



Human Dimensions of Wildlife

An International Journal

ISSN: (Print) (Online) Journal homepage: <https://www.tandfonline.com/loi/uhdw20>

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To cite this article: M. Janaki, Rohan Pandit & Rishi K. Sharma (2021) The role of traditional belief systems in conserving biological diversity in the Eastern Himalaya Eco-region of India, Human Dimensions of Wildlife, 26:1, 13-30, DOI: [10.1080/10871209.2020.1781982](https://doi.org/10.1080/10871209.2020.1781982)

To link to this article: <https://doi.org/10.1080/10871209.2020.1781982>



Published online: 18 Jun 2020.



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The role of traditional belief systems in conserving biological diversity in the Eastern Himalaya Eco-region of India

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ABSTRACT

Many areas of biodiversity rich regions in South Asia are governed by local communities through norms and practices enforced by traditional community institutions. The role of traditional belief systems in wildlife conservation in such regions continues to be debated in contemporary conservation discourse. We examined the traditional beliefs and taboos of different tribal communities in the Eastern Himalaya Eco-region and their contribution to natural resource management and biodiversity conservation through semi-structured interviews ($n = 299$) conducted with indigenous communities. Among the 35 threatened mammals of IUCN Red List, 28 received some form of protection from taboos and traditional beliefs. We also explore the relevance of these informal institutions in contemporary society, in the contexts of ongoing socioeconomic changes and global demand for wildlife products. Informal, culturally mediated, self-regulation of communities reliant on natural resources for sustenance provides an opportunity to address the complexities of reconciling human needs with conservation goals.

KEYWORDS

Indigenous beliefs and taboos; informal institutions; community based conservation; biodiversity hotspot; community conserved areas

Introduction

In the Asian context, forests are cultural landscapes where traditional societies are an integral component (Ramakrishnan, 2007). The predominant approach to wildlife conservation has been an establishment of protected areas by the state that curtails community access to resources and focuses on law enforcement (Singh, 1999). State-led protected areas leave little meaningful space for community participation. Local communities continue to bear the burden of conservation, resulting in resentment that is further aggravated by wildlife-caused damage to crop and livestock, injury and loss of human life and poor recourse to compensation or mitigation. It is not surprising that conservationists often find little community support for wildlife conservation, especially when the species in question are potentially dangerous carnivores or crop-raiding wild ungulates that threaten local livelihoods (Madden, 2004). While conservationists are increasingly debating whether land-sharing or land-sparing would cause better outcomes for wildlife conservation and commodity production (Kremen, 2015) many countries have historically practiced sustainable land sharing (Persha et al., 2011; Ranganathan et al., 2008). The debate is primarily framed around agricultural food production, whereas many forest-dependent communities

practice subsistence agriculture and draw most of their other needs from the forests (Fischer et al., 2014).

A globally important biodiversity hotspot that finds itself at the center of this debate is the state of Arunachal Pradesh in the Eastern Himalayas of India. It is one of the 200 globally important eco-regions of the world where conservation is expected to achieve the goal of saving a broad diversity of Earth's ecosystems and ecological processes (Olson & Dinerstein, 2002). The population density is approximately 13/km² (Velho & Laurance, 2013) and the people of Arunachal Pradesh are predominantly tribal, with the scheduled tribes forming 65% of the population. The low population density is dominated by scheduled tribes having subsistence based agriculture as the primary source of income for the majority. Three major legal forest categories in the state are: (a) State led Protected areas (18% of total forest cover), an area where forest management is by the state government; (b) Anchal reserves (21% of the total forest cover), an area where forests are co-managed by communities and forest department; and (c) Unclassified state forest (61% of the forest cover), which is under community control (Velho & Laurance, 2013). With such a large extent of forest in Arunachal Pradesh outside state-led protected areas, informal institutions like taboos and traditional belief systems that require no external enforcement could play an essential role in conservation.

Taboos and traditional belief systems have traditional ecological knowledge embedded in them; this knowledge acts as a “library of information” and teaches people to cope with dynamic changes in the ecosystem (Berkes et al., 2000). Faced with accelerated global change and declining ecosystem services, these knowledge systems help connect present to past, reinforcing resilience in complex socio-ecological systems (Gómez-Baggethun et al., 2013). Earlier, many critics viewed the practice of taboos as irrelevant and dismissed its value in conservation (Colding & Folke, 1997). It was believed that traditional ecological knowledge would only be of folkloric interest and would be forgotten with technological and economic advancement (Gómez-Baggethun et al., 2013). However, traditional ecological knowledge continues to exist in many societies, some even adapting to new ecological and socioeconomic conditions (Gómez-Baggethun et al., 2013). Social groups that have a constant group membership, long-term residence, and heavy reliance on natural resources have often developed successful informal institutions for the management of natural resources (Jones et al., 2008). Hotspots of biodiversity are often located in regions where traditional societies abound (Colding & Folke, 2001; Stevens, 2014; Toledo, 2013). The evolving knowledge systems that exist in traditional societies strengthen human capacity to deal with disturbances and maintain ecosystem services (Gómez-Baggethun et al., 2013).

Can traditional belief systems also play a role in the conservation of biological diversity in a contested space, where the state and the local communities are engaged in a low but simmering conflict over ownership and management of the forests and the biodiversity they harbour? In Arunachal Pradesh, where a majority of the land is currently Unclassified State Forest under community management, the state could re-categorize the area as a protected forest at any point in the future. However, illegal and rampant hunting of wildlife, even inside existing protected areas, is believed to have led to an “empty forest syndrome”, showing that designating a high legal protected status alone may be insufficient for effective conservation (Datta et al., 2008). Within this context of ongoing conflicts regarding forest ownership and wildlife management and conservation, we examined traditional beliefs and practices of 15 tribes in 11 districts of Arunachal Pradesh and their potential role in

conservation. We examine whether the informal institutions embraced by these communities might play a role in maintaining the rich biological diversity in the region and whether consideration of traditional beliefs in conservation planning could influence conservation outcomes.

