed using a grounded theory approach (Thornberg and Charmaz, 2014) to compile and rank normative expectations regarding how others would respond to those who collaborated with law enforcement or who advocated against wild bird meat consumption.

Table 1
Variables measured in in-person structured surveys.

Variable	Question wording	Response categories	Method of analysis
Descriptive norms	If someone from outside the village entered the nature reserve to catch birds, would people in this village report this person to the police?	Yes/no	Count
	If a person from your village entered the nature reserve to catch birds, would people in this village report him/her to the police?	Yes/no	Count
	If you told others not to hunt birds/eat birds, would they listen to you?	Yes/no	Count
Injunctive norms	How would others think about a person who reported an illegal bird hunter from your community to the police? (asked only in Villages #2 - #5)	Open-ended	Thematic coding
	How would others respond to a person who told them not to eat wild bird meat?" (asked only in Villages #2 - #4)	Open-ended	Thematic coding
Motivations for hunting wild birds	Why do you think other people hunt?	Respondents answered yes/no to each of the following fixed answer choices: "to sell," "because it is fun," "to be with their friends," "to eat," "tradition," and "other reason."	Count
Motivations for eating wild birds	Why do you think people eat birds?	Respondents answered yes/no to each of the following fixed answer choices: "because they taste good," "because the meat is safer," "because they want to supplement their nutrition," "because they want to save money," or "another reason."	Count

Table 2
Variables measured on self-administered questionnaires (SAQs).

Variable	Question wording	Response type	Method of analysis
Bird hunting behavior	Men: Within the past year, how many times have you caught small birds? Women: [Consider in your family in the past year, who caught birds most frequently] In the past year, how many times did this person catch birds?	Respondents were shown many pictures of small birds that would typically be caught with nets, such as bulbuls. Respondents wrote the number of times they had caught such birds.	Count
	Men: Within the past year, each time you catch small birds, how many small birds do you catch? Women: [Consider in your family in the past year, who caught birds most frequently] In the past year, how many birds does this person catch each time they go hunting?	Respondents wrote an estimated average number of birds	Count
	Men: In the past year, how many of the following large birds have you caught? Women: [Consider in your family in the past year, who caught birds most frequently] In the past year, how many of each of the following birds did this person catch?	Respondents wrote how many of each of seven species (Silver Pheasant, Red Junglefowl, Arborophila sp., Gray Peacock Pheasant, Great Barbet, Mountain Imperial Pigeon, and Emerald Dove) they had caught. An "I don't hunt" option was also provided for respondents to mark if they did not hunt	Count
Characteristics of bird hunting	Men only: The last time you went hunting, what was your primary motivation for being in the forest?	Respondents were asked to check all that applied of seven fixed answer choices (catching birds, collecting mushrooms, collecting bamboo, collecting rattan, picnicking with friends, hunting other animals, and "other"). An "I don't hunt" option was also provided for respondents to mark if they did not hunt	Count
	Men: What method do you use to catch birds? Women: Which methods has [the person in your house who catches birds] used to catch birds?	Respondents were asked to check all that applied of seven methods (net, gun, slingshot, snare for large ground birds, basket trap for ground birds, small snare for songbirds, and poison) An "I don't hunt" option was provided for respondents to mark if they did not hunt.	Count
	Men only: On average, how many people do you go hunting with?	Respondents wrote a number	Count
	Men: In the last year, how many times have you sold birds? Women: In the last year, how many times has [the person in your house who catches birds] sold birds?	Respondents wrote a number	Count
Characteristics of bird eating behavior	In the past year, how many times have you eaten wild bird meat?	Respondents wrote a number	Count
	Last time you ate birds, how many people were you with?	Respondents wrote a number	Count
	The last time you ate wild bird meat, where were you ?	Respondents were asked to check one of the following options: "I don't eat wild bird", "my own home", the home of a friend or relative", "restaurant", within the forest", or "another location"	Count
Recreational hunting motivation	Men only: Do you think catching birds would be fun?	Respondents were asked to circle one of three options: "not fun" "no opinion", and "very fun"	Simple logistic regression with hunting behavior
Economic hunting motivation	How much money did your family make last month?	Respondents wrote a number (in RMB)	Same as above
Injunctive norm	If you catch birds, how would your friends feel about it?	Respondents were asked to circle one of three options: "disapprove", "no opinion", and "approve"	Same as above
	Women only: Would you approve of others catching wild birds?	Respondents were asked to circle one of three options: "disapprove", "no opinion", and "approve"	Count
Descriptive norm	Please predict what percent of men in this village have hunted birds in the past year.	Respondents wrote a percent	Simple logistic regression with hunting behavior
Personal norms	Do you think catching birds is right or wrong?	Respondents were asked to circle one of three options: "wrong", "no opinion", and "right"	Count
Cultural preference for wild bird meat	Which kind of meat is the most nutritious?	Respondents were asked to rank domestic chicken, domestic pork, domestic beef, and wild bird meat from 1 to 4, with 1 being the most favorable rating.	Simple logistic regression between ranking of wild bird meat and wild bird meat consumption behavior
	Which kind of meat is the safest?	Same as above	Same as above
	Which kind of meat is the tastiest?	Same as above	Same as above

