

Journal of the MSc in Primate Conservation

Canopy

Volume 22
Issue 1
Winter 2021



OXFORD
BROOKES
UNIVERSITY

Canopy

Journal of the Primate Conservation
MSc Programme
Oxford Brookes University

ISSN

2054-2070

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Front Cover

White bearded gibbon (*Hylobates albibarbis*) at the Sebangau National Park, Indonesia
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Letter from the Editors

Welcome to the Winter 2021 edition of Canopy, the MSc Primate Conservation in-house journal! As editors, it has been a thrill to read through the work completed by our previous MSc students, which has covered an incredibly diverse range of topics, species, and countries. 2021 celebrates the 18th year of Canopy and we are so proud to be a part of it. We are the first cohort since many COVID-19 protocols were lifted and we believe lockdown and isolation made us especially keen to socialize and we are very grateful to have in-person classes. We have become a tight-knit group, and are proud of the supportive and inclusive environment we and the course staff have nurtured this year.

We have chosen gibbons as the main focus of this edition to reflect the interests of our cohort, which includes many gibbon lovers. The driving force behind this interest lies not only in the gangly, awkward and (somewhat frightening) appearance of the gibbon, but also in their importance to healthy habitats throughout Eastern Asia. The articles we have gathered for you address a variety of topics including reports of field studies, conservation education methods and insights, people-primate interactions, and a discussion of ontological evolution in the field of conservation.

Over the years quite a number of members of staff, PhD and MSc students from Oxford Brookes University have done research on gibbons, including in Bangladesh, India, Laos, Cambodia, Vietnam, Indonesia and Malaysia, as well as in captivity in the UK, EU and the US. This edition includes an interview with Dr Susan Cheyne (page 30), one of our lecturers, and a big name in the world of gibbon research. Her current work focuses on the behaviour, ecology, and socio-ecology of gibbons within Bornean peat-swamps. In this issue, she speaks about potential future research projects, highlights of her work, and her involvement with the Borneo Nature Foundation.

Also included in this edition is a staff letter (page 4) courtesy of Professor Vincent Nijman, who provides an engaging reminiscence of a personal encounter with gibbons during his extensive time in the forests of Indonesia.

We want to thank everyone who has made this Masters programme so fulfilling, including all our staff, lecturers and everyone who graciously agreed to speak for us at the Monkey Monday seminars.

Please enjoy,

The editors (Stephanie, Amanda, & Julia)



Letter from the Lecturer

This issue focusses on gibbons, the small apes, of which some 20 species occur throughout Southeast Asia as well as the easternmost part of South Asia and the southernmost part of East Asia. We recognise four extant genera, the hoolock gibbons in Bangladesh, India, China and Myanmar, the crested gibbons in China, Vietnam, Laos and Cambodia, the siamang in Malaysia and Indonesia and the *Hylobates* gibbons from eastern Myanmar south to central Java. In 1923 a mandibular fragment with M_{2-3} found in southwest China was recognised as yet another genus (*Bunopithecus*). Research published in 2018 showed that a sixth genera (*Junzi*) was present in those parts of central China where currently gibbons are no longer persist, and that they may have survived until a few hundred years ago. And last year, researchers described a seventh genus based on a single molar M_3 from northwest India (*Kapi*).

To me gibbons are something special; hearing their songs and observing them in the forest are some of the highlights of my primatological career. When I was asked to write this welcome address, I checked my field notes to see what I wrote down I observed my first wild gibbons (I remember that day very well). On 30 March 1994 I was in Gunung Gede-Pangrango National Park in west Java, at 1,085 m above sea level as measured by an atmospheric pressure altimeter on my wristwatch. We had arrived the day before, when we had set up camp in the forest on the ledge midway on a very steep valley slope. Opposite us, at the same level but on the other side of the valley, a pair of Javan hawk-eagles had built a nest and, taking turns, they were incubating one single egg. As part of our MSc project, me and a fellow student, Resit Sözer, were observing these rare eagles. At 07:47 hrs while on an early morning reconnaissance I noted something peculiar and wrote it down in my notebook "it smells like the monkey house in the [Amsterdam] zoo". A few moments later a group of four Javan gibbons passed at eye level through the canopy of the trees growing ten or twenty metres below us. We looked at each other, and while they must have been as surprised as we were to see each other from such a short distance, they brachiated in their normal way, and continued with what I assume was their usual morning routine. In the days and months following we observed (and heard) many more gibbons, both in west and central Java, and this started a lifelong interest in the small apes. I have been fortunate to do research on many more gibbons in the wild, in India, Thailand, Malaysia and throughout western Indonesia. In addition, I (co-)supervised PhD students working on gibbons in Bangladesh, Laos and Indonesia, and through them learnt even more about these majestic forest dwellers.