Methods

Study Area

Arunachal Pradesh, a state in the union of India, is situated in the Eastern Himalaya (Figure 1), which is a part of the Indo-Myanmar biodiversity hotspot (Olson & Dinerstein, 2002). The state is home to 26 major tribes and about 110 ethnic groups. A tribe can have multiple clans who identify themselves as people descended from a common ancestor. Every district in Arunachal Pradesh has different dominant tribes (Figure 1). Most of these tribes practice animism; however, a few tribes like the Monpas, Membas, and Khambas are Buddhists. A majority of these indigenous communities are primarily agro-pastoralists who practice shifting cultivation and have community ownership of land (Aiyadurai et al., 2010). The state continues to support large forested areas, in part due to low human population density (17/km² compared to the national average of 382/km²; Government of India, 2011).

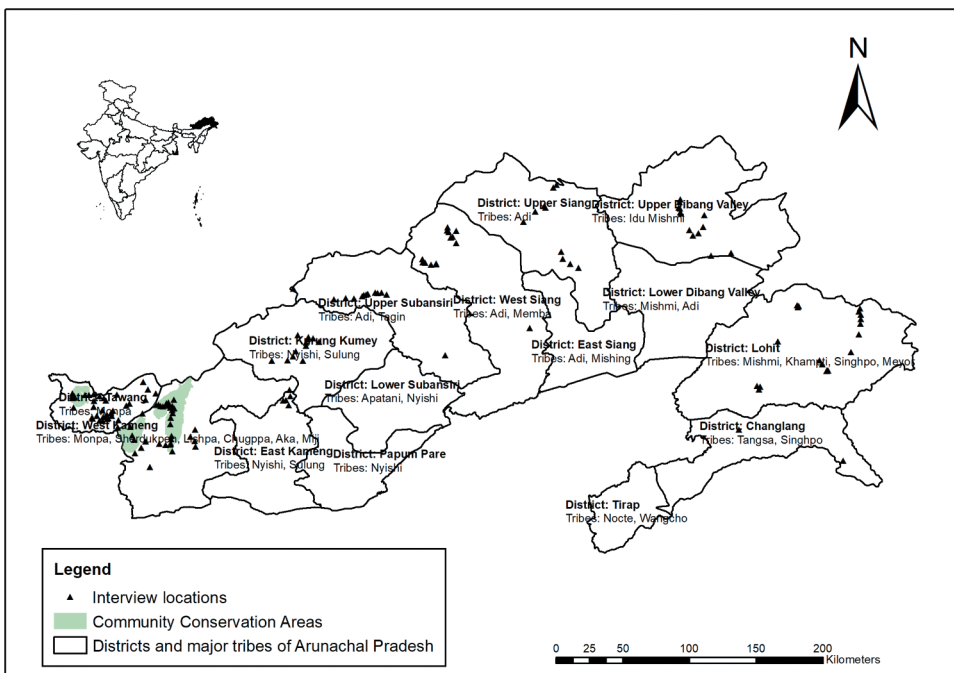


Figure 1. Map of study area depicting sampling locations, community conserved areas and major tribes in the state of Arunachal Pradesh, India. The map inset shows the location of Arunachal Pradesh in India.

Assessing Traditional Beliefs about Wildlife

The survey team comprised of two lead researchers and three local research assistants who assisted in conducting interviews. Since most interviewees were fluent with Hindi (a language spoken across the region), we rarely required any assistance in translation. We conducted semi-structured interviews ($n = 299$) with the indigenous communities in 160 locations (ranging from hamlets, villages, grazing grounds and townships) across 11 districts in Arunachal Pradesh (Table 1). We conducted the study from March 2017 to July 2018. We used snowball sampling to identify hunters and herders for our sampling, preferably in the age class 25–60 years. Hunters and herders were primary targets because of their extensive and active association with forests and use of forest products (including wildlife). In case of unavailability of hunters and herders at a location, village elders and village heads were approached for the interviews. We focused on mammals as they function as umbrella species and are most affected when protection measures are eliminated. The questionnaire covered information on the presence/absence of mammals within community lands and the taboos/beliefs surrounding these mammals and forests. Examples questions and probes deployed during the interviews to understand the traditional beliefs included: “Are there any beliefs/taboo/stories about an animal (wild mammalian species) in your culture? Are there any beliefs/stories about forests? Are there any sacred sites? Are there any restrictions on harvesting any mammal or forest product? Can all members of society harvest any forest products? What happens if somebody does not follow these restrictions?” The information we documented was often in the form of stories and beliefs whose origin varied in religion, medicine, mysticism or even totemism (such as emblems or symbols). We categorized these under a broad definition of taboos and beliefs that prohibited or regulated the use of natural resources. Before conducting interviews, the survey team obtained permission from the village headman/administrative head. We then started the interviews by clarifying the objectives, the purpose of the study, and the right of the interviewee to discontinue at any juncture. We carried and displayed photographic plates of mammalian species to avoid any mistakes in species identification.

Table 1. The districts and tribes in the state of Arunachal Pradesh covered as a part of the study.