Some questions were asked differently for men and women, and both question wordings are given here. Note that the previous year's income was also measured on SAQs, however recall errors resulted in heavily skewed results and a high level of missing data. Because previous year's income was strongly correlated with previous month's income ($p < 0.05$), we retained only previous month's income as our measure of household economic condition

3. Results

3.1. Study population

Response rate was 93%. Of 176 respondents, 92 (52%) were men, and 84 (48%) were women. The average age was 32.13 years (s.d. = 7.39). The average household size was 5.42 people (s.d. = 1.40). Eighty-three percent of respondents had lived in the same village for their entire lives; average residency time was 28.29 years (s.d. = 10.68). Formal education levels were low: 88% had at least completed elementary school, but 82% studied no further than middle school. Most (99%) households' livelihoods relied on cultivating rubber for sale to latex processing facilities. Eighty-four percent of respondents raised chickens, 53% raised pigs, and 11% raised water buffaloes and ducks, primarily for personal consumption. Previous year's household income estimates averaged USD $5231.34, (s.d. = $3405.98). Only 1% of our sample reported yearly incomes below China's per capita poverty line of 2300RMB (USD$334).

3.2. Characterization of wild bird hunting and consumption (SAQ data)

Respondents from 120 households with Dai men between 18 and 45 years of age agreed to complete SAQs ($n_{women} = 45$, $n_{men} = 75$). Of these households, 19% included a member who had hunted birds during the previous year. An additional 3% of households with hunters indicated tools they used to hunt birds but did not explicitly report hunting in the previous year. Across all five villages, households with hunters reported killing 78 birds of at least four Level 2 key protected species under China's 2021 Wildlife Protection Law: six Silver Pheasants (*Lophura nycthemera;*), 43 Red Junglefowl (*Gallus gallus*), 24 Partridges (*Arborophila sp*), 5 Mountain Imperial Pigeons (*Ducula badia*); as well as 9 Great Barbets (*Megalaima virens*), 12 Emerald Doves (*Chalcophaps indica*) and an estimated 643 small passerines during the previous year. Hunters in these households caught small birds on average 3.4 times/yr (min = 1, max = 10, s.d. = 3.07). The percentage of households with hunters varied between villages, with a high of 43% and a low of 17%. Only one household reported a hunter selling harvested birds. Overall, 27% of surveyed households reported having a member who hunted birds, bats, or non-bat mammals in the past year. See Appendix B Table B.4 for a summary of the mammals harvested and Appendix B Tables B.5–B.6 for extrapolated estimations of hunter prevalence and annual harvests.

Guns were used by hunters in 27% of hunting households, nets by 66%, and slingshots by 88%. Large snares and basket traps meant for catching larger ground birds were used by hunters in 16% and 27% of hunting households, respectively. Twenty-two percent used small songbird snares.

Table 3
Social norms.

Type of response	Count of responses	Percentage	Exemplary quotations
Dislike for the person who reported	64	70.33%	"People would want to kill [that person]" (Man, 23) "People would think he/she is wrong" (Woman, 25) "People would beat [that person] up" (Man, 29) "People would hate [that person]; they would look down on [that person]" (Woman, 28)
Support for the person who reported.	10	10.99%	"They will think this person is protecting the animals" (Man, 33) "Those who understand this person would think what he did was right" (Man, 31) "They would recognize the action was correct, but they still wouldn't like that person." (Man, 27) "People need to report to the police if they can't first persuade the hunter" (Man, 43)
Social repercussions for the person who reported	8	8.79%	"You need to think about your own future before deciding to report somebody to the police" (Man, 28) "It would ruin the neighbor relationship." (Man, 25) "People would bear grudges against this person for his/her whole life" (Man, 40)
Perspectives vary	8	8.79%	"Everyone's way of looking at things is different" (Woman, 42)
Situation is impossible/could never happen	8	8.79%	"Nobody would report to the police" (Woman, 27, Village 2) "I don't know, because nobody has ever reported before) (Woman, 28)
Feeling that this person is "getting in other's business"	4	4.40%	"They would think that person is minding other people's business" (Woman, 18)
Depends on the person reporting	2	2.20%	"It depends on who called the police" (Man, 32)

Responses to the question, "How would others think about a person who reported an illegal bird hunter from your community to the police?" (n = 91, Villages #2-#5). Totals exceed 100% because some responses were assigned to multiple categories.