As stated above, observing gibbons in the wild has been a highlight. Recording them in trade, and especially seeing their canines being ripped out to make them more suitable as pets, does make the list of low points. In the early years of my primatological career I (and others) regularly observed gibbons in the animal markets in Southeast Asia, but in recent years this illegal trade has moved largely online. Most online platforms, including Facebook and Instagram, as well as many customer-to-customer websites precluded the sale of live and/or threatened animals, but it is evident that enforcement is weak. In many parts of Asia customers no longer visit animal markets or pet shops to obtain gibbons, they just order them online, pay electronically and have their delivery dropped off by an Uber (or equivalent) driver. Conservation in the online world is an area where still a lot of work needs to be done.

The articles that were selected by the editors include ones dealing with singing behaviour, the effects of forest fragmentation and the forest fires associated with the Southern El Niño Oscillation events on the survival of gibbons, the Realpolitik of gibbon conservation on the China-Vietnam border, and the perceptions of humans towards gibbons and other species. Combined they give a good indication of the work that has been done by students on the MSc in Primate Conservation and the MRes in Primatology and Conservation, and it also gives you an insight into the amazing world of the gibbons.

Prof Vincent Nijman, Module leader, Primate Conservation

The Fragmented Forest Game: Using a simulation game to bring to life the impact of forest fragmentation on gibbon survival

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Scientists and conservationists have been informing governments and the public about the dangers of habitat destruction and climate change for decades (Bongaarts & O'Neill, 2018). They also lament the complacent response to their warnings (Bongaarts & O'Neill, 2018). However, knowledge by itself is not enough to affect behaviour change. The aim of conservation education is not only to impart knowledge but to change attitudes and behaviour (Tan *et al.*, 2018). Actively experiencing a conservation problem using a simulation game can help to make conservation issues relevant and real, generating emotions that can have an enduring impact on participants.

Centuries of forest destruction (Pan *et al.*, 2016) have driven China's four remaining gibbon species to the brink of extinction in isolated fragments of just three provinces: Yunnan, Guangxi and Hainan Island. Their survival continues to be jeopardised by further forest clearance for monoculture plantations and cardamom cultivation (Zhu, 2017), mining, firewood collection (Xu & Wilkes, 2004), hunting (Fan, 2017), frequent droughts (Qiu, 2010) and devastating forest fires (Chen *et al.*, 2014). Yet, in competition to support panda conservation (Wei, 2018), the

public remains largely unaware, unconcerned (Fan & Bartlett, 2017) and state protection is lacking for gibbons.

The Fragmented Forest Game was devised as a key component of a gibbon conservation education programme for schools in China. It is a cross-curricular, team activity, which simulates what happens to individual gibbon families when a forest becomes fragmented. By immersing the children in a game of survival, the objective is to learn and appreciate the value of contiguous, mixed forests for gibbon survival by experiencing the difficulties of habitat fragmentation first-hand, not as passive observers, but as active participants (Tan *et al.*, 2018), thus, effecting change on their attitudes and future behaviours. Experiential gaming has been shown to be popular with a wide range of learning styles (Tan *et al.*, 2018) and, in rural areas of developing countries, where literacy levels can be lower, activities that include kinaesthetic learning can be particularly effective (Franquesa-Soler *et al.*, 2019).

The Fragmented Forest game forms part of an experiential learning cycle (Kolb, 1984), comprising the concrete experience: three rounds of a physical, competitive game; a reflective discussion between rounds; and

assessments, composed of the discussion log, a quiz and the output from two subsequent, creative activities. The value of many potentially powerful conservation activities may be wasted by failing to follow up with opportunities for reflection and reinforcement (Jacobson *et al.*, 2006). Appealing to different ages, learning styles and abilities, and applying several learning theories, these assessments not only evaluate the effectiveness of the game but also help to reinforce the learning. Furthermore, such repetition of concepts in different but associated contexts helps to make the learning more enduring by strengthening the neural paths that contain this information (Jacobson *et al.*, 2006).