District	Tribe interviewed	Interviews conducted
Tawang	Monpa	98
West Kameng	Monpa, Miji	47
East Kameng	Nyishi and Sullung	14
Kurung Kumey	Nyishi	24
Upper Subansiri	Tagin and Galo	19
West Siang	Memba and Bokar	31
Upper Siang	Adi, Memba and Khamba	20
Dibang	Idu Mishmi	23
Lohit	Digaro Mishmi	4
Changlang	Lisu	1
Anjaw	Miju Mishmi, Meyor	18
Total	15	299

Table 2. Colding and Folke's typology of resource and habitat taboos and their nature conservation and resource management functions (Colding & Folke, 2001). Colding, J., & Folke, C. (2001). Social Taboos: "Invisible" Systems of Local Resource Management and Biological Conservation. *Ecological Applications*, 11(2), 584. <https://doi.org/10.2307/3060911>.

S. No.	Category	Function
1	Species- specific Taboos	Total protection of species in time and space
2	Life history Taboos	Regulate withdrawal of vulnerable life history stages of species
3	Segment Taboos	Regulate resource withdrawal
4	Temporal Taboos	Regulate access to resource in time
5	Habitat Taboos	Restrict access and use of resources in time and space
6	Method Taboos	Regulate methods of resource withdrawal

Data Analysis

We used Colding and Folke's typology of resource and habitat taboos (RHT), to classify the information obtained from the interviews into species-specific, life history, temporal, habitat and segment taboos (Table 2) (Colding & Folke, 2001). We used this typology as they base it on an exhaustive literature review from a variety of disciplines such as marine biology, physical geography, anthropology, ethnobotany and ecology and therefore represents a systematic synthesis of existing knowledge on nature-related taboos. Much of existing literature does not deal with taboos principally, referring to them incidentally in nature conservation and natural resource management contexts. Colding and Folk's typology places taboos into six categories based on their potential nature conservation and resource management objectives and explicitly suggests their role in biodiversity conservation and sustainable resource management.

Results

Out of 35 mammals found in Arunachal Pradesh, 28 received some form of protection from taboos and traditional beliefs (Table 3). Among the 28 mammals protected by taboos and beliefs, 8 were endangered, 13 were vulnerable and 6 were near threatened species as per the IUCN Red List. Across 15 tribes surveyed, 14 tribes exhibited taboos against the extraction of ungulates and carnivores. We did not observe any specific taboos for 7 out of the 35 mammalian species (Table 3), yet there were traditional beliefs that revolved around a few of them. For example, encountering the red panda was considered as a good omen, while encountering any species of flying squirrel during the day was considered as a bad omen. We also observed that taboos and beliefs were often consistent for members of the same genus. For example, although most communities have taboos on hunting the tiger (Species-specific taboos), they also avoid killing other cat species.

The indigenous belief systems we explored may not recognize taboos explicitly, and some taboos were referred to in conjunction with traditional knowledge, relationship of people with environment, and natural resource management contexts. The following quote reflects the complexities of identifying and assigning determined values to taboos as they often co-exist with other bodies of knowledge. In the following case, the taboo around a species is interweaved with the ethnozoological use of the species under certain circumstances:

"We revere the Himalayan Marmot as we believe that one of the many reincarnations of the Lama (Buddhist monk) is in the form of a marmot. However, when someone in the village

Table 3. List of mammals classified as per the IUCN's red list with the associated taboos and tribes found in Arunachal Pradesh ($n= 299$) that were Critically Endangered (CR), Endangered (EN), Vulnerable (VU) and Near Threatened (NT).

S. no.	Species	IUCN Status	WPA	Taboo type	Tribe
Family: Elephantidae					
1	Asiatic Elephant (<i>Elephas maximus</i>)	EN	I	Species- specific	Bugun
Family: Lorisidae					
2	Bengal Slow Loris (<i>Nycticebus bengalensis</i>)	VU	I	Species-specific	Mishmi, Meyor
Family: Cercopithecidae					
3	Assamese Macaque (<i>Macaca assamensis</i>)	NT	II	Species-specific	Monpa, Memba, Khamba and Mishmi,
4	Arunachal Macaque (<i>Macaca munzala</i>)	EN		Species-specific	Monpa, Memba, Khamba and Mishmi
5	Capped Langur (<i>Trachypithecus pileatus</i>)	VU	I	Species-specific	Monpa, Memba, Khamba and Mishmi, Meyor
6	Eastern Hoolock Gibbon (<i>Hoolock leuconedys</i>)	VU	I	Species-specific	Monpa, Memba, Khamba and Mishmi
Family: Sciuridae					
7	Black Giant Squirrel (<i>Ratufa bicolor</i>)	NT	II		
8	Namdihapa Flying Squirrel (<i>Biswamoyopterus biswasi</i>)	CR			
9	Bhutan Giant Flying Squirrel (<i>Petaurista nobilis</i>)	NT	II		Monpa
Family: Manidae					
10	Indian Pangolin (<i>Manis crassicaudata</i>)	EN	I		Monpa
11	Chinese Pangolin (<i>Manis pentadactyla</i>)	CR	I		Monpa
Family: Felidae					
12	Asiatic Golden Cat (<i>Catopuma temminckii</i>)	NT	I	Species-specific	Monpa, Miji, Nyshi, Sullung, Tagin, Memba, Khamba, Adi, Bori-Bokar and Mishmi, Meyor
13	Marbled Cat (<i>Pardofelis marmorata</i>)	NT	I	Species-specific	Monpa, Miji, Nyshi, Sullung, Tagin, Memba, Khamba, Adi, Bori-Bokar and Mishmi, Meyor
14	Clouded Leopard (<i>Neofelis nebulosa</i>)	VU	I	Species-specific	Monpa, Miji, Nyshi, Sullung, Tagin, Memba, Khamba, Adi, Bori-Bokar and Mishmi, Meyor
15	Leopard (<i>Panthera pardus</i>)	VU	I	Species-specific	Monpa, Miji, Nyshi, Sullung, Tagin, Memba, Khamba, Adi, Bori-Bokar and Mishmi, Meyor
16	Tiger (<i>Panthera tigris</i>)	EN	I	Species-specific	Monpa, Miji, Nyshi, Sullung, Tagin, Memba, Khamba, Adi, Bori-Bokar and Mishmi, Meyor.
17	Snow Leopard (<i>Panthera uncia</i>)	VU	I	Species-specific Taboo	Monpa, Miji, Nyshi, Sullung, Tagin, Memba, Khamba, Adi, Bori-Bokar and Mishmi, Meyor.
Family: Viverridae					
18	Binturong (<i>Arctictis binturong</i>)	VU	I		Mishmi
19	Large Indian Civet (<i>Viverra zibetha</i>)	NT	II		
Family: Canidae					
20	Wild Dog (<i>Cuon alpinus</i>)	EN	II	Species-specific Taboo	Monpa, Memba
Family: Ursidae					