Thirty-three respondents (28%) reported eating wild-caught birds during the past year, including 27 men (36% of men) and 6 women (13% of women). Forty-seven respondents (39%), including 35 men (47% of men) and 12 women (27% of women), indicated eating wild birds at some time in the past. Respondents who consumed wild birds reported eating wild birds 2.25 times per year on average (s.d. = 1.32, min = 1, max = 7). Hunters ate wild birds at a significantly higher frequency (mean = 3.67, s.d. = 2.10) than non-hunters (mean = 0.93, s.d. = 2.11). Bird consumption frequency was a significant positive predictor of hunting (B = 0.45, s.e. = 0.13, p = 0.00045, Table 4).

3.3. Social norms and wildlife hunting and consumption

3.3.1. Data from ethnographic observation and key informant interviews

Wild bird meat can be a symbol of hospitality to guests, served during special occasions. When one of FAC's field assistants married, her father served bowls of fried passerines to his son-in-law's family. FAC also observed a village official serving wild meat to his friends at an informal gathering. A separate village official stated that everyone hoped to be the friend of a skilled hunter, because they wanted to be invited to share his catch. Key informants said that hunters shared their harvest with friends and neighbors, only exchanging wild meat for money in cases of surplus harvest and then only with weaker social connections. Good harvests from hunting received social affirmation and respect. However, key informants explained that the prohibitions on guns and hunting had greatly increased the level of social intimacy required for sharing wild meat, limiting intra-village communication regarding hunting. Villagers respected others' right to hunt as they pleased and treated harvested wildlife as personal property of the hunter. When coming upon bats caught in nets set by others, the villager accompanying FAC expressed anxiety about damaging his reputation in the community if caught setting another person's bats free.

3.3.2. Data from in-person surveys

Seventy percent of respondents predicted negative societal responses to someone who reported a community member for illegal hunting. Responses ranged from hatred to viewing the person as "nosy" or "in other people's business" (Table 3). Accordingly, only 35% percent of respondents felt their fellow villagers would call the police on a hunter from within the community, significantly less than the 81% of respondents who said the police would be called on a hunter from outside the community (n = 174, X^2 = 74.37, p < 0.05). Twenty-nine percent of respondents thought that an advocate against bird consumption would receive others' ridicule or hate, while a further 46% thought a hypothetical advocate would be misunderstood or fail to convince others, indicating normative expectations against anti-bird consumption advocacy (n = 66, Villages 2–4, Appendix B Table B.3). Only 4% of respondents felt that others would listen if they were told not to catch birds and 42% felt confident that nobody would listen (n = 149), indicating widespread perceptions of support for bird hunting. Forty-five percent of respondents believed nobody would listen if told not to eat birds, and 49% felt a portion of the community would not listen (n = 143), indicating perceptions that others support bird consumption.

3.3.3. Data from SAQ

Injunctive norms significantly predicted bird hunting behavior (B = 0.52, s.e = 0.22, p = 0.019, Table 4). Compared with non-hunters, hunters were significantly less likely to feel that their friends would view hunting negatively or ambivalently (X^2 = 14.08, p < 0.001). They also perceived more positive descriptive norms regarding hunting in their communities, estimating greater

Table 4
Coefficients from logistic regressions between predictor variables and bird hunting in the previous year.

Predictor of bird hunting		Estimate	St. Error	z-value
Recreational Belief	"Neutral" → "Fun"	-1.5870	0.8461	-1.876
	"Not Fun" → "Neutral"	-0.8049	0.8054	-0.999
	"Not Fun" → "Fun"	-2.3918**	0.7184	-3.330
Injunctive Social Norm	"Neutral" → "Disapprove"	1.2261	0.6874	1.784
	"Approve" → "Neutral"	1.9148	0.9483	-2.023
	"Approve" → "Disapprove"	3.1409***	0.9884	-3.178
Descriptive Social Norm		0.0180	0.0170	1.056
Income		-0.1840	0.3266	-0.563
Recreation X Income	"Fun" X Income	4.5151*	2.1209	2.129
	"Neutral" X Income	-1.4642	1.0706	-1.368
	"Not Fun" X Income	-0.4700	0.4892	-0.961
Injunctive Social Norm X Income	"Approve" X Income	-2.5849	2.0551	-1.258
	"Neutral" X Income	0.7498*	0.4100	1.829
	"Disapprove" X Income	-0.1466	0.4895	-0.299
Descriptive Social Norm X Income		-0.000454	0.0173	-0.263
Bird Eating Frequency		0.4499***	0.1282	3.510

The second column specifies the comparison of values for which estimates apply. Coefficients of recreational beliefs and injunctive social norms are obtained from post-hoc Tukey pairwise comparisons.

* p < 0.05.

