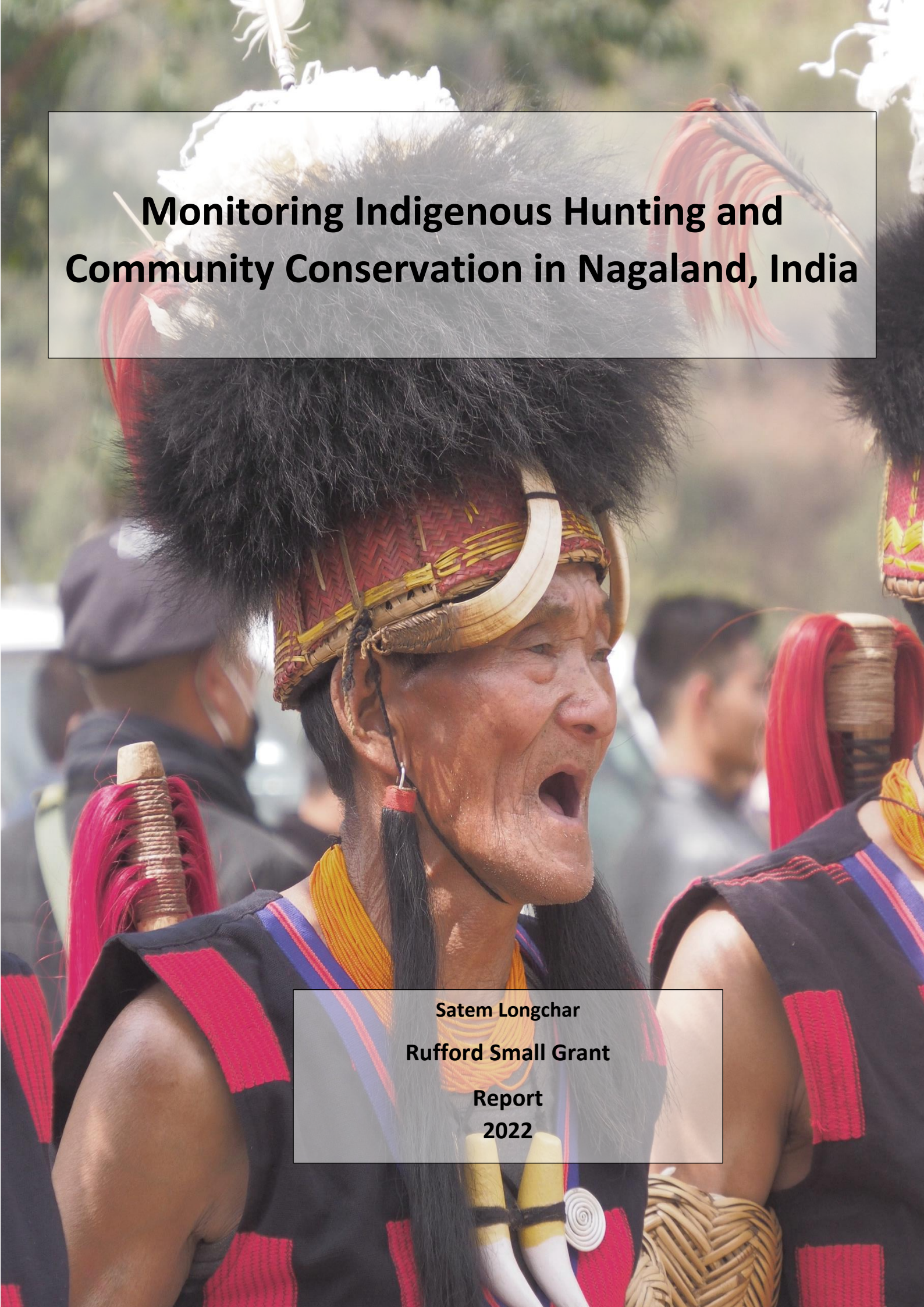
Monitoring Indigenous Hunting and Community Conservation in Nagaland, India



Satem Longchar

Rufford Small Grant

Report

2022

Content

Introduction

Indigenous communities have the most cultural diversity in the world (UN Permanent Forum on Indigenous Issues, 2010) and the highest biodiversity as 80% of biodiversity is located on indigenous lands, traditionally owned and managed by indigenous people who have sustainably used and conserved a vast diversity of plants, animals and ecosystems since the dawn of humankind (Swiderska 2009). India has 705 indigenous communities recorded under Article 342 of the Constitution of India, spread over different States and Union Territories of the country (Ministry of Tribal Affairs report 2021-22). The Naga tribe is a group of several indigenous communities of Northeast India and the North-western corner of Myanmar.

For indigenous communities, hunting has been an integral part of adaptation, survival, and vital skill as it provides food for survival and shapes the community's social environment. The forests are a crucial food source for the communities that influences society's dynamics and the environment (Dhyani and Dhyani 2020; Ember 2020). Forests are also sources of traditional medicines, house-building materials and implements all derivatives of the forest produce (McElwee 2010). Indigenous knowledge of the uses of forest-produced plants is astounding, and tribal communities in northeast India rely on plant leaves for more than 50 per cent of their foods (Singh, Pretty, and Pilgrim 2010); hence the variety of forest-produced plants is essential in a tribal diet. But, overharvesting through hunting, fishing and gathering (Deori 2005) have become a primary threat to forests. The shift to the use of shotguns from traditional hunting weapons is also a factor contributing to overhunting (Alvard 1995). Nagaland is one region in India where many people rely on indigenous knowledge and traditional forest products. The Naga people's relationship with the forest is deeply rooted in their tradition; tribespeople trades with one another through barter system by bringing forest-produced items in exchange for their food, medicines, fodder and timber, which proves the great significance of forest to the Naga tribespeople. Forests are hence critical to Naga households as they provide shelter, have historically assisted in the Nagas' economy, and continue to sustain many families in the rural areas as a source of income. Nagaland state is highly dependent on the forest for agricultural and other forest products and activities such as habitat modification and rampant hunting place massive pressure on wildlife survival.

Wildlife has been of great significance to many Naga people and is illustrated generously in the culture of the 16 Naga tribes. Inspiration from nature is woven into traditional Naga attire by incorporating prints of animals on shawls or using wildlife parts as accessories. Among the Naga male, prowess in hunting commands deep respect, whether it was headhunting historically or hunting wild animals in the forest. Hunting wild animals are mostly executed to supplement the diet. Previously, the Nagas hunted with the aid of bow and arrows, spears, dao (machete) and slings until muzzle-loading guns grew popular among the Naga tribespeople. This association between hunting wildlife with the culture in Nagaland persists to this day in Nagaland. Some hunt for livelihood sustenance, but most hunt for sport. This activity reduces wildlife population in the otherwise good forest—also known as "empty forest syndrome."

This report aims to review the cultural importance of wildlife to the Nagas and the methods they use to hunt wildlife. This information comes from studying the literature and indirect field observations while researching wildlife in Nagaland.

Study Area and Method

1. Study area

Nagaland forests fall within a transition zone between the Indian, Indo-Malayan, and Indo-Chinese bio-geographic regions at the junction of the Himalayan Mountains and southeast Asia (Changkija 2012).