(Continued)

Table 3. (Continued).

S. no.	Species	IUCN Status	WPA	Taboo type	Tribe
21	Sun Bear (<i>Helarctos malayanus</i>)	VU	II		
22	Asiatic Black Bear (<i>Ursus thibetanus</i>)	VU	II	Species-specific Taboo	Monpa
	Family: Mustelidae				
23	Oriental Small-clawed Otter (<i>Aonyx cinerea</i>)	VU	I		
24	European Otter (<i>Lutra lutra</i>)	NT	II		
	Family: Ailuridae				
25	Red Panda (<i>Ailurus fulgens</i>)	EN	I		
	Family: Moschidae				
26	Alpine Musk Deer (<i>Moschus chrysogaster</i>)	EN	I	Life-history Taboo	Adi and Mishmi
27	Black Musk Deer (<i>Moschus fuscus</i>)	EN		Life-history Taboo	Adi and Mishmi
	Family: Cervidae				
28	Hog Deer (<i>Axis porcinus</i>)	EN	III	Life-history Taboo	Mishmi
29	Sambar (<i>Rusa unicolor</i>)	VU	III	Life-history Taboo	Monpa, Miji, Nyshi, Sullung, Tagin, Memba, Khamba, Adi, Bori-Bokar and Mishmi.
30	Gaur (<i>Bos gaurus</i>)	VU	III	Life-history Taboo	Monpa, Miji, Nyshi, Sullung, Tagin, Memba, Khamba, Adi, Bori-Bokar and Mishmi.
	Family: Bovidae				
31	Mishmi Takin (<i>Budorcas taxicolor</i>)	VU	I	Life-history, Segment and Species-specific Taboo	Monpa, Miji, Nyshi, Sullung, Tagin, Memba, Khamba, Adi, Bori-Bokar and Mishmi.
32	Himalayan Serow (<i>Capricornis thar</i>)	NT	I	Life-history Taboo	Monpa, Miji, Nyshi, Sullung, Tagin, Memba, Khamba, Adi, Bori-Bokar and Mishmi.
33	Red Goral (<i>Naemorhedus baileyi</i>)	VU		Life-history Taboo	Monpa, Miji, Nyshi, Sullung, Tagin, Memba, Khamba, Adi, Bori-Bokar and Mishmi.
34	Himalayan Goral (<i>Naemorhedus goral</i>)	NT	III	Life-history Taboo	Monpa, Miji, Nyshi, Sullung, Tagin, Memba, Khamba, Adi, Bori-Bokar and Mishmi.
35	Chinese Goral (<i>Naemorhedus griseus</i>)	VU		Life-history Taboo	Monpa, Miji, Nyshi, Sullung, Tagin, Memba, Khamba, Adi, Bori-Bokar and Mishmi.

suffers greatly from allergies, Marmot meat is the best cure." (Village head, Monpa tribe, West Kameng district).

We observed taboos under almost all the key domains of Colding and Folke (2001) typology. In the following section, we identify these taboos and practices, attempt to explain their origin and function, and integrate a few examples from other parts of the world.

Species Specific Taboos

Species-specific taboos entail cultural groups banning the killing or detrimental use of specific species in both time and space (Colding & Folke, 2001). Buddhist tribes like the Monpas, Membas, Khambas do not hunt or consume any primates as they believe that primates were their ancestors and they, therefore, attribute religious significance toward the species. Studies also show that the Lindu community from Indonesia prevents harming of macaques, despite the species' crop raiding behavior (Riley, 2010). People of Buddhist faith believed that one of Buddha's reincarnations was a monkey and so they accord the species tolerance and protection in China and Thailand (Riley, 2010).

“We do not hunt monkeys; we even consider it lucky if we encounter a capped langur before setting out for a new job. However, over the years, the macaques have increased in numbers and they cause much damage to our crops, so sometimes we are forced to hunt a few to chase away the large groups of macaques. Otherwise, we do not hunt monkeys; they are our ancestors” (Village head, Monpa tribe, Tawang district).

Species specific taboos may also have their origin in local folklore where people relate closely to certain species. The quote below captures the refrain toward killing elephants linked to folklore that speaks of a close bond between people and elephants.