** p < 0.01.

*** p < 0.001.

percentages of men hunting in their communities (mean = 15.11%, s.d. = 15.2) compared with non-hunters (mean = 10.05%, s.d. = 15.56), although the difference was non-significant ($p > 0.05$). Interestingly, 84.4% of women reported disapproving of wild bird hunting, and 82.7% of men and 91.1% women thought hunting wild birds was "wrong" (see discussion).

Social bonding was also associated with bird hunting, with 56% of hunters indicating that picnicking with friends was their primary purpose for being in the forest the last time they killed a bird. Hunting usually occurred in groups (mean group size = 3.28 people, min = 1, max = 9, s.d. = 2.29).

Akin to our findings regarding hunting, patterns of wild bird meat consumption also indicate that this behavior is subject to social influence. Fifty-six percent of men who consumed wild birds did not hunt, indicating that wild bird meat is shared. On average, birds were eaten in groups (mean group size = 5.65 people, min = 1, max = 10, s.d. = 2.34). Forty percent of respondents (49% of men and 17% of women) who consumed wild birds most recently ate birds at a friend's or relative's home. Fifteen percent of respondents who consumed wild birds most recently ate wild birds in restaurants, implying social settings.

3.4. Culture and wildlife hunting and consumption

3.4.1. Data from ethnographic observation and key informant interviews

Ethnographic observation and key informant interviews support a link between positive attitudes toward hunting and cultural identity, often expressed as memories of times before stricter enforcement of wildlife protection laws. The older generation of villagers recalled times when the skilled hunters hunted twice a week, and villagers still respected certain elders for their past hunting abilities and knowledge of the forest. Key informants showed nostalgia when recounting memories of netting large numbers of birds around fruiting trees. Reflecting its historical importance in Dai livelihoods, wildlife hunting is a central plot element and a common activity of heroic protagonists in folk stories within FAC's host village. For example, after being raised by a forest spirit, the heroic king of Xishuangbanna frequently hunts wildlife in "The Story of Xishuangbanna," recorded in an old book regarded as a community heirloom. Another folk story told by villagers, which was translated to Chinese by the county people's committee (Ai et al., 1993, pp. 469–473), explains the parental care of the breeding male Great Hornbill (*Buceros bicornis*) as the reincarnation of a legendary, caring hunter, who brought fruits (and of course meat) home to his pregnant wife after each hunting trip. In these stories, hunting is associated with skill, bravery, and provisioning for family.

Hunting clearly held recreational allure for some people. One key informant reported hunting Palm Civets (*Paguma larvata*) purely for sport when non-Dai friends from another province visited him. Discussion with these friends revealed that they viewed hunting and eating wildlife as an important part of local tradition to experience during their visit. FAC also took note of villagers talking of domestic cattle set loose in another village's forest for hunting by customers with rented guns. Finally, although women typically do not hunt in Dai society, a woman key informant said she had gone hunting simply for the thrill of the experience.

Catching and eating wild bird meat is considered part of Dai cultural identity in much the same way as the collection of other culturally important NTFPs such as wild fish, which most Dai men catch regularly with nets and basket traps. Sharing wild caught fish around a campfire with friends is an almost universal pastime and social activity, and key informants explained that, before anti-hunting laws were better enforced, they gathered together in the same way to eat wild caught birds.

Key informants revealed a cultural preference for the taste of wild meat linked to wild animals' diverse forest diets. For example, one key informant attempted a breeding operation with wild caught Red Junglefowl because their meat could sell for higher prices

Table 5
Coefficients of logistic regression between predictor variables and past bird consumption behavior.

Predictor of bird consumption		Estimate	Std. Error	z-value	p-value
Monthly Income		-0.2105	0.1996	-1.055	0.2916
Taste Ranking	1 → 2	0.17435	0.66189	0.236	0.9935
	2 → 3	-1.45529	0.68197	2.134	0.1402
	3 → 4	0.06899	0.54116	-0.127	0.9992
	1 → 4	-1.21194	0.51563	2.350	0.0855*
	1 → 3	-1.28093	0.60815	-2.106	0.1487
	2 → 4	-1.38629	0.60093	2.307	0.0946*
Safety Ranking	1 → 2	-1.02962	0.59911	-1.719	0.313
	2 → 3	-0.18760	0.60014	0.313	0.989
	3 → 4	0.01633	0.52698	-0.031	1.000
	1 → 4	-1.20089	0.52579	2.284	0.101
	1 → 3	-1.21722	0.57118	-2.131	0.143
	2 → 4	0.17127	0.55713	0.307	0.990
Nutritional Ranking	1 → 2	-0.9445	0.7443	-1.269	0.576
	2 → 3	-0.1542	0.6773	0.228	0.996
	3 → 4	0.2601	0.4740	-0.549	0.945
	1 → 4	-0.8385	0.5656	1.483	0.441
	1 → 3	-1.0986	0.6249	-1.758	0.287
	2 → 4	0.1059	0.6230	-0.170	0.998

The second column specifies the comparison of values for which estimates apply. Coefficients for taste, safety, and nutritional rankings are obtained through post-hoc Tukey pairwise comparisons.