The Nagaland state of India shares an international border with Myanmar and is bounded by the Indian states of Assam, Arunachal Pradesh, and Manipur. The forest in Nagaland has 75% of its original forest cover (http://www.fsi.nic.in/). It has six different forest types belonging to five broader groups: tropical semi-evergreen, tropical moist deciduous, subtropical broadleaved hill, subtropical pine and montane wet temperate forests (Champion and Seth 1968). The state has a wide variation in altitude and climate, from hot lowland Assam plains to sub-alpine forest bordering Myanmar. The range of abiotic features adds to the diversity of flora and fauna of Nagaland, which hence sits within the Indo-Myanmar global biodiversity hotspot (Myers et al. 2000).

In Nagaland, 16 major tribal groups retain unique languages, customs, and traditions. Customary laws governed Naga's social life, village authorities wielded power unbridled by the Indian government, and the economy remained highly dependent on agriculture and forest. It is one of the states in India with the most extensive community participation in conservation areas (Kothari and Pathak 2006), with 88% of the forest community-owned and managed.

This research study on "monitoring indigenous hunting and community conservation in Nagaland" was conducted in two different regions of Nagaland with distinctive cultural, forest management and biogeographical location

a. Khelia Community Forest

This community forest covers 244 km^2 located between 1200-3000m in the easternmost part of Nagaland and consists of community forest owned by two separate villages: the Choklangan village (26° 4'9.46 "N, 95° 7'0.41 "E) and the Wui Village (26° 2'8.40 "N, 95° 3'56.77 "E). These villages sit alongside the international border between India and Myanmar (*Figure.1*), making these Indian villages some of the last on the Myanmar border. One of the major Naga tribes, the Khiamniugan Naga, dominates this part of the Indian region. This community forest is classified as a temperate broad-leaved forest and sustains a good patch of dense forest. It is one of the least explored areas of Nagaland and India, making the area fundamental for biodiversity conservation.

b. Intangki National Park

The only national park in Nagaland with an area of 202 km^2, managed by the government of Nagaland, and is located in the Peren district of Nagaland (25°37'53.70"N, 93°28'50.90"E) at elevations from 200 m to 700 m (*Figure.1*). Diverse tribal communities surround the park. Tribal communities of Kachari-Dimasa,

Chakesang, Zeliang and Kuki, occupy the North of Intangki and the Kuki and Zeliang Naga tribes populate the south of INP. The park borders the neighbouring state of Assam and is located on the banks of the Dhansiri River, forming a conterminous forest with Assam's Dhansiri Reserve representing a vital corridor for wildlife between the two states. Intangki National Park comprises moist deciduous riverine forest and hill forest with a mixed composition of vegetation (Champion and Seth 1968).

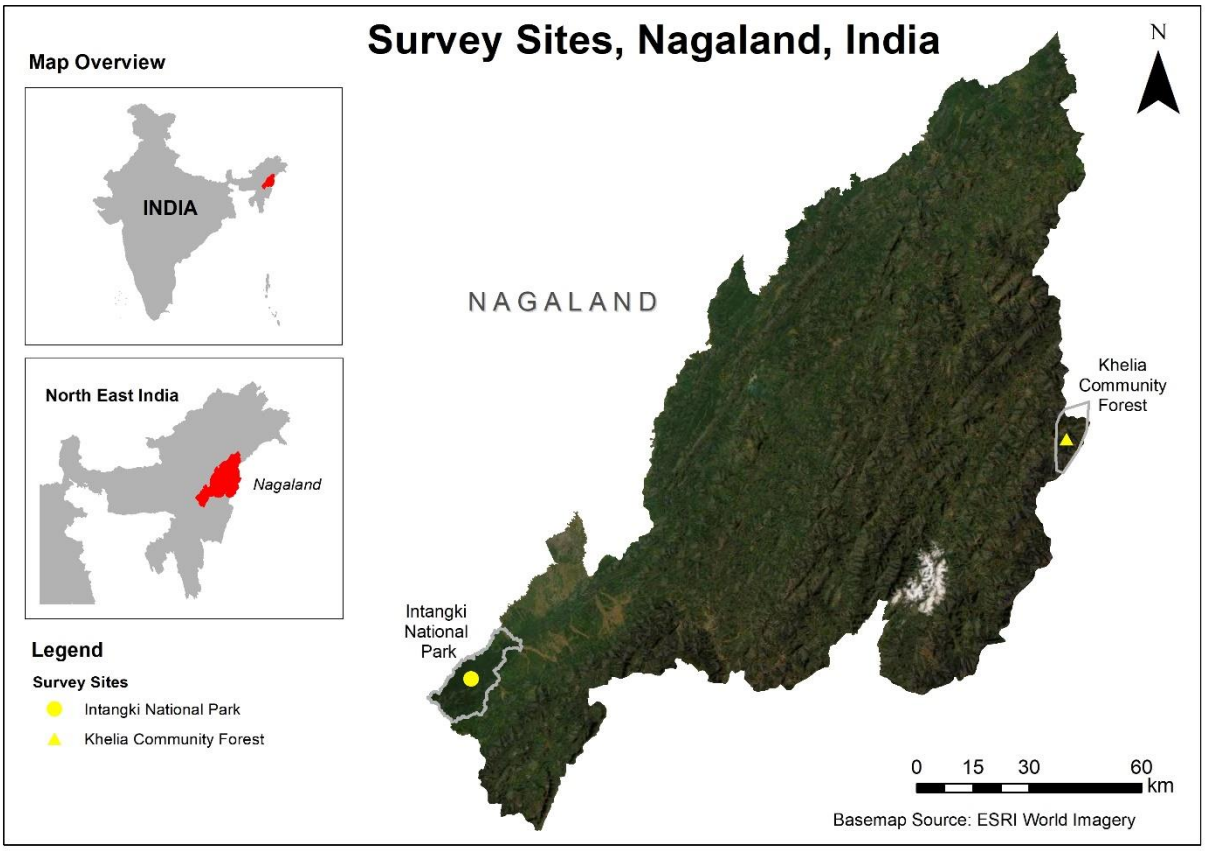


Figure 1: Map showing the location of Nagaland in India (inset and the two survey sites (Intangki National Park and Khelia community forest in Nagaland.

2. Methods

Field surveys were conducted from Nov 2019 to June 2021 in Intangki National Park and Khelia community forest (*Figure 1*).

Camera traps were used to record wildlife and human presence from January 2020 to June 2021. We used Cuddeback cameras (Cuddeback, De Pere, Wisconsin, USA), programmed to take five images per trigger with minimum delay between triggers. Cameras were operational 24 hours for 30 days in each camera trapping session during the dry season (October to March) and pre-monsoon season (April to June). We followed the All India Tiger Estimation 2018 protocol for camera trapping (Jhala, Qureshi, and Nayak 2019). One single-sided camera trap was deployed in each 2 km^2 grid within a systematically distributed sampling area (100 km2). Cameras were uniquely coded and deployed in 100 km^2 areas. Cameras were set to maximize animal photo captures and placed at crossings, water holes, salt licks, and along animal paths.