“We call the Elephant Ama Zomo, which means Mother of the land. There were two bugun (tribe) brothers that lived together. One day the brothers had placed all the meat they had hunted and went for work. This bag of meat suddenly transformed into a woman and cooked for the brothers and went back to be a bag of meat. This kept happening over weeks, and one day the younger brother discovered the miracle, fell in love with the beautiful women and asked her to marry him. She agreed upon the condition that he should never hurt her by saying she is just from meat and not human. However, the elder brother, in jealousy, killed the younger brother and kept his wife. But, one fine day over a fight, he told her she is just meat and nothing more. The lady, in anger, left the house and as she crossed the river, she turned to an elephant and went into the forest. So, elephants are from us and we do not hunt, instead respect the Ama Zomo of our forests.” (Erstwhile Hunter, Bugun Tribe, West Kameng District).

Species-specific taboos often originate by considering animals as religious symbols, the reincarnation of humans and even as an aversion to the presence of toxins in or the unpleasant physical appearance of the species (Colding & Folke, 2001). Amongst the mammalian species in our study area, most carnivores, especially cats, were not hunted or consumed across a majority of tribes as they are totemic symbols of spiritual significance. The Mishmi tribe, who are predominantly animists, believe that the tiger is their ancestral brother born from the same womb. Often most of these tribes have the highest sanctions (in-kind) if they violate the taboo on hunting carnivores. It is interesting to note that many western cultures also avoid eating carnivores given the potential for disease transmission (Jones et al., 2008). The distribution of taboos across traditional societies suggests that humans have evolved predispositions to develop aversions to food likely to make us ill (Jones et al., 2008). Although most of the species-specific taboos have their origin in religious sentiments, the conservation values of these taboos are undeniable.

Life History Taboos

We also found examples of life history taboos wherein a cultural group bans the use of certain species during a vulnerable phase of its life history depending upon age, sex, size, or reproductive status. Across northeast India, indigenous communities have practiced hunting for subsistence over millennia. As part of pre-scientific resource management practices, life-history taboos existed for the hunting of pregnant and young animals of all ungulates for most tribes, especially Nyishi, Adi, Tagin and Apatani tribes. However, it is important to note that with the increasing local and commercial demand for wild meat, ungulates rank high in the most preferred wild meat (Velho & Laurance, 2013). The illegal commercial poaching driven by high demand for various wildlife products in China and Southeast Asia

(Aiyadurai, 2011) may render the influence of taboos, especially life history taboos, ineffective as taboos primarily influence regulated subsistence hunting.

Segment Taboos

Segment taboos are when specific segments or sub-populations of individuals within a society are prohibited from gathering or consuming certain species. Four king clans of Monpas called Monpa Bapu, who live in Thembang in the West Kameng district, do not hunt Mishmi takin (IUCN status: Vulnerable). Local people believe they are the descendants of Wongme Palder, who was of the Tibetan royal lineage. Several generations after Wongme Palder, an unknown king had four sons; from the eldest to the youngest, they were named Khochilu, Sherchokpa, Atjepu and Dirkipa. They became the founders of the royal clans in the Thembang region and were called Bapus. Each of the king clans had servants and sub-ordinates whose descendants formed the four slave clans called Gila. The origin of the segment taboo, where spirits punish Monpa Bapus if they hunt Takin but can consume its meat, can be explained as a mark of power and status of the group.

“As Monpa Bapus (higher clan) we are not allowed to hunt a Takin as we believe that the Takin is a Monpa Bapu itself and if any Bapu kills a Takin, only misery and illness will be cast upon his house.” (Erstwhile hunter, Monpa tribe, West Kameng District).

“Although as Bapus (predominantly yak herders) we own grazing land customarily that extends up to Mago, we have an understanding with the Miji tribe that lives nearby that the land belongs to us and the animals belong to the Miji tribe.” (Village head, Monpa tribe, West Kameng district).

Although we did not delve deep into the dynamics of belief systems where tribes co-exist, the above quotes highlight one such case, where different resource ownerships are allocated to tribes (Monpa and Miji) that co-exist. Such discrepancies can be important to take into account for conservation practitioners.

We saw another example of segment taboo in the women of the Mishmi Tribe in eastern Arunachal, who do not consume any wild meat. The prohibition on the consumption of any wild meat by women belonging to the Mishmi probably stems from customs or perceived health risks. Although these taboos might not have their origin in conservation or protection of a species, segment taboos may serve as a strategic response to avoid game depletion in some traditional societies (Colding & Folke, 2001).

Temporal Taboos

Similarly, temporal taboos entail a ban on access to resources during certain specific periods. A yearly communal hunting event is followed by a ban on hunting for the next few months in tribes such as Nyishi, Adi, Tagin and Apatani of Central Arunachal Pradesh. Anecdotal evidence from discussions with our interviewees also revealed a similar practice among the Shertukpen tribe from western Arunachal Pradesh, who do not hunt one month before their annual religious festival *Chekyor*. These practices by the Nyishi, Adi, Tagin, Apatani and Shertukpen tribes, all have their origins in the prudent and sustainable use of their subsistence resources.

Habitat Taboos

Habitat taboos restrict access and use of resources of a habitat in time and space. Although it might overlap with temporal taboos since restrictions in a habitat can sometimes pertain to certain periods of time, however, the restriction on access and use revolves largely around the habitat and the value ascribed to it. We observed habitat taboos with Monpas of western Arunachal Pradesh, who revere high altitude/glacial lakes/wetlands and therefore regulate the access by imposing restrictions on habitation and resource extraction around these lakes.