* $p < 0.1$.

than domestic chicken, but he observed that the superior taste could not be maintained without replication of their wild diet. Villagers frequently said the pork and chicken sold at market lacked taste, because it came from non-local breeds and was fed a factory-made mix of grain and chemicals.

3.4.2. Data from in-person surveys

Many survey respondents referred to traditional reliance on natural resources as a part of their rural and ethnic identity, explaining that their communities "live near the mountain and rely on the mountain." This common phrase reveals a pervasive mindset among respondents about how their close relationship with the forest set them apart from urban or non-ethnic minority people. Most respondents (67%) believed others ate birds because of taste preferences, but some stated that others ate wild birds because wild bird meat was safer (13%) or more nutritious (10%) than domestic alternatives.

3.4.3. Data from SAQs

We found that taste preference significantly predicted wild bird meat consumption. Respondents who ranked wild birds as least tasty were significantly less likely to eat bird meat than those ranking it as tastiest ($B = -1.21$, s.e. $= 0.52$, $p = 0.086$) or second tastiest ($B = -1.39$, s.e. $= 0.60$, $p = 0.095$; Table 5). Furthermore, capture of wild birds and other wildlife often coincides with collection of other NTFPs that are important in traditional Dai cuisine, furniture-making, or construction. Thirty-one percent of men who hunted birds stated on SAQs that the last time they caught birds, their primary motivation for being in the forest was to collect wild mushrooms, wild vegetables, or rattan. Finally, SAQs further confirmed the recreational value of hunting for the Dai; beliefs that hunting was fun significantly predicted hunting behavior ($B = -2.39$, s.e. $= 0.72$, $p = 0.0025$, Table 4).

3.5. Economic factors and wildlife hunting and consumption

3.5.1. Data from ethnographic observations and key informant interviews

We found that households' economic conditions tended to be unrelated to their wild bird hunting and consumption behavior. Domestic pork, chicken, and fish are widely raised or are available at affordable prices from local breeders or the town market, with occasional price increases for pork. A key informant explained that now people eat wild meat not because they have no alternative, but because they "feel the itch" to taste it. However, at least two households in the first author's host village were economically vulnerable and were known to obtain economic savings and nutritional benefits from NTFPs including wild meat. Compared with the present day, several villagers recalled both more abundant wildlife, poorer economic conditions, and food scarcity twenty to thirty years ago. According to key informants, wild meat was a common source of protein in village diets during those times. During FAC's fieldwork, villagers still prided themselves on their ability to find food in the forest in part because it gave them security against economic instability.

3.5.2. Data from in-person surveys

Most respondents (72%) believed others hunted primarily to eat the wild meat they harvested. Only six percent believed others ate wild meat because it saved them money. Thirteen percent thought others caught birds primarily for sale.

3.5.3. Data from SAQs

Income did not predict hunting behavior ($p > 0.05$, Table 4). Mean monthly income of hunters (mean $=$ \$515.79, s.d. $=$ \$289.82) was non-significantly less than that of non-hunters (mean $=$ \$576.55, s.d. $=$ \$366.74, $p > 0.05$). Respondents who ate wild birds reported non-significantly lower incomes (mean $=$ \$629.25, s.d. $=$ \$433.39) than those who did not eat bird meat (mean $=$ \$742.65, s.d. $=$ \$642.92, $p > 0.05$). Income also did not predict wild bird consumption ($p > 0.05$, Table 5). However, we found significant effects in recreational beliefs' interaction with income on hunting behavior ($B = 4.52$, s.e. $= 2.12$, $p = 0.033$). We also found significant effects in injunctive norms' interaction with income on hunting behavior ($B = 0.75$, s.e. $= 0.14$, $p = 0.067$) (Table 4).

4. Discussion

4.1. Summary of findings

This study contributes to a limited literature exploring the socio-cultural determinants of non-economically-oriented illegal wildlife hunting in the rural tropics, with important implications for how conservation practitioners engage rural communities in wildlife management. So far as we know, this is the first study to explicitly investigate the role of social norms in mediating wildlife hunting and consumption among a rural farming community in China or mainland southeast Asia. Our work demonstrates that cultural taste preferences predict wild meat consumption and that personal wild meat consumption and recreational beliefs about hunting predict hunting behavior. We also show that injunctive norms predict hunting, and we explore how social norms facilitate wildlife hunting and consumption as embedded components of a culture that ascribes positive meaning to hunting and wild meat.