Fourteen villages around the study areas INP (n=11) and KCF (n=3) were targeted for the interview survey. We surveyed seven villages from Intangki National Park and three from Khelia community forest. Due to COVID19 restrictions, we could not sample some villages and interview people as we could not enter the village due to the village council rules on outside visitors. The interviews in the permitted villages were conducted in a casual environment with semi-structured questions on Saturdays and Sundays when the villagers were available for interaction for 30-40 minutes per individual and were conducted in the Nagamese language. Sensitive topics on hunting were not an issue to discuss with the villages around the Khelia community forest as they embraced the fact that this hunting is a part of their tradition. However, some participants around Intangki National Park were hesitant about the topic as they were weary of the forest department's restrictions on wildlife hunting and extracting natural resources from the park.

We observed the types of hunting techniques from the locals as the lead author (SL) grew up in these communities, and also evidence of the hunting traps found in the forest in the recent biological surveys. We consulted the oral traditions of these wildlife hunting from the village elders and documentation of wildlife via written records of these ancestral hunting through literature and museum collections.

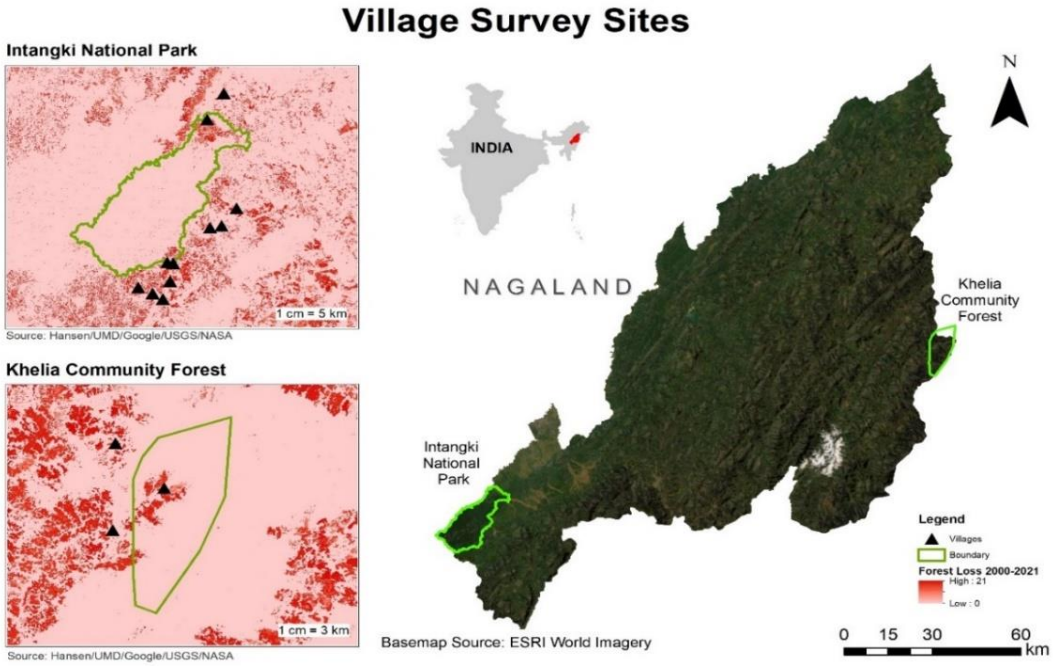


Figure 2 Map shopping the village survey sites of Intangki National Park and Khelia community reserves, Nagaland, India.

Results and Discussion

Documenting wildlife in Nagaland

From the camera traps exercise, we recorded 28 wild mammals from Intangki National Park and 15 species from the Khelia community forest (Appendix A and Appendix B). From this exercise, we also recorded the presence of sun bears for the first time in Nagaland.

We recorded 100 human signs with 90 hunter's campsites (old and new) from Intangki National Park and 37 human signs with 22 hunter's campsites from the Khelia community forest. Human presences were photographed on camera traps, n=15 from INP and n=30 from KCF. The human photographed in KCF mainly was the villagers and Mithun herders utilizing the community forest.

Traditional hunting methods, usage and preferences of wildlife and hunting drivers.

We interviewed 45 hunters and 10 village elders for this interview; we conducted this questionnaire survey to understand the dynamics of hunting methods, preferences and usage and drivers from the Naga hunters. For selections of wild meat, barking deer *Muntiacus muntjac* was an easy choice for the respondent (n=27) as the preferred wild meat. They explained that it was easy to catch, had good meat taste, and they received a reasonable price in the market (£64 to £100 for the whole animal); they can also sell it per kilogram if there are more buyers, with the rate set by the village councils (£1.6 to £3.25); Wild boar was the 2nd choice for the preferred species (n=8). In the Khelia community forest area, locals prefer bears as their choice of wild meat (n=4) because of the bile value in the market (ranging from £74 to £427, based on the size of bile), its skin and claws in traditional costumes and the meat for protein consumption.

Hunting drivers were mainly for consumption and livelihood purposes. We asked the hunter's opinion on accepting alternative sources if given options and n=8 respondents were willing to give up hunting if they get a better alternative source with a steady income; however, n=11 respondents were not interested in the alternative options. We also asked about changes in animal population and sightings in the forest; 39 interviewees responded that the number of animals in the forest had decreased; then we asked for a change in hunting frequency "pre and post" pandemic with the hunters, n=25 of them seem to have no change, whereas n=9 hunters hunted more during and after the pandemic (Appendix C).

We interviewed ten village elders to talk about using wild animals in their traditional costumes during tribal festivals from villages around Intangki; Great Indian hornbill *Buceros bicornis* tail feather is the most sought after for traditional costumes. These birds are also valuable as each tail feather costs 1500 INR (£16) to 2500 INR (£27) and are rare to find in the forest of Nagaland, so locals get these feathers from neighbouring states like Arunachal Pradesh and Assam. For villages around the Khelia community forest, the preferred animal for the traditional costumes is the Asiatic black bear's *Ursus thibetanus* skin, claws and canine teeth, wild boar's *Sus scrofa* tusk and hair, Tiger's *Panthera tigris* canine teeth and claw, and great Indian hornbill tail feather (Appendix E).

<u>Traditional hunting and usage</u>

Despite the diverse way of life of different Naga tribes, the traditional hunting practice is very similar. All the Naga tribes have three weapons- dao, spear and shield (*pers Obsv*). Guns seem to have had late entry into Nagaland, with the first gun reported in the 1830s, a revolutionary change for the Naga tribespeople.

Some hunting techniques might differ, but the weapons used are similar from one tribe to another. Most works of literature on ancient Naga society are documented by British

colonial officers and anthropologists from the European countries (Hutton 1965; Mills 1925) based on the explored areas. The passing of knowledge through oral traditions is practised in events like clan gatherings, village meetings and even marriage ceremonies.

The hunters we interviewed rarely use the traditional methods of hunting wild mammals as they rely on modern guns; however, some still use traditional methods of trapping animals (for pheasants). Hunters from the villages around Khelia community forest areas use more traditional forms of using traps and snares than the hunters from villages in Intangki (*pers obsv*). From the survey, we recorded 33 numbers of individuals owning guns and 13 individuals with licenses. Local-made guns are popular in the Khelia community forest areas as they are cheaper and are made by local people who can custom-make the design for the guns. We recorded nine individuals from the interview who owned local firearms for hunting. We also recorded the other traditional hunting methods and techniques from the village elders and hunters.