“When I used to take my yaks to higher altitude areas during the summer, we used to avoid staying next to the lakes, because we believe if we make too much noise or disturb the lake by littering or extracting firewood, the weather changes within minutes with heavy rainfall or snow and we have also heard about how the lakes engulf people who do not treat the lakes with respect. There have been people who even never woke up the next day.” (Yak herder, Monpa tribe, Tawang district).

We also observed habitat taboos among the Adi and Galo tribes, who considered certain portions of the forest sacred. They believed *Yapom* (female forest spirit) occupied the sacred forests, so they would rarely venture into these patches. When they must venture into these sacred patches, they move in quietly and do not litter or urinate in these areas. They even believed that if anyone disrespected the *Yapom*, small stones would rain down upon them in these sacred patches of forests.

It is difficult to ascertain the origin of habitat taboos in our study. In the case of high-altitude wetlands, this could be a strategy to secure sources of water which are valuable to local communities living in the valleys downstream. Habitat taboos may not have any direct benefit to wild animals but may benefit them indirectly by providing refugia.

Method Taboos

Method taboos involve banning the use of specific methods and techniques for acquiring individuals of a species for consumption. Although we did not observe any method taboos during this study, a recent study explained how the village council of the Shertukpen tribe in Shergaon recently banned the use of dynamite and bleaching for fishing and felling of trees within a 3 km radius around the headquarters of the village council and certain sacred sites (Velho & Laurance, 2013). Another study in the eastern rainforests of Madagascar explained a method taboo in the harvesting of a tropical shrub called Pandan wherein they do not cut the central shoots that are yet to separate as it is necessary for sustained harvesting (Jones et al., 2008). The communities in the Bevoahazo valley in Madagascar also have imposed ban on the use of fishing nets for fishing in the Tsaratango river (Jones et al., 2008). Indigenous communities often develop method taboos based on past lessons learned from over-exploitation of important resources.

Other Beliefs and Practices Influencing Natural Resource Management

Besides taboos and beliefs, we also observed local judiciary systems as formal institutions across different tribes. These institutions solve disputes and punish deviants, but they also play an important role in regulating natural resources by defining a set of rules regarding

land ownership and resource extraction. These formal institutions are known by many names across tribes. For example, the Monpa tribes have a local judiciary system called *Mangma* that often punishes trespassers (including local Monpas) who collect natural resources such as firewood and timber in quantities larger than required for subsistence. They also punish hunters that hunt animals illegally. We observed another formal committee called Gumin Rego Kilaju (GRK) in the Basar circle in the West Siang district that was initially formed to address the hygiene and sanitation issues in the community caused by rearing pigs in the open. However, their role has expanded beyond social issues to the conservation of their forests and natural resources.

We also observed ethnozoological use of animals and other natural resources for a variety of purposes including meat, medicinal, magico-religious, spiritual and even for clothing especially involving mammalian species across all tribes ([Appendix 1](#)).

Discussion

The Role of Taboos and Beliefs in Natural Resource Management

The taboos and beliefs we observed within communities across the state of Arunachal Pradesh have many implications for natural resource management. Traditional ecological knowledge is infused with traditional beliefs and practices and they are passed on to promote resource stewardship and conservation (Chunhabunyatip et al., [2018](#)). Traditional communities have communal land with strict community property rights that restrict outsiders from extracting any resources from their land. The long-term dependence of indigenous people on natural resources fosters a conservation ethic and also establishes an economic incentive for the community to conserve (Gadgil et al., [1993](#)). In our study, we identified many wildlife-related taboos and beliefs with significant consequences for conservation. For example, species-specific taboos that offer protection to elephants among the Bugun tribe and big cats across many tribes in Arunachal Pradesh. However traditional knowledge and practices also extend beyond wildlife to impact other aspects of the ecosystems they inhabit. Another practice extensive in northeast India is *Jhum* cultivation, which is a variation of shifting cultivation, found in the most tropical forests. In *Jhum*, traditional societies nurture sources of ecosystem renewal by creating small-scale disturbances such as fires, which are inherent in the internal dynamics of the ecosystem and often set the timing of ecosystem renewal processes (Berkes et al., [2000](#)). Tribes like the Nyishi, Apatani and Shertukpen have a communal hunt every year which also serves as an evaluation of resources which could help decide which resources to extract and which to avoid, based on their abundance. Many traditional groups have systems in place to monitor the status of shared resources, and the changes in the ecosystem. For example, the Shamans of Tukano, Colombia, schedule yearly hunting excursions where they monitor species abundance based on their field observations (Berkes et al., [2000](#)). A study of Quechua farmers in Bolivia revealed how traditional societies adapt their local practices such as cultivation cycle and geographic spreading of cultivation plots to reduce risk of harvest failure by keeping track of environmental change observed through traditional ecological knowledge systems (Boillat & Berkes, [2013](#)). Traditional ecological knowledge can even provide historical climate knowledge that can provide practical insights into the policy design of adaptation strategies (Boissière et al., [2013](#)). Although it is impossible to correlate

the superior or inferior state of an ecosystem with the existence of strong or weak local institutions (Chunhabunyatip et al., 2018), the spatial and temporal refugia provided to threatened species by traditional societies is undeniable (Colding & Folke, 1997).

We observed a pattern of consistency in beliefs and taboos across tribes in Arunachal Pradesh, where some beliefs and taboos were shared across different ethnolinguistic groups of the tribes. For example, we observed similar taboos across Tani language-speaking tribes (Apatani, Galo, Nyishi and Tagin) a branch of the Sino-Tibetan languages. The most prevalent taboo observed across most of the tribes were taboos against killing carnivores, especially large cats. However, the dynamic nature of human-wildlife interactions has brought about a shift in perception where they consider wild dogs as a menace because of the widespread livestock depredation attributed to them across the state.