The Game

Round one represents the formation of gibbon families travelling through the forest together. The teams (comprising 3 or 4 children) line up as in a relay, the first child running to the other side, where a team member is waiting. They then run together, collecting the third member of the team, moving as a family to the finish line. The first team to cross the line choose their starting point, “the sleeping tree,” for round two. This replicates the success of the fittest gibbons in defending the best territory and informs the children that gibbons choose a sleeping tree every day. At the end of the round, the teacher asks pre-prepared questions to help the students to reflect on their experience, how this might

relate to gibbons in the wild and ensure all learning points are covered. Their answers are logged by the teacher for later analysis.

In round two, the teacher distributes green and red balls or beanbags within loosely delineated lanes, representing their family’s territory, according to a pre-prepared “forest” design (Fig. 1). The objective is to collect as much food as possible, with red balls worth 5 points, and green balls worth 1 point. A minimum of 15 points is needed to survive. Since gibbons are very territorial, teams are told primarily to use their own lane (territory). If a player enters another team’s lane to collect food, the waiting team members make gibbon noises and the intruder should then move out of that lane. Team members run one at a time, collecting one ball and running back to put it in the basket. The game continues until all of the balls have been collected. The teams then calculate their points, which were recorded on the Game Record.

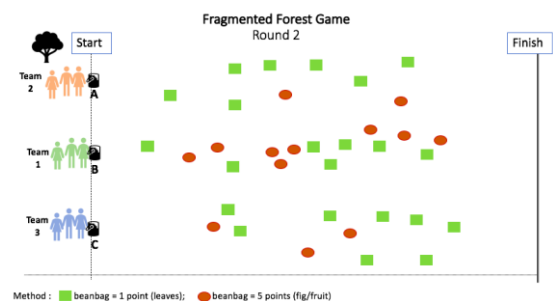


Figure 1. Representation of Round Two of Fragmented Forest Game with balls distributed as fruit and leaves

In the reflective discussion, the teacher signposts the children back to an activity on the gibbon diet, asking why the red balls might be worth more than the green balls, reinforcing learning about high- and low-quality foods. Lastly, the teacher reminds the children that gibbons usually defend their territory using vocalisations and uses pre-prepared questions to cover the key learning points.

Round three has the same objective as round two with the balls arranged in the same places, but location A is separated from the other teams by demarcating a gap on the grass. All balls are removed from the gap representing a loss of food as trees are cut down (Fig. 2). The winning team from round two has the first choice of a sleeping tree; the losing team is allocated Location A. The team in Location A are told they cannot safely cross the gap, as it represents 100-metres and gibbons avoid coming down from the trees, because of human and animal predators. This round also introduces the role of hunters, who run along the gap and tag any player that moves into the gap. Tagged players are out, that is, captured or killed by the hunter. The game finishes when all the balls are collected. The teams empty their baskets and calculate the points. The winning team has the most points.

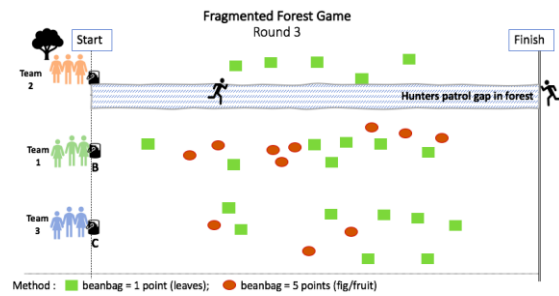


Figure 2. Representation of Round Three in which a gap fragments the forest, isolating Team 2 and reducing the available habitat for Teams 1 and 3.

In the final reflective discussion, teachers request feedback from the isolated team, who will have had insufficient food available to survive. This key learning point may have been overlooked by the other teams. The teacher extends their learning and ensures that all key points have been considered by asking pre-prepared questions about the long-term prognosis for the isolated group, and competition for food in contracting forests. In order to maintain a positive message and avoid a sense of hopelessness (Wells & Zeece, 2007), the teacher concludes by encouraging ideas about what can be done to help. The Learning Cycle is then completed by two related, creative activities, which contribute to the evaluation and the extension of positive ideas.

Following the game, students answer the multiple-choice quiz in their workbooks, which evaluates their learning and the effectiveness of the game. In the game's first pilot in the UK, the results from the quiz suggested the game is effective in

transmitting knowledge about key behaviours of wild gibbons, demonstrating the value of mixed forests and the numerous problems for gibbons arising from forest fragmentation. In addition to being informative, feedback from students and the teacher also indicated that they enjoyed it, with 82% of students choosing a 4 or 5 for enjoyment value on the Likert scale. They also appeared engaged in the process, collaborated well with their team-mates, and the majority of key learning points were raised during the reflective discussions

The Fragmented Forest Game was a fun and effective way of making the impact of forest fragmentation on gibbon survival come alive, generating emotions and competitive spirit between the teams and relating it to the real experience of gibbons in fragmented habitat. Although designed for gibbon conservation education in China, its learning is applicable to many animal species around the world and could be enjoyed by a variety of ages.