Hunting weapon

Traditional weapons: Traditional hunting techniques have reduced substantially since the introduction of guns in the region. Guns are now most preferred, dao is still an indispensable weapon, and some traditional methods are practised rarely while hunting, like bow and arrows, spearing, and group chase hunting.

Daos: Dao is the local Nagamese name for machete (*Figure*.3). The dao is the essential equipment you will find in a Naga household. They serve various purposes, from cutting meat and chopping trees to warfare weapon and celebrations, and they vary in size and shape. They are unique to each Naga tribal community, and the differences are in the design of the blade, its length and the handle.

Spears: Are the most commonly used weapons to hunt animals (*Figure*.3). Spears are of different types, ranging from the hunting and multipurpose spear to dancing/ceremonial spears and rich man's spear. To this day, the killing of larger livestock is executed through spearing, especially during traditional ceremonies or festivals.

Bows and arrows: Another technique used for hunting is bows and arrows, which vary according to the wildlife hunted (*Figure* 4). Longbows are for larger animals, and short crossbows are for birds.

Slings and catapult: Mainly used to shoot down birds and monkeys, a trend still practised in Nagaland.

Shield: Elephant skin, bear, and Tiger, as recorded by Verrier Elwin (Elwin 1959), skins were used as a shield. Also, in some cases, buffalo skin or Mithun skin were used as a shield

Figure.3. Different types of daos and spears from the Nagaland state museum, Kohima. The top spear is the rich man's spear which is adorned with brass; the middle six spears are the dancing spears of different Naga tribes, then the hunting spear, and the bottom is the multipurpose spear.

Figure 4. Picture of bow and arrows (left and centre) with arrow holder (right) made from barking deerskin and bamboo from Choklangan village.

Hunting techniques

The Naga people employ various techniques, from traps and snares to direct hunting (in a group or with dogs) and poisoning.

Traps and snares: There are different types of traps that local people use to hunt, varying according to target species, size, and habitat.

Pitfall traps: Local people dig the ground at places the target animal is likely to use, such as crossing points, water holes or salt licks. Bamboo spikes are fixed at the bottom to impale any animals that fall into the pit. The pitfall is then covered with leaves and twigs. This trap targets larger mammals that will not climb out of the hole.

Box traps: These traps are baited with fruits and vegetables and have falling doors triggered once the species of interest comes inside the box to eat the bait. These traps are used to capture primates and large carnivores.

Triangular snares: These are small fences with regular gaps, where a trap is set for any small animals that may try to run through (*Figure* 5). The traps are typically nooses to catch bird's feet and are very common for catching birds, particularly pheasants and are employed in many eastern parts of Nagaland.

Figure 5. Snares for catching pheasants and small mammals are made up of bamboo with bamboo thread.

Traps: These traps are kept in the hedge opening or holes for small mammals or rats (*Figure*.6)

Deadfall traps along the rock crevices: Heavy stones or wooden stumps, usually larger than the target animal, are set up to fall on the animal when a tripwire triggers it, killingly it quickly. This trap is used mainly for hunting jungle rats.

Gun trap: This type of trap is a modified version of the traditional trap; here, the noose of the trap is attached to a muzzle loading gun, which is aligned in the direction of the animal path, and when the trap is triggered, it is set to fire at the target.

Frog trap: This is a favourite summer hunting activity unique to eastern Nagaland. Frogs are a delicacy, and summer is the season to hunt them. Conical-shaped collection bamboo baskets are tugged in between several vertical posts along many edges of the streams; the frogs are washed down to the edge of the stream by the

strong currents and are collected in the baskets (*Figure*.7). In a good season, the villagers can collect as many as 500 individuals of frogs.

Group chase hunting: Local people chase sounders of wild boars *Sus scrofas,* or even large carnivores in the nearby fields and surround them before killing them with spears and dao.

Primates in groups are lured into the tunnel-like passages of undergrowth by baiting them with berries, catching them en-masse at the end, and are speared to death by the group hunters.

Figure 6. Image a) of a trap kept in the rat hole entrance b) hedge trap made out of bamboo on display at the Nagaland state museum, Kohima.

Figure 7. Images of a traditional frog trap along the Chokla River, Khelia community forest.

Hunting dogs: Naga tribespeople often train dogs for game hunting. Even today, animals in these hunts are pursued using hunting dogs that bale the animals up before human hunters kill them. These dogs are highly trained and can target specific animals, including reptiles like the Bengal monitor lizard *Varanus bengalensis*.

Poison/Plant toxins: The Naga tribe uses poisons to paralyse the animals they hunt. Creeper plants like *Millettia pachycarpa* are used for poisoning the river while fishing. The process involves pounding of creeper plant with sticks or dao. Exudates from the plant are splashed into the water until the fish below float to the top. The fishes are caught by hand, scooped with bamboo baskets, or struck with daos. This practice is prevalent in the Lotha, Kachari and Dimasa tribes, a sub-tribe of Nagaland, living nearby Intangki National Park. Another deadly plant is the *Aconitum sp.* (*Figure* 8) which is used to poison animals by smearing arrow tips with plant toxins. This is widely practised by Khiamniungan Nagas, where the traditional community's primary mode of hunting wild meat is using a bow and arrow.

Bird lime: The sap of *Ficus spp* is collected and stirred until it becomes thick, which is heated in bamboo and then allowed to cool. This sap is smeared on bamboo skewers and placed on branches where the bird might perch with some seeds to lure the birds. The birds get stuck to the bait skewers and cannot fly away, which the hunter later retrieves. This hunting method is very popular with children (*Figure* 8); to this day, these actions are found in rural areas of Nagaland.

Figure 8. Images of a) children on their way to trap birds with birdlime, and b) a collared scops owl *Otus lettia* caught in one of these traps. C) *Aconitum sp*p. from Khelia community forest.

Attitudes and Perception

We conducted a small survey during the questionnaire survey regarding the attitudes and perceptions of community conservation and wildlife conservation. A total of 80

individuals participated in this survey; we had 15 female participants and 65 male participants with different age group ranges (Appendix D).

According to the questionnaire responses, all wildlife has decreased. However, primates (hoolock gibbon *Hoolock*, rhesus macaque *Macaca mulatta*, pigtailed macaque *Macaca leonina*, stump-tailed macaque *Macaca arctoides* and capped langur *Trachypithecus pileatus*) have noticeably reduced more than the other wildlife. The wild pig is the only animal that is perceived to be increasing or having no change in its population. The elephant was the most popular animal the villagers liked to see in the wild (n=52), followed by primates, barking deer, Tiger and hornbill, although the latter three are mostly for economic benefits. However, in the Khelia community forest, Indian gaur/ bison *Bos gaurus* is the most sought-after animal (n=6) followed by bears (n=5); due to its rarity in the wild, and desire for gaur hybrid with the mithun *Bos frontalis* (domestic version of gaur) for bigger sized animal which has better commercial value, however, the locals assumed the species to be locally extinct in their region.

On the biodiversity values, the 15 responded that there are economic values from the forest as they can generate income by selling timbers and firewood and collecting vegetables and fruits from the forest to be sold in the market. 42 respondents agreed that biodiversity provides both economic and aesthetic values.

The local's perceptions of biodiversity loss seem to be from forest clearing for agriculture and hunting (n=38) and timber logging (n=24). Out of the 80 individuals, 50% were highly concerned about the biodiversity loss, whereas 10% of the participants were not concerned about the loss. Nonetheless, all the participants agreed on the need for conservation awareness in the village.