Although this study did not aim to quantify the threats of hunting on species of conservation concern, the hunting rates we documented indicate that several nationally protected species in XNNR are exposed to unmonitored hunting pressure. Although law enforcement in the area has increased in intensity since these data were collected, awareness of laws and fear of law enforcement were already high (Chang et al., 2019). This study supports growing evidence that law enforcement alone is insufficient to control wildlife

hunting (Keane et al., 2008).

This study did not examine whether hunting was ecologically sustainable, and our results do not causally implicate Dai hunters in biodiversity loss (Weinbaum et al., 2013). This article should not be interpreted as advocacy for interventions in our particular study communities; rather, the discussion below uses our study results as a case through which to explore the ways social and cultural factors may shape how commonly-used interventions impact wildlife hunting and consumption. Because managed wildlife hunting is effectively illegal in China, as it is throughout much of southeast Asia (Harrison et al., 2016), we frame our discussion around a goal of outright reduction in wildlife hunting. This reflects the practical confines within which wildlife conservation practitioners operate, however we acknowledge that community-managed hunting arrangements can sometimes better achieve long-term socio-ecological sustainability (Bodmer and Puertas, 2000; Steinmetz et al., 2006; van Vliet et al., 2015).

4.2. Social norms and behavioral change interventions

This study found that positive injunctive norms significantly predicted hunting behavior, which may partially explain the persistence of hunting in spite of legal disincentives. This is novel evidence for the importance of social influence in guiding wildlife use in our study region, though Chinese farmers' ecological restoration decisions are also known to be affected by social conformity (Chen et al., 2009). Our finding invites consideration of social influence-based strategies to encourage sustainable behavior, which are successful in western contexts but are less common in the rural tropics (Abrahamse and Steg, 2013).

Social marketing campaigns have been employed to save threatened species in China (DeWan et al., 2013) and Laos (Saypanya et al., 2013) and have been suggested as a tool for community engagement to stop hunting in Xishuangbanna (Chang et al., 2019). Social marketing functions through normative messages that foster pro-environmental behavior by focusing people's attention on others' approval of the behavior and by focusing attention away from the prevalence of discouraged behaviors (Schultz et al., 2007; McKenzie-Mohr and Schultz, 2014). In conservation, "pride campaigns" aim to leverage group-norms (e.g. pride in endemic natural heritage (Andriamalala et al., 2013)), which drive sustainable behavior through people's psychological need to adopt "in-group" practices (Ellemers and Haslam, 2011). Societal change occurs through leadership or initiatives that accentuate desired group norms and focus people's attention on their group identity (Turner et al., 2008; White and Simpson, 2013).

However, our study highlights the complexity of social and cultural values that set wildlife hunting and consumption apart from the more malleable environmental behaviors studied in most behavioral change research (e.g. littering, energy conservation, composting; Cialdini et al., 1991; Schultz et al., 2007; White and Simpson, 2013). Wildlife hunting in our study communities likely could not be shifted solely through the social marketing tactics as described above, because it is undergirded by a complex system of beliefs (e.g. that wild bird meat tastes superiorly), social conventions (e.g. socializing with friends via barbecuing wild bird meat; serving wild birds to esteemed guests) and normative expectations (e.g. that others will disapprove of advocating against eating wild birds or collaborating with law enforcement) that would all have to be changed accordingly (Bicchieri and Mercier, 2014; Bicchieri and McNally, 2018).

Our study enables exploration of these beliefs, conventions, and expectations by highlighting a cultural basis for hunting that manifests itself through recreational and gustatory preferences (Section 3.4). First, adding to Chang et al.'s (2017, 2019) findings that recreation motivates hunting, we draw attention to how this may be rooted in aspects of local culture: oral accounts of elders' past hunting adventures, folk stories featuring heroic hunters, and a mentality of self-subsistence that forms an important part of local identity. Second, we found that preference for the taste of wild bird meat predicted wild bird meat consumption. We linked this preference to a belief that the superior taste of wildlife comes from wild animals' forest diet, a belief which is also present among Laotian (Singh, 2010) and urban Chinese (Zhang et al., 2008) wildlife consumers. This finding supports evidence from nearby Vietnam that farmed wildlife would not reduce demand for wild caught meat (Drury, 2009). The cultural foundations of hunting behavior in our study communities reveal why changing wildlife hunting can be so challenging. Community engagement initiatives that have reduced hunting behavior have either conducted culturally-sensitive outreach over several years (Steinmetz et al., 2014) or have revived pre-existing cultural practices that had already limited hunting of certain species (Fernandes, 2006).