“We are traditionally hunters, so we do not kill carnivores, especially cats, since they are hunters too. We dislike wild dogs however and kill them because they are solely responsible for decimating our herds of livestock at one go. Wild dogs are a nuisance.” (Erstwhile hunter, Shertukpen tribe, West Kameng).

When discussing indigenous beliefs systems, it is essential to also consider the ethno-biological uses of wild animals that are infused within cultural and spiritual beliefs. In our study, we recorded the use of several mammals for medicinal, subsistence and magico-religious purposes (Appendix 1).

Wild animals have contributed to human spirituality over generations, and bio-cultural beliefs have influenced how people perceive and use their environment and prevent the exploitation of resources (Alves et al., 2012). Nevertheless, in the face of globalization and commodification of nature, some self-regulating feedbacks that in the past ensured environmental sustainability may no longer be operative (Alves et al., 2012).

Are Indigenous Belief Systems Relevant in Contemporary Society?

When scrutinized closely, many traditional taboos and cultural beliefs bear resemblance with contemporary conservation practices in form, but not in content. For example, taboos and beliefs that prohibit the extraction of particular resources resemble the “preservation” ethic (Muir, 1916) in modern conservation. In contrast, taboos and beliefs that control the extraction/use of specific resources resemble the “conservation” ethic (Callicott, 1990) of modern-day conservation. However, unlike in contemporary conservation, the sanctions in informal institutions are self-enforced either through spirits who are presumed to punish violation by casting illness or bringing bad luck, or other costs that include cash, cattle and social pressure (Colding & Folke, 2001). These informal institutions act as knowledge systems that differ from contemporary conservation measures as they are morally, ethically, spiritually, intuitively and holistically based (Berkes et al., 1995), rather than externally enforced.

Despite the rich knowledge systems that exist in these informal institutions, northeast India has suffered severe population declines and local extinction of large mammalian species because of changing perceptions, the emergence of new illegal wildlife trade markets, and failing government and community institutions (Velho & Laurance, 2013). The lack of economic alternatives or any other source of sustainable livelihood in the region ties the community with the forest; as a result, local residents remain dependent on wildlife hunting (Aiyadurai, 2011). Although traditional practices such as hunting originated as part

of the cultural practices of the community, it became economically beneficial to the people, given the proximity to Myanmar and wildlife trade routes in China (Aiyadurai, 2011). To understand the dynamics of the socio-economic environment and its implications for conservation in socio-ecological systems is a challenge. A systemic review of studies that link biodiversity and poverty revealed that most studies treat poverty as a unidimensional issue, where poverty is almost exclusively measured as income (Roe et al., 2014). However, poverty is a multidimensional concept that does not confine to economic measures but also extends into all aspects of well-being (Harrison et al., 2015). It encompasses many factors such as lack of power, prestige, voice and an inability to define one's future (Sen, 1999). Recognizing the complexities of motivations and political-economic context, illegal wildlife hunting no longer becomes only a conservation concern but also an issue of poverty and development (Duffy et al., 2016).

The cultural beliefs we studied are also at a crossroads because of a shift toward Christianity across northeast India, where many local communities like the Miju Mishmi have abandoned their beliefs systems but continue to hunt (Aiyadurai, 2011). A borrowed culture has become the guiding principle of the younger generations, who consider their culture as a primitive and an uncivilized way of life (Ramya, 2012). In Indonesia, for example, conversion to Christianity resulted in people abandoning taboos against killing and eating of Orangutans (Riley, 2010). Similarly, in Meghalaya, India, traditional beliefs regulating subsistence practice in sacred groves no longer exist and, even if they do, they are mostly disregarded (Khan et al., 2008). Such changes in the socio-cultural environment often result in relaxing of taboos and beliefs and can negatively affect the long-term survival of species and their habitat. With large-scale religious conversions and youth abandoning their traditional belief systems, both the historic belief systems and the ethnozoological uses of natural resources are increasingly less operational. A study focusing on understanding such belief systems in Nongchaiwan wetland in Thailand revealed that while the older generation inherited the spiritual beliefs and practices that helped regulate the behavior and actions of the people dependent on the wetland, the younger generations perceived the wetland as a source of livelihood as those belief systems changed (Chunhabunyatip et al., 2018). These shifts in perceptions and acculturation may eventually lead to the extinction of traditional belief systems and the degradation of natural resources (Chunhabunyatip et al., 2018).

Establishing a connection between traditional belief systems and the conservation of biodiversity is not a simple task. However, approaches to conserve biodiversity based on cultural and religious values are often more sustainable than those based on enforcement and regulation alone (Alves et al., 2012). Failure to recognize local governance systems risk the collapse of existing governance and the erosion of ecological values, including the ecosystem services essential for human well-being (Alves et al., 2012). It is therefore essential to involve forest-dependent communities in the design and implementation of conservation measures from the outset (Alves et al., 2012). Approaches with minimal social resonance, such as stricter enforcement, are likely to fail. Instead, an emphasis should be placed on integrating cultural and spiritual values in wildlife conservation and ecosystem management (Alves et al., 2012).

A myopic view of communities as causes of the environmental problem or helpless victims of circumstances is problematic. We should pay greater attention to the roles of informal institutions in conservation, focusing on a shared search for solutions (Jones et al.,

2008). The recognition of informal institutions and their conservation capacity calls for potential synergy between local communities and conservation managers. There is a need to create multi-stakeholder, indigenous community-led partnerships and collaborations that integrate traditional ecological knowledge to cope with environmental changes and challenges (Davidson-Hunt et al., 2013). Deepening our cultural understanding of traditional societies can help in the design and effective delivery of conservation measures that are compatible with local customs and practices (Kellert et al., 1996). Stories that overlap with indigenous beliefs can also promote more efficient conservation-related communication, for people often respond better to emotions, traditions, and cultural beliefs than scientific facts (Jones et al., 2008).