The challenges of engaging in biodiversity conservation for the participants were the lack of time to participate as they are occupied with farming or community work. Also, conservation actions are challenging to some people as they do not own the land. Some people require resources from the forest, and some have issues with hunters coming to their community forest from other villages or towns (Hayward et al. 2005). However, planting trees around the community forest and hunting restrictions in the community forest were the biodiversity conservation actions the villagers were willing to do.

Hunting frequency during the pandemic hasn't changed for most villagers. However, some participants from 3 villages around INP responded that there was an increase in hunting frequency as they have more free time for hunting.

Usage and Drivers of Hunting: Past And Present

1. Hunting practices

Hunting practice was driven by protein sustenance, wildlife-related medicine, and extraction of traditional costumes from wildlife, social status and elimination of problematic wild animals in any Naga society. There are strong ethics amongst Naga people for wildlife extraction, and this loosely translates to taboos. These taboos are aligned with natural explanations and blended into Naga indigenous practices and lore. For this, the locals utilized the knowledge of seasons, time, weather, plant

diversity, animal behaviour and the availability of resources in their culture. There was balance in wildlife hunting, as taboos and traditional weapons bound these wildlife hunting practices.

Taboos traditionally controlled the hunting and consumption of wild meat and in cases of food restrictions, consumption can indicate a scarcity of food. An unspoken rule maintained while hunting is that female animal are usually avoided due to their contribution to maintaining the population. Clearly, this only occurs when active hunting is conducted, as snaring and similar methods are indiscriminate. Some directly protect certain wildlife species because of taboo, for example, the eastern Naga tribe does not kill the larger feline species such as clouded leopard, *Neofelis nebulosa*, Tiger *Panthera tigris* and leopard *Panthera pardus* as they consider them as the reincarnation of their village angh (king). The Khiamniugan Naga does not allow hunted tiger meat inside the village.

Similarly, meat of many types of carnivores is restricted only to the menfolk and consumed out of the village. Unlike the men, women never participated in hunting events and were limited to consuming a few species of wild meat. To this day, women usually do not partake in patriarchal activities. However, the diversity of wild meat consumption has increased in these recent years. Wildlife that was protected by cultural taboos is now consumed and hunted extensively after the introduction of Christianity in the state across Nagaland.

Bond of brethren and kinship behaviour is exhibited in these hunting practices in the clans. These shareholders in bush meat distribution are equally important. Wildmeat head is given to the person who kills the animal, a portion of the meat is given to the gun owner, the hunting dogs and the owner also get their share of meat, and the rest are distributed amongst the team. This behaviour shows unity amongst the brethren.
Wild meat has been an essential part of the Naga diet and continues to be so; it supplements protein in many impoverished areas close to the forest. Nagaland is a poor state with few employment opportunities, so more people have to resort to nature for survival. Nagas enjoys all animal meat, from insects to elephants, depending on the region where they are found. Wild meat is a delicacy and a rarity for this generation where wildlife is decreasing. This rarity has triggered a trend of gifting wild meat to influential people in society to gain favours or to show their appreciation. This has put more value on the prices of wild animals and, in the process, exhausted wildlife. Though the government of India has implemented Wildlife Protection Act 1972, the rules are often ignored by Naga society as this gesture has a long association with customary practices. Unless we can stop the overexploitation of wildlife in Nagaland, future generations will be left with less or no experiences of nature than we currently experience (Hayward et al. 2022).

2. Wildlife trade:

Wildlife products are also trafficked, especially across the border to Myanmar, as this allows easy access for animal products to enter the Chinese traditional medicinal industry and provides the local supplier with cash. Wildlife, such as elephant *Elephas maximus* (ivory and bones), Asiatic black bear *Ursus thibetanus* (bile), Tiger (skin, teeth and claw), pangolin *Manis pentadactyla* (*Figure*.10), are in great demand and provide good money to the local hunters. Wild animals and plants are also sought after by Chinese wildlife traders; this demand triggers locals to overharvest their natural

resources. Species like *Paris polyphylla*, konjac plant, and some species of bracket fungus were collected from the forest by the villagers to supply to Myanmar during the field session 2020-2021 (*Figure*.9). This is driving the empty forests that are now common throughout much of the world (Redford 1992; Bugir et al. 2021).

Figure 9: Forest products extracted from the community forest for the Chinese traditional medicinal industry. a. Konjac tuber b. Unknown roots c. Dried bracket fungus.

a. *b.* *c.* *d.*

Figure 10. a) Bear hunted on Indo Myanmar border. b) Dried Bear bile collected by the vendor to be sold when the Chinese market opens. c) Tiger claws and bear skin used in traditional headgear. d) Hunted Pangolin on the Indo-Myanmar border. Pandemic has affected the wildlife business due to the closure of the international boundaries.

3. **Wildlife conflict:**

Human-wildlife conflicts are also a reason for excessive wildlife hunting in Nagaland. Species like wild boar, barking deer, and elephants are frequent crop raiders in agricultural areas. Most bear sightings near human habitation in Nagaland occur during the fruiting of *Livistona jenkinsiana,* a typical palm plant in northeast India and a plant that the Naga communities depend on for housing and food. These palm trees are usually planted around the village areas, in their farmlands, and within household backyards. Clearing forests due to agriculture, plantation expansions, and timber extraction have resulted in the loss of large animal habitat areas. This mass felling of the forest has affected the habitat of many species and reduced the quality of forest ecosystems. Farmland close to forest areas increases the chance of animals foraging in the agricultural land and hence results in more significant conflict with humans

a. b. c.

Figure 11. Pictures of a) barking deer hunted by a younger hunter and his friends. b). A wounded barking deer drowned in the river. c) Human-bear conflict in Mokokchung.

Conclusion

The cultural importance of biodiversity has been evident in Nagaland for years, and Naga traditions have co-evolved with their surrounding environment and socio-political situation. Yet the loss of biodiversity in Nagaland means that the concept of biodiversity conservation struggles in the state. The spiritual connection to the forest diminished in Nagaland when animist practices (indigenous religion) were abolished in Nagaland in the mid-19th century when the British converted Naga tribes to predominantly Christians through American Baptist missionaries.

Today, Nagas are struggling with unemployment, a slow rate of development, and accessibility to health care in many places. These are the results of the political system's corruption and insurgency unrest in the state, which affects the economy. Dependency on the forest is still very much integrated into Naga roots and everyday

lives. Due to the feeble economy, people's livelihood depends on biodiversity for survival and alleviating poverty.

Nagaland has a unique conservation management system, with 11% of the total forest cover owned by the government and the rest managed by tribal communities. These community forests are essential assets as it harbours a variety of biodiversity contributing to the unique ecosystem. The individual villages, clan members and local families own and manage these forests. These forests sustain their livelihood as they provide the community with farming land, support their livestock such as Mithun (*Bos frontalis*), provide firewood, and enable timber logging for personal use and small-scale commercial logging.

But in recent years, overharvesting and unsustainable usage of the community forests has impacted biodiversity and the people directly dependent on the forest. For example, apart from hunting, timber logging in recent years has been made easier by the introduction of chain saws, depleting the forest faster. In Nagaland, the primary forest is shrinking rapidly, and along with this loss, it can draw diseases. Forest conservation should be a priority for training conservation staff to protect wildlife and assist in preventing zoonosis.