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The potential Influence of pair bond strength on singing behaviour in Bornean agile gibbons (*Hylobates albibarbis*)

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Gibbons are small, arboreal, Asian apes that typically live in small and socially monogamous family groups. Each group defends a territory from other groups of gibbons. Their distinctive singing behaviour is thought to play an important role in advertising to other gibbons that a territory is occupied (Fan *et al.*, 2009), and to maintain a respectable distance between groups (Mitani, 1985). It is possible that the durability of the relationship between the mated pair of gibbons, sometimes called the pair bond, influences singing behaviour (Palmobit, 1996). During this study, I followed and collected data on two mated pairs of Bornean agile gibbons (*Hylobates albibarbis*). My intention was to show that higher amounts of time spent performing behaviours associated with a strong pair bond, such as grooming, playing, and feeding near one another (cofeeding) are associated with a higher level of effort put into singing. This is represented by variables such as the length of song bouts, number of great calls, the time the gibbons first sing in the morning, and their position in the order of the morning chorus of gibbon singing.

The study took place at the Natural Laboratory of Peat-swamp Forest (NLPSF) in Central Kalimantan, Indonesia, approximately

20km south-west of the provincial capital of Palangka Raya. The site covers 500km² of the north-eastern Sabangau catchment, a partially forested 9,200km² area of peat swamp between the Katingan and Sabangau rivers. The 6km² area of the NLPSF in which this study took place is an area of low productivity recovering mixed swamp forest, having been selectively logged for thirty years as part of a logging concession and illegally logged for several years after the concession's closure. Failed attempts to convert this area into agricultural land further damaged the forest through the creation of drainage canals, causing the highly flammable peat to periodically dry. This contributed to frequent forest fires, even to this day (Harrison *et al.*, 2007). The site is operated by the Center for International Cooperation Management of Tropical Peatland (CIMTROP), based out of the University of Palangka Raya. The Bornean Nature Foundation (BNF) works in partnership with CIMTROP to research and conserve the forest and its native animals.

During this study, two fully habituated mated pairs of *H. albibarbis* were followed from when they awoke in the morning until they entered a sleeping tree for the final time that day. During this time, I used focal time

sampling to record the activities of a single focal animal every five minutes. From this, I calculated the proportion of the daily time budget spent grooming, playing and co-feeding for a given day. I recorded data on singing behaviour as it occurred, including whether the group sang at all on that day, the time the gibbons first began to sing, the time the female first great called, the number of great calls, the total time spent singing, and the group's position in that morning's chorus. I also calculated the proportion of time spent singing, the average bout length, and the number of great calls per bout. Overall, 52 followers were successful in collecting behavioural and singing data.

All statistical tests were performed with IBM SPSS Statistics 22 software. I used multiple regression analysis to construct models explaining variation in the 9 dependent singing variables using the 3 explanatory social variables. When originally constructing the models, other variables were used which described different components of gibbon behaviour. For the purposes of this small article, these variables are removed and not addressed. For the singing variables that were not capable of providing significant models or otherwise breached the assumptions of the multiple regression test, I performed Spearman's rank-order correlations to show the correlations between the singing and social variables.

A multiple regression model was created for the proportion of time spent singing. This included proportion play for total time spent singing which included proportion groom, and for time of first great call which included proportion play. None of the results given by these social variables were significant. Adding other variables caused the overall model to become non-significant or to breach the assumptions of the test.

The remaining social variables (abstinence from singing, time of first sing, order in the chorus, total number of great calls, average number of great calls, average bout length) either did not form significant models in multiple regression or breached the assumptions of the test. I used Spearman's rank-order correlation instead to show the correlations between the response and explanatory variables. None of these 6 dependent variables was shown to have a significant relationship with any of the 3 explanatory variables.

These results imply that the time a gibbon spends playing, grooming, or feeding in close proximity with their mate, and hence the strength of the pair bond between mated individuals, may not be as important in influencing gibbon singing behaviour as has been previously thought. It is also possible that these social behaviours are not good indicators of pair bond strength. Though it was not possible to achieve due to limited available personnel, it would be interesting in

the future to use GPS data to quantitatively examine the distance between both individuals in a mated pair. This is thought to be a very good representative of pair bond strength (Geissmann & Orgeldinger, 2000). It is also possible that the use of other statistical tests such as time series analysis or cross correlation could provide a result that is more representative of reality. My sample size of four individuals is also quite small and including other individuals in the analysis would be an improvement.