Community conservation areas (CCA) in the state of Arunachal Pradesh illustrate how traditional knowledge and governance institutions enhance stewardship and promote wildlife conservation. Collectively the CCAs now cover approximately 1300 km² of biodiversity-rich forests. Community-led institutions governing the CCAs incorporate existing cultural practices in the management and set the rules and regulation to govern their natural resources by drawing from their traditional ecological knowledge systems. For example, in efforts to create a synergy between local institutions and conservation managers, WWF-India and the Mandala-Phudung-Khellong CCA management committee integrated scientific and traditional knowledge to commercialize *Xanthoxylum acanthopodium* (Sichuan pepper), a non-timber forest product that has been traditionally harvested and bartered by the Monpa tribe in Mandala-Phudung-Khellong CCA. The community's knowledge of harvesting and nurturing the plant, combined with the scientific knowledge of the plant properties and availability of a profitable market, has led to the sustainable commercial harvesting of the NTFP product. This multi-stakeholder partnership, rooted in traditional knowledge, has created incentives and fostered trust among stakeholders to work together for the biodiversity conservation of the community forests. Cultural beliefs and practices therefore are already playing a vital role in the conservation of forests and wildlife in this region, and evidence suggests they can be replicated and extended for meaningful conservation impacts at scale. However, we advocate for a cautious approach about over-generalizing the applicability of taboos in nature conservation (Colding & Folke, 2001), as species conservation occurs in traditional societies as a means of human survival and not necessarily from a moral or ethical sense of need for conservation.

Although our study yielded important insights about the role of taboos and traditional beliefs in wildlife conservation, time constraints imposed by logistic challenges and rugged terrain prevented a more extensive ethnographic study which would yield richer insights. Further studies that quantify wildlife populations or biodiversity and its relationships with weak or strong traditional institutions across diverse contexts around the world could help us gain more insights into the role of traditional ecological knowledge and taboos in biodiversity conservation. Although the ethnozoological uses of animals was not a focus of our study, the various uses of wildlife also have important conservation implications and should be studied in more detail. Understanding the ethnozoological beliefs and uses of wild animals as well as the complexities of cultural institutions that guide human-wildlife interactions deepens our understanding of the economic, cultural and social roles played by animals, which can help plan more effective policies to reconcile human needs with conservation goals (Bobo et al., 2015).

Conclusion

Illegal hunting of carnivores and their wild prey species is thought to have led to a cascading effect on large mammals in many parts of Arunachal Pradesh and around the world, resulting in what conservationists refer to as an empty forest syndrome (Datta et al., 2008). Conservationists have noted similar concerns in large forested areas across the globe as unsustainable hunting has caused defaunation with cascading effects on various ecosystem functions, resulting in significant losses of wildlife and ecosystem degradation (Wilkie et al., 2011). Hunting of wildlife by the indigenous tribes is considered as one of the most serious threats for conservation (Aiyadurai et al., 2010; Velho et al., 2012). While these concerns are valid, our study also revealed that most species (28 of the 35-mammalian species studied) are protected by various forms of community taboos associated with them, suggesting many indigenous cultures are also important advocates for wildlife conservation.

Despite strong arguments for inclusion, protected areas in India are consistently managed by excluding local residents (Rastogi et al., 2012). Exclusion of local communities create conflicts that can jeopardize biodiversity values and create hostility toward protected areas and conservation managers (Rastogi et al., 2012). An enhanced understanding of community structure and agency – the capacity of individuals to act independently – could help to alter this dynamic, removing and/or minimizing many of the factors such as social class, gender and religion that constrain individual decision-making in a natural resource context (Duffy et al., 2016). Indigenous communities should be granted the power to take part in the design of natural resource management plans, so they retain the right to control and conserve ecological habitats through the inclusion of traditional beliefs. Such inclusive approaches support not only the conservation of biodiversity, but also the conservation of cultural diversity (Chunhabunyatip et al., 2018). The consideration of socio-cultural norms in conservation planning can aid the effective reconciliation of human needs and conservation goals (Jones et al., 2008). Community conservation areas in the state of Arunachal Pradesh illustrate how it might be possible to develop inclusive practices that acknowledge and integrate traditional knowledge systems to achieve culturally responsive wildlife conservation.

Acknowledgments

This work is supported by Sony India Private Limited and an Innovation Grant from Wildlife Practice, WWF-International. We are grateful to Arunachal Pradesh Forest Department for continued support towards science and conservation efforts in the state, especially P. Ringu and Bharat Bhatt who contributed to the logistical planning of the project. We are also grateful to Subhash Tamang, Sonam Rai, Anghu Shrestha, Dechin Pema Saingmo, Pemba Tsering, Bengia Mrinal, Lham Dhondup, Tsering Gombu, Tsering Pema for their indispensable support on field and their warm company during field work. Kamal Medhi and Anupam Sarmah provided overall guidance and support for implementation of the project. We are grateful to the diverse indigenous communities for sharing their knowledge with us.

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Appendix 1

List of different ethnozoological uses of mammals observed across tribes in Arunachal Pradesh
<https://datadryad.org/stash/share/GhLcKM-wuiwoOGhau4pF9qbnGLYoXst3pHds26JkMws>.