One of the study areas, the Noklak district, has recorded a high prevalence of scrub typhus in the region, resulting in more human deaths than COVID19 in 2020 (state government report). Scrub typhus is a vector-borne disease influenced by rat density and climate factors (Wei et al. 2017). This is a resurgent disease in India after years of dormancy (Ranjan and Prakash 2018); studies in Nagaland associate the high prevalence of scrub typhus with climate change (Khan et al. 2016) with the clearance of forests. Our study found that within the Noklak district, Khelia community forest of 244 sq. km and 16 sq. km has been lost in the last 20 years (SL unpublished. data). This forest loss contributes to the loss of 57% of the state's total tree cover and 17% of its total tree cover across north-eastern India states, making it the sharpest decline among all states (global watch.com)

Deforested jungles for jhum farming draw rats as they raid the sown rice and vegetables. These rats are a vector for scrub typhus and are drawn toward human habitation. The presence of such attractants leads them to move away from their natural habitat and towards human habitation and facilitates the spread of diseases. Interestingly, many smaller carnivores are also drawn towards such locations in search of rats and are often targeted by the locals to hunt for consumption. This may be counterproductive as these predators could act as biological controls on the rats.

Poor management of community forests can be an essential driver of biodiversity loss. Nagaland has a special provision under article 371 A of the constitution of India which states that no act of Indian Parliament would apply to the state of Nagaland in matter relating to religious or social practices of Nagas, Naga customary law and procedure, administration of civil or criminal justice involving decisions according to Naga customary law and ownership and transfer of land and its resources. Thus, the power of ownership and transfer of land and its resources resides with the community—including control of such land through customary law and procedure. Most community and villages have their customary law and policy, and lacuna in forest management in

the villages might affect the biodiversity in an unsustainable and uncontrolled manner unless the villages evolve a concrete local policy for preserving biodiversity.

Dependency on forests has drawn the Naga communities' attention, especially after the pandemic. Many unemployed people returned to the village when the pandemic happened, most returning to farming. This consequence has made some villages rethink their forest utilization and efforts to protect their community forest. However, this unemployment is still an impending dilemma for many people, especially the literate youth in Nagaland. Though the state secured a 79% literacy rate among the states of India, yet state's main economic contribution is agriculture. The lack of alternative livelihood often takes a heavy toll on the community forest, especially with the preference for jhum agriculture. There are government subsidies and occasional government livelihood opportunities, but there are limitations to such options.

In such situations where forest dependency is high, community conservation becomes challenging as it moves towards the fortress side of the conservation management spectrum, protecting habitats and species and keeping out people while neglecting anthropogenic needs via sustainable utilization. This is a poor outcome as people are integral to these forest ecosystems but must live more sustainably to enable their lifestyles to persist. Currently, some villages recognize the need for conservation action and efforts to protect their community forests. However, there is more to do across Nagaland, like conservation action via reinforcing conservation awareness messages at the community, village, and state levels and regular monitoring of the forest monitoring or restrictions on the extractions of forest products to control wildlife extraction activities. All these need the collective efforts of all stakeholders - local government, state forest department, local community, researchers, and NGOs. Some key conservation issues that need to address are:

a. Threats and challenges in Nagaland community forest.
b. Equitable technical education and vocational training facilities should be established to increase employment opportunities.
c. Sustainable and alternative options to reduce the high dependency on forest products from the local communities
d. Socio-economic drivers behind the extraction of forest products and illegal wildlife trafficking
e. Reviving age-old practices of preserving and utilization of nature.
f. Practising forest restoration for abandoned Jhum fields with native trees.

Monitoring and protecting wildlife in community reserves takes a whole level of challenges. Community conservation is a challenge, especially in areas where there are economically challenged, as this encompasses management from the government and different levels of community management (tribe/ village/ and clans). This process itself is complicated, but if it is successful, it could contribute to model management for future generations, where it is culturally accepted and economically sustainable.

Conservation Action

Through this grant, we got the opportunity to execute the following activities

1. Local youths were employed to assist the researcher in camera trapping and surveying as paid field assistants, porters, and local forest guides.
2. We trained these field assistants (4 in number) to grow mushrooms by collaborating with a local mycologist, who taught them how to grow edible mushrooms (oyster mushrooms) from home using available raw materials (dried rice paddy stock, dried grass, bamboo, and mushroom spawns that was brought from the mycologist's lab). Then a small seminar was conducted on commercializing their products for their livelihood.
3. The grant was used to create a start-up business for these field assistants to grow mushrooms for a small-scale business in their village.
4. These youths also became instructors in their village to grow mushrooms and inspired 54 more individuals, including several women self-help groups on the Indo-Myanmar border. (*Figure*. 13)
5. From the fieldwork experiences we got through this grant, one of our field assistants from the Indo-Myanmar border gave up hunting practices and is presently pursuing a filmmaking course to become a wildlife film documentary maker, and another field assistant is now employed as a forest guide for a National NGO.
6. This project has allowed reaching out to the village elders and council members of Choklangan village, Wui village, Kingpao Village, Khelma, and New Soget village to participate in biodiversity conservation in their community forest to tackle hunting issues and forest loss. We were also able to reach out to the leaders of the Khiamniungan Baptist Churches Association (KBCA) to be proactive in reaching out about biodiversity conservation in their church outreach.
7. From this grant, our fieldwork area, Khelia King (local translation as Khelia Mountain) on the Indo-Myanmar border, was discovered to be the second-highest mountain in Nagaland. It has garnered attention from the public as well as the state administration and is currently in the process of being officially recognized (Anichar 2021) (in press)
8. This discovery has nudged the village near the community reserve (Khelia community reserve) to promote the mountain as a potential ecotourism site and potential conservation area to protect wildlife.
9. We recorded golden cats from our camera traps in this community reserve area, which has also garnered attention amongst the Khiamniungan community for its protection.
10. We were also able to hand out library books to around seven primary government schools (Thanks to the Pratham Books Publication for the collaboration.)

Biodiversity work

1. From this grant, we could photograph Nagaland's first record of the Sun bear and the first record of the Asiatic black bear from Intangki National Park.
2. We were able to document 3 different colour morphs of golden cats from Nagaland at the Indo-Myanmar border, adding to the diverse colour morph of golden cats from northeast India (unpublished data).

Figure 13: Pictures of mushroom making process with the local community.

Acknowledgement

We had a vast team who assisted us throughout this project. Fieldwork was possible with the help of Kedi, Joshua, Lungsui, Song, Oscar, Malo, Paukipau, Athi, Chongs, khangtu, Dilungbo, Uncle Lal, David, Uncle Thanga (Ex-chairman of Khelma), Youth President of Beisumpuikam Village, Aku from Kamti village from Intangki National Park.

Thank you to Thangsoi, Thangpong, Pathan, Payo, Shingyui, Mongti, Thangim, Chakpok, Pasing, Lendimong, Noksa, Sochiu, Yamtemong from Khelia Community Forest.