Our demonstration of the importance of social norms in shaping wildlife hunting suggests that the lectures and propaganda-style information campaigns currently dominating anti-hunting outreach in Xishuangbanna (Chen et al., 2019) may not, by themselves, result in a reduction in hunting. In our study communities, for example, reduction in hunting and eating wild birds would require open *coordination* among villagers; to merit one's sacrifices, one's decisions to refrain from hunting or eating wild birds would require assurance that others were doing the same. Such coordination would require communal enforcement and communication about shared intentions to deviate from the status quo. Coordination, however, is constricted by two social norms documented in our in-person surveys: (1) a social norm prohibiting interference in another person's wild bird hunting and (2) a social norm encouraging acceptance of and partaking in consumption of wild bird meat with friends and family. These norms become clear via Bicchieri's (2005, p. 11) deconstruction of social norms into *empirical expectations* (i.e. belief that sufficiently many people conform to the norm) and *normative expectations* (i.e. belief that sufficiently many people expect one to conform to the norm). The first norm is supported by empirical expectations that most people approve of hunting (Section 3.3.2) and normative expectations about social sanctions for cooperating with law enforcement (Table 3). The second is supported by empirical expectations that most people approve of eating wild bird meat (Section 3.3.2) and normative expectations that an advocate against bird consumption would be ridiculed (Appendix B Table B.3).

These social norms have two implications for wildlife management. First, they constrain the effectiveness of wildlife protection laws, both by engendering bottom-up collaboration against enforcement (as noted by Chang et al., 2017) and by negating the possibility of local level implementation. For example, although village committee members cooperate with authorities to collect

villagers' muskets and to arrange lectures about nature reserve rules, village committee members are also keenly aware of and bound by pro-hunting social norms (Section 3.3.1). This means that, while frequently recommended (Xu and Melick, 2007b), devolution of natural resource management to village committees would be insufficient to increase compliance with anti-hunting regulations.

Second, even if education campaigns changed individuals' personal beliefs and attitudes, social norms would maintain wildlife hunting and consumption through *pluralistic ignorance,* whereby most people believe a behavior is widely approved of while privately not endorsing it (Bicchieri and Mercier, 2014). Our in-person surveys documented widespread beliefs that others hunt and eat wild birds because of superior taste (Section 3.4.2); however, our SAQs revealed that most people did not rank wild bird meat as tastier than domestic alternatives (Appendix B Table B.2). Likewise, beliefs that others would not endorse advocacy against hunting wild birds (Section 3.3.2) can be compared to findings that most women disapprove of wild bird hunting and that most men and women think wild bird hunting is "wrong" (Section 3.3.3). Lack of communication is an important driver of pluralistic ignorance (Bicchieri, 2005), and our study found that topic sensitivity caused by gun prohibition has constrained communication about hunting (Section 3.3.1). Our findings indicate that reducing bird hunting would require overcoming restrictions on communication and fostering collective shifts in both normative and empirical expectations. The experiences of social change programs around the world indicate that achieving such objectives is difficult, and that it may be best accomplished through a combination of normative media campaigns and facilitated community deliberation whereby open discussions of beliefs induce coordinated shifts in personal beliefs and social expectations (Bicchieri and Mercier, 2014; Bicchieri, 2016, ch 4).

In contrast to a simple case of pluralistic ignorance, our study is also an example of how many beliefs underlying pro-hunting social norms can be accurate reflections of social reality, greatly complicating social change goals. The normative expectation that many others approve of eating wild birds is accurate (39% of SAQ respondents ate wild birds). The normative expectation that others would disapprove of advocacy against eating wild birds is likely also true, because birds were usually eaten in large groups, often at friends' houses or restaurants (Section 3.3.3), in the context of social intimacy, trust, and hospitality (Section 3.3.1). Refusing wild birds or criticizing wild bird consumption in such circumstances would compromise valuable social capital, and, at best, generate psychological distress from failing to meet others' expectations (Sugden, 2000). This means that a hunting intervention would also need to change related beliefs and practices, which may involve fundamental values such as trust, friendship, hospitality, respect, and cultural identity. Culturally sensitive and participatory programs have successfully altered deep-rooted customs by re-shaping cognitive associations between values and the promoted behavior change, being careful to avoid challenging values or important social institutions (Bicchieri, 2016, ch 4; Bicchieri and McNally, 2018). The implications for wildlife conservation are that any externally-driven efforts to affect Indigenous hunting practices would require abundant time and resources, close connections with the community, and strong ecological or social justifications.

4.3. Beyond economic models for wild meat

Our case study adds to a growing body of evidence that economic development is an incomplete indicator of the reasons people hunt and eat wildlife (Morsello et al., 2015). Wildlife hunting and consumption persisted in our study communities alongside economic development and abundant domestic alternatives because they were rooted in cultural preferences for recreation and the taste of wild meat. However, in contrast with wild meat consumption in some urban settings (Zhang et al., 2008; Shairp et al., 2016), this combination of wealth and cultural preferences did not make wild meat an expensive luxury item. In fact, in spite of demand from a sizeable minority of the population, only one hunter in our sample took advantage of (informal) market opportunities to sell their birds. This is likely because any extra meat beyond what hunters could personally consume was shared with friends and family (Section 3.3.1). Although in the past wildlife harvests may have been more commonly traded for money, the low catch rates at the time of time of this study would have left little to sell after satisfying personal desires and social expectations. Even if they did not eat their own harvest, a hunter who profited monetarily without sharing would be breaching a social convention. Thus, at low catch rates, social norms may prevent hunting from becoming commercially oriented in our study communities.