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Understanding people's motives behind their negative interactions with great apes

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Primates have the highest proportion of endangered species of all mammals (Shultz, 2016). Human interference is the largest and most detrimental aspect of conserving a species, as they are often responsible for altering their habitats, hunting, and disease transmission. Because great apes have such a long reproductive cycle, the killing of just one fertile ape can be detrimental to an entire population (Wich *et al.*, 2012).

Competition for space and resources between humans and animals causes many of today's

conflicts. Animals that adapt to anthropogenic landscapes are often seen as pests, especially when it comes to crop raiding (Dickman, 2010). As human beings expand their colonies and territories, the natural habitat of great apes is being encroached upon. It is predicted that crop raiding conflicts between the great apes and humans will only increase, as forests are being destroyed and converted into farmland at an alarming rate (Campbell-Smith *et al.*, 2011). Economically valuable crops are

often targeted, posing a great issue for the locals.

The most common threats to great ape populations are deforestation and habitat degradation, hunting, the illegal wildlife and bushmeat trade, and anthroponotic transfer of disease. It is important to understand the causes of these threats and people's motives behind them if we are to begin implementing successful conservation programmes.

Deforestation & degradation

Logging is a significant issue when it comes to diminishing great ape densities since it disrupts food sources, increases locomotor activity by decreasing canopy size, and makes the forest more accessible to humans, resulting in increased hunting. Deforestation and degradation are significantly decreasing the land that great apes live on. Recent studies have indicated that orangutans can maintain a healthy population in slightly logged forests, but most logged forests are being entirely removed and replaced with agriculture, such as oil palm plantations (Campbell-Smith *et al.*, 2011). Protecting the world's forests is environmentally important, but it is not always economically beneficial, making it difficult for people to find the motivation to preserve nature.

Hunting

Forests are being converted into human-dominated landscapes at an unsustainable rate, resulting in more human-wildlife conflict.

This often results in the killing of animals. Despite the consequences of logging being so perilous to these animals, Marshall *et al.* demonstrated that hunting may actually be the main cause for orangutan populations. Animals that live closer to humans may be more susceptible to diseases and being hunted. They are also killed as a food source, for the pet trade, and even for medicinal purposes (Davis *et al.*, 2013).

A study conducted by Meijaard *et al.* (2011) shows that 27% of individuals either didn't know or didn't think that orangutans were protected under Indonesia's national law. Orangutan deaths were reported as higher in areas where people had these thoughts. Many people also reported killing because they perceived the orangutan is a dangerous animal. Education is crucial in these scenarios. Many of the killings were associated with religion. If methods of education were involved at a church level, perhaps the message could get across more efficiently. Another common reason seemed to be opportunistic. Emphasising that it is no longer socially acceptable could prevent these sorts of killings as well.

Illegal wildlife trade & bushmeat trade

It is estimated that 3,000 great apes are lost each year to the illegal wildlife trade (Freund *et al.*, 2016). Wildlife crime is a significant issue on the black market (the fourth-most common), including primates sold as pets, used as bushmeat, or for traditional

medicines. In 2013, it was a \$19 billion industry, with no indication of it slowing down.

The pet trade and the bushmeat trade are linked, as hunters kill the parents and then sell the orphaned animals as pets. The parent is then often sold as bushmeat (Freund *et al.*, 2016). Adult females are most killed in the search for infant to be sold. This is detrimental to populations as female great apes have a low reproduction rate and they are being hunted unsustainably.

Techniques for obtaining and trading bushmeat have been improving over the years, with better technology. Despite many of these hunted animals being Critically Endangered, the bushmeat trade continues to thrive as the economic value of the meat is high (Jones-Bowen & Pendry, 1999). Many villages rely on the income from the sale of bushmeat, so if it were to be outlawed, these areas would not be able to financially support themselves without breaking the law. Furthermore, many groups have become solely reliant on the revenue brought in from bushmeat.