My sincere gratitude to Professor Qamar Qureshi and Shikha from the Wildlife Institute of India, Adrash Kulkarani and Dr Amar Soren for the academic assistance, Major Shullai for logistic help in pandemic lockdown, Nagaland, Forest Department - Director of Intangki National Park and Intangki staff for the permits, Noklak Administration Team and former District Commissioner Mr Reny Wilfred for the logistic support and permit and Pratham Books Organization, Bangalore, India, for donating library books for seven schools across my field sites.

I sincerely thank the Village elders and villagers of Wui, Choklangan, Kingpao, Beisumpuikam, Kamti, Beisumpuilo, New Nkeo, New Soget, Sailem, Pelhang and Khelma for allowing us to work in their village areas, helping our team, especially during the pandemic. I am grateful to Uncle Haopo of Bongkolong village for his help. My gratitude to Rohan, Raj, Tsume, Chempe, Junglio, Dr Meyajungla, Dr Among, Yithachu EAC, Agumle, and Lungbay forester INP, for making the fieldwork more memorable.

I also like to mention my sincere acknowledgement and gratitude to two village elders- Lt. Meliang of Choklangan village and Lt. Nzamlak of Beisumpuikam village, whom we

lost shortly after the fieldwork. I am deeply grateful for their guidance throughout the field days and the unconditional support I received from both.

Thank you, Dr Matt Hayward and Carrol Chan, for your help.

None of this would have been possible without the fantastic support of the Rufford Foundation. Thank you so much.

Literature Citation

Alvard, Michael. 1995. 'Shotguns and sustainable hunting in the Neotropics', *Oryx*, 29: 58-66.

Anichar. 2021. 'Will Japfu lose status as 2nd highest peak in Nagaland?', *In press*.

Bugir, Cassandra K, Carlos A Peres, Kevin S White, Robert A Montgomery, Andrea S Griffin, Paul Rippon, John Clulow, and Matt W Hayward. 2021. 'Prey preferences of modern human hunter-gatherers', *Food Webs*, 26: e00183.

Champion, Sir HG, and Shiam Kishore Seth. 1968. 'A revised survey of the forest types of India'.

Changkija, Sapu. 2012. 'Forests and Floristic Diversity of Nagaland', *Glimpses of Forestry Research in the Indian Himalayan Region*: 67-74

Deori, P. 2005. *Environmental History of Naga Hills, 1881-1947: Land and Forest : the Colonial Policy* (Anshah Publishing House).

Dhyani, Shalini, and Deepak Dhyani. 2020. 'Local socio-economic dynamics shaping forest ecosystems in Central Himalayas.' in, *Socio-economic and eco-biological dimensions in resource use and conservation* (Springer).

Elwin, Verrier. 1959. *The Nagas in the nineteenth century*.

Ember, Carol R. 2020. 'Hunter-Gatherers (Foragers)'.

Hayward, Matt W, Ninon FV Meyer, Niko Balkenhol, Chad T Beranek, Cassandra K Bugir, Kathleen V Bushell, Alex Callen, Amy J Dickman, Andrea S Griffin, and Peter M Haswell. 2022. 'Intergenerational inequity: stealing the joy and benefits of nature from our children', *Frontiers in Ecology and Evolution*: 28.
Hayward, Matt W, Rehema M White, Khayalethu M Mabandla, and Pakama Bukeye. 2005. 'Mammalian fauna of indigenous forest in the Transkei region of South Africa: an overdue survey', *South African Journal of Wildlife Research-24-month delayed open access*, 35: 117-24.

Hutton, John H. 1965. 'The mixed culture of the Naga tribes', *The Journal of the Royal Anthropological Institute of Great Britain and Ireland*, 95: 16-43.

Jhala, YV, Q Qureshi, and AK Nayak. 2019. "Status of Tigers, Co-Predators and Prey in India 2018: Summary Report." In.: National Tiger Conservation Authority, Government of India, New Delhi.

Khan, Siraj A, Vinotsole Khamo, Helen J Uriah, Trishna Bora, and Prafulla Dutta. 2016. 'Scrub typhus in hilly regions of north east India', *The Indian Journal of Medical Research*, 144: 138.

Kothari, A, and N Pathak. 2006. 'Protected Areas, Community Based Conservation and Decentralisation: Lessons from India', *report prepared for the Ecosystems, Protected Areas, and People Project (EPP) of the IUCN World Commission on Protected Areas (through the IUCN Regional Protected Areas Programme, Asia)*.

McElwee, Pamela D. 2010. 'Resource use among rural agricultural households near protected areas in Vietnam: the social costs of conservation and implications for enforcement', *Environmental Management*, 45: 113-31.

Mills, JP. 1925. 'The Ao Naga Tribe of Assam. A study in Ethnology and Sociology. By WC Smith. With an introduction by JH Hutton, CIE, D. Sc., MA, Honorary Director of Ethnography, Assam', *Journal of the Royal Asiatic Society*, 57: 731-33.

Ranjan, Jai, and John Antony Jude Prakash. 2018. 'Scrub typhus re-emergence in India: Contributing factors and way forward', *Medical Hypotheses*, 115: 61-64.

Redford, Kent H. 1992. 'The empty forest', *Bioscience*, 42: 412-22.

Singh, Ranjay K, Jules Pretty, and Sarah Pilgrim. 2010. 'Traditional knowledge and biocultural diversity: learning from tribal communities for sustainable development in northeast India', *Journal of Environmental Planning and Management*, 53: 511-33.

Swiderska, Krystyna. 2009. 'Protecting traditional knowledge: a holistic approach based on customary laws and bio-cultural heritage', *Conserving and valuing ecosystem services and biodiversity: economic, institutional and social challenges*: 331-42.

Wei, Yuehong, Yong Huang, Xiaoning Li, Yu Ma, Xia Tao, Xinwei Wu, and Zhicong Yang. 2017. 'Climate variability, animal reservoir and transmission of scrub typhus in Southern China', *PLoS neglected tropical diseases*, 11: e0005447.

https://www.thebridgechronicle.com/pune/st-exclusive-curious-case-nagaland-gun-licences-8264

https://nagalandpage.com/will-japfu-lose-status-as-2nd-highest-peak-in-nagaland/

https://morungexpress.com/survey-on-number-of-villages-in-nagaland-2021-released

https://www.theguardian.com/climate-academy/2020/oct/12/indigenous-communities-protect-biodiversity-curb-climate-crisis

https://indiankanoon.org/doc/371998/ Indian constitution Amendment for Nagaland, Article 371 A

https://indianexpress.com/article/north-east-india/nagaland/in-christian-nagaland-indigenous-religion-of-pre-christian-nagas-withstand-test-of-time-5010777/

https://en.unesco.org/indigenous-peoples

http://www.censusindia.gov.in

https://tribal.nic.in/Statistics.aspx

Appendix A. Checklist of mammals photographed on camera traps from Intangki National Forest