However, our documentation of economic and subsistence benefits for a small minority of households (Section 3.5.1), as well as our finding that recreational motivation and injunctive norms were stronger predictors of hunting for households with higher income (Section 3.5.3), illustrate that economic and food security can still play a role in communities where most hunting is non-economically motivated. These findings emphasize the plurality of motivations behind wildlife hunting and consumption in heterogeneous communities.

5. Conclusions and recommendations

Our study contributes a novel analysis of the social and cultural meanings of wildlife hunting and wild meat in a rural community in the forested southeast Asian tropics, a socio-ecological system where economic development thinking typically dominates wildlife conservation discourse. Recent research showed that although wild meat is hunted by approximately 150 million households across the Global South, on average it contributes only 2% of overall economic and subsistence income for rural households, mostly through direct consumption rather than sale (Nielsen et al., 2018). Yet high levels of overall harvest cause alarm among conservation biologists globally (Benítez-López et al., 2017). To this end, our study offers evidence that wildlife hunting and consumption may sometimes be more of a social and cultural topic than an economic one, and that practitioners should carefully assess potential cultural and social meanings associated with wildlife hunting and wild meat before deciding whether or how to engage tropical forest communities in programs to reduce hunting. We found that, when the trust of reliable informants is gained, key informant interviews and ethnographic observation enable an understanding of the cultural and social factors influencing communities' use of wildlife. Because hunting is

often a sensitive topic, such qualitative methods can allow for triangulation of results from more traditional surveys, which may be vulnerable to response biases (Bernard, 2011; Solomon et al., 2015).

Our study considered the cultural basis for behavioral change, however we did not measure ongoing cultural evolution, in which social norms are dynamic (Mesoudi, 2009). Interaction with non-Indigenous cultures (e.g. with non-Dai Chinese and mainstream Chinese media) can influence a society's social norms (Luz et al., 2015). Future research into the contemporary influence of globalization on beliefs about hunting and wild meat consumption would yield important insights on evolving wildlife hunting norms (Von Essen, 2018). Religion is also a major determinant of social norms and relationships to nature (Zeng and Reuse, 2016). Although study of Dai religious beliefs' and institutions' effect on wildlife use was beyond our capacity and expertise, this represents an important gap in knowledge and an opportunity for inter-disciplinary scholarship to provide a more holistic perspective on wildlife use. Cultural practices around wildlife harvesting are disproportionately researched in non-western Indigenous communities, often by western non-Indigenous scholars (Von Essen, 2018), and we recommend that future studies meaningfully engage Indigenous communities in knowledge co-production (David-Chavez and Gavin, 2018).

Finally, our findings invite further consideration of how social norms may interact with formal regulations. In some cases, informal moral norms have been shown to actually strengthen compliance with even loosely enforced regulations, but these same moral economies (cf. Scott, 1977) may allow for noncompliance in situations where regulations are perceived as unjust (Gezelius, 2002). Attitudes toward natural resource regulations are often more complex than the dichotomy of compliance and non-compliance presented in this study and may be influenced by the perceived fairness of rules and trust in the sensitivity of broader society to resource users' needs (Gezelius and Hauck, 2011; Boonstra et al., 2017). In spite of our findings that social norms can contribute to noncompliance with hunting laws, previous research among hunters in Xishuangbanna found widespread belief in the legitimacy of the law (Chang et al., 2017); this raises questions about how distinct state imposed regulations may be from traditional norms in guiding behavior.

Our research findings emphasize the role of social norms in shaping hunting practices. In closing, we emphasize that caution is needed when social norms and cultural values of non-local conservationists conflict with those of the communities they attempt to engage (van Vliet, 2018). We suggest that before any conservation interventions begin, care should be taken to understand and appreciate the cultural meanings associated with hunting and wild meat.

Ethics approval and consent to participate

This research was reviewed and approved by the Institutional Review Board of Colorado State University, according to protocol 17-7090H.

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CRediT authorship contribution statement

Francis A. Commerçon: Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft, Visualization, Funding acquisition. **Mingxia Zhang**: Conceptualization, Methodology, Writing – review & editing, Supervision, Project administration, Funding acquisition. **Jennifer Solomon**: Conceptualization, Methodology, Writing – review & editing, Supervision, Project administration.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data accessibility

The data that support the findings of this study are available on request from the corresponding author (FAC). The data are not publicly available due to containing some information that could compromise the privacy of respondents.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.gecco.2021.e01882.

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