Family	Common names	Scientific names	IUCN Status	Indian Wildlife Protection Act 1972
Manidae	Chinese pangolin	*Manis pentadactyla*	Critically endangered	Sch I (Part I)
Bovidae	Indian gaur	*Bos gaurus*	Vulnerable	Sch I (Part I)
	Red serow	*Capricornis rubidus*	Near threatened	
Elephantidae	Asian Elephant	*Elephas maximus indicus*	Endangered	Sch I (Part I)
Felidae	Clouded leopard	*Neofelis nebulosa*	Vulnerable	Sch I (Part I)
	Leopard cat	*Prionailurus bengalensis*	Least concern	Sch I (Part I)
	Indian leopard	*Panthera pardus*	Vulnerable	Sch I (Part I)
	Marbled cat	*Pardofelis marmorata*	Near threatened	Sch I (Part I)
Canid	Wild dog	*Cuon alpinus*	Endangered	Sch II (Part I)
Cervidae	Sambar deer	*Rusa unicolor*	Vulnerable	Sch III
	Muntjac deer	*Muntiacus Muntjak*	Least concern	Sch III
Suidae	Wild Pig	*Sus scrofa*	Least concern	Sch III
Primate	Capped langur	*Trachypithecus pileatus*	Vulnerable	Sch I (Part I)
	Rhesus macaque	*Macaca mulatta*	Least concern	Sch II (Part I)
	Pig tailed macaque	*Macaca leonina*	Vulnerable	Sch II (Part I)
Vivveridae	Himalayan mask civet			
	common palm civets	*Paradoxurus hermaphroditus*	Least concern	Sch II (Part I)
	small Indian civets	*Viverricula indica*	Least concern	Sch II (Part I)
	large Indian civet	*Viverra zibetha*	Least concern	Sch II (Part I)
Herpestidae	Crab eating mongoose	*Herpestes urva*	Least concern	Sch II (Part I)
Helictinidae	Ferret badger	*Melogale sp*	Least concern	Sch II (Part I)
Mustelidae	Yellow-throated marten	*Martes Flavigula*	Least concern	Sch II (Part I)
Hystricidae	Asiatic Brush tailed porcupine	*Atherurus macrourus*	Least concern	Sch II (Part I)
	Malyana Porcupine			
	Northern tree shrew	*Tupaia belangeri*	Least concern	
	Back striped weasel	*Mustela strigidorsa*	Least concern	
Ursus	Himalayan black bear	*Ursus thibetanus*	Vulnerable	Sch II (Part I)
	Sun bear	*Helarctos malayanus*	Vulnerable	Sch I

Appendix B. Checklist of mammals photographed from camera traps from Khelia community forest

Family	Common names	Scientific names	IUCN Status	Indian Wildlife
Bovidae	Red serow	*Capricornis rubidus*	Near threatened	
Ursus	Himalayan black bear	*Ursus thibetanus*	Vulnerable	Sch II (Part I)
Felidae	Golden cat	*Catopuma temminckii*	Vulnerable	Sch I (Part I)
	Clouded leopard	*Neofelis nebulosa*	Vulnerable	Sch I (Part I)
	Leopard cat	*Prionailurus bengalensis*	Least concern	Sch I (Part I)
	Marbled cat	*Pardofelis marmorata*	Near threatene	Sch I (Part I)
Canid	Wild dog	*Cuon alpinus*	Endangered	Sch II (Part I)
Cervidae	Muntjac deer	*Muntiacus Muntjak*	Least concern	Sch III
Primate	Rhesus macaque	*Macaca mulatta*	Least concern	Sch II (Part I)
Vivverida	Himalayan palm civet	*Paguma larvata*	Least concern	Sch II (Part I)
Prionodor	Spotted linsang	*Prionodon pardicolor*	Least concern	
Helictinid	Ferret badger	*Melogale sp*	Least concern	Sch II (Part I)
Mustelida	Yellow-throated marten	*Martes Flavigula*	Least concern	Sch II (Part I)
Hystricida	Asiatic Brush tailed porcupine	*Atherurus macrourus*	Least concern	Sch II (Part I)
	Malayan porcupine	*Hystrix brachyura*	Least concern	

Appendix C: Questions and response for hunter survey from villages around INP and KCF.

Which species do you prefer?			**Do you own any firearms/guns**	
Species list	Total	Reason	YES	33
Barking deer	27	easy to catch/ Value/good taste	NO	10
wild boar	8	for consumption	LOCAL Made gun	9
gaur	2	for consumption		
Civets	1	for consumption		
Primate	3	sports hunting/ thrill	**Do you have a licence to keep the gun?**	
Flying fox	1	for consumption	YES	13
Bear	4	market demand/ medicinal	NO	22
serow	2	for consumption		
At what age did you start hunting?		**Would you accept alternative ways for protein consumption?**		
5-15	12	No, I prefer the wildmeat	7	
16-25	25	Yes, I want substitute for wildmeat	13	
25-35	6	I want both the wild meat and substitute for protein consumption.	17	
35-	0	Not Sure	6	
Do you hunt in any particular season?		**Any changes in animal populations?**		
Dry	0	Decrease	34	
Winter	28	No change	9	
Spring	1			
All-season	12			
Conservation related questions				
How do you think you can help?		**Alternative livelihood?**		
Response	Total	Response	Total	

Avoid hunting on restricted areas	3	a) Yes, I am interested	8	
Planting more trees and to reduce hunting	8	No, I am not interested	11	
Planting trees	7	Maybe	2	
Continue hunting	1	Not sure	3	
Give up hunting	6			
Covid after and before		**Would you be interested in conserving wild flora and fauna?**		
Response	Total	Response	Total	
More Hunting	9	a) Yes, I am interested	30	
Less Hunting	0	b) No, I am not interested	8	
Neutral/ no change	25	c) Maybe	3	
		d) Not sure	2	

Appendix D: Questions and responses for wildlife conservation awareness in villages around INP and Khelia CF.

Age group in years		Animal they like to see in the wild		Biodiversity values		Main cause for biodiversity loss		Concern on biodiversity loss in the village		What are the challenges in biodiversity		Contributions to biodiversity conservation		Covid before and	
15-25	13	Response	Total number of respondent	Response	Total number of respondent	Response	Total number of respondent	Response	Total number of respondent	Response	number of respondent	Response	Total number of respondent	Response	Total number of respondent
25-35	24	Tiger	12	Economic	15	Clearing for agriculture	38	Highly concerned	40	No time to focus on	29	Stop making snares	1	No change in hunting	50
35-45	19	Hornbill	8	Aestheic value	8	Habitat fragmentation	6	Moderately	21	Others	27	Planting trees	43	More hunting	9
45+	24	Sambar	7	Both	42	Poaching and hunting	38	Slightly concern	3	No incentives	9	I do not know	5		
Female	15	Primates	10	I don't know	9	Timber logging	24	Not at all concern	8	No economic benefits	7	Stopping the hunting of	4		
Male	65	Barking deer	18			Don't know	5					Protection of birds during	1		
		Bear	8									Hunting restriction	11		
		Elephant	52									Spreading awareness on	7		
		Gaur	6									Abiding the village rules	2		

Appendix E: Questions and responses for traditional uses of wildlife and hunting from the village elders in villages around INP and KCF.

What are the different traditional methods of hunting?			Any practices of hunting wild animals (skin/fur/feather) related to ceremonial or any cultural practices?			What is your preferred traditional method for hunting?		
	INP	KCF		INP	KCF		INP	KCF
Spear	8	3	YES	5	3	Spear	2	0
Dao	8	0	NO	3	0	Dao	2	0
Trap	8	3	Reasons	Hornbill for feather	Bear, wild pig, tiger, Hornbill feather	Gun	5	1
Handmade Gun	2	1				Traps		1
Bow and Arrow	0	2						