Zoonotic transfer

Zoonotic diseases are the most common emerging infectious diseases. Wildlife is an enormous industry that makes a lot of money. Kenya and Tanzania make around half a billion US dollars each year in wildlife tourism. Europe gains nearly 10,000 Euros from

hunting, Africa gains hundreds of millions from the bushmeat trade (Chomel *et al.*, 2007). As human population continues to grow, we are seeing more anthropogenic forests and fewer animal habitats. As animals are losing their habitat, they are more frequently exposed to humans. Loggers are particularly at risk (Jones-Bowen & Pendry, 1999). Whilst logging a forest, a person is likely to encounter several different species of animal. If one is able to infect the logger through zoonosis, then the logger returns to civilisation and infects other people, we could be looking at an epidemic, or even worse, a world-wide pandemic outbreak.

There are several diseases that could be transferred from humans to great apes, including the common cold, influenza, tuberculosis, measles, rubella, mumps, yellow fever, polio, Ebola, encephalomyocarditis, hepatitis, small pox, chicken pox, bacterial meningitis, and a variety of parasites (Schultz, 2016). These diseases can transfer either through aerosol transmission (breathing the same air), or faecal-oral transmission (caused by direct contact).

Transfer of pathogens between humans and non-human primates is especially high in anthropogenic zones, usually caused by poaching, forest conversion, and general habitat destruction. In 2011 alone, there were 8.7 million cases of tuberculosis within humans (Wolf *et al.*, 2013). 24% of these cases were in Africa, making chimpanzees,

bonobos, and gorillas at risk. Despite humans being the main carriers of the disease, anthroponotic transfer to other primates is possible. As humans are interacting with apes more frequently due to anthropogenic conversion, the likelihood of tuberculosis transfer to apes is higher than ever (Carne *et al.*, 2014). Apes are social creatures, meaning disease transfer can be rapid. There have been numerous reports of great apes receiving pathogens from humans (Chomel *et al.*, 2007).

As eco-tourism is becoming more of a booming industry, there are more anthropogenic risks to the animals involved. Great apes are especially at risk as they are physiologically similar to humans and are susceptible to human-borne pathogens (Rudicell *et al.*, 2010). The more endangered an animal is, the closer people seem to want to be to these animals. The positives of this are that it raises awareness and shows that people care for the well-being of the animals, but the downside is that it acts as a potential bio-hazard for all involved.

As conservationists, it is important to understand the various hazards to great apes. Understanding motives behind anthropogenic actions that negatively impact the animals is the first step toward creating a successful conservation programme. For deforestation and degradation, it is a competition for space. People have a multitude of reasons for hunting, including fear of the animal, human-

wildlife conflict, the illegal wildlife trade, and the bushmeat trade. Zoonotic and anthroponotic transfer can occur any time a human comes in contact with an animal, making loggers and poachers particularly threatening as they are frequently within great ape habitat. Zoonosis and anthroponosis also occurs during ecotourism, making it especially important for individuals running the programmes to be particularly diligent in making sure that the tourists do not come in close contact with the animals. The threats that great apes experience have been the same for decades. This has allowed us to see trends in population sizes and how each threat affects the animals. It is important for us to utilise this knowledge to implement successful conservation strategies.

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Assessing the impact of an El Niño fire on a population of Müller's gibbon (*Hylobates muelleri*) in a threatened Bornean forest

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Tropical forests, the biome that hosts most primate species, are becoming increasingly threatened by fires. The cause of these fires is mainly anthropogenic, however, there are also natural factors that contribute to fire in tropical forests. One such factor is the El Niño phenomenon, which occurs every few years and leads to extreme droughts throughout much of the tropics, exacerbating the impact of existing fires (Field *et al.*, 2016). Furthermore, the frequency and severity of El Niño are predicted to increase due to climate change (Cai *et al.*, 2018), therefore to effectively conserve primate populations it is crucial to determine the impact of these

events and subsequent fires. While many studies have addressed the impact of disturbance such as drought and fire on primate populations, few have assessed this using a longitudinal data set, especially before and after a disturbance event (Chapman *et al.*, 2000; Almeida-Rocha *et al.*, 2017). Therefore, it is difficult to draw robust conclusions about the long-term impacts of fires on primate populations.

I conducted auditory point transect surveys on a population of Müller's gibbon (*Hylobates muelleri*) in Sungai Wain Protection Forest (SWPF) in East Kalimantan three years after an El Niño event in 2015 led to fires at the

site. I analysed this survey data along with data collected from the same site three years before the fire.

My aims were: 1. To compare the population size and group density estimates produced from data collected from surveys in 2012 and 2018 within the pristine area of SWPF using triangulation analysis, and; 2. Use these estimates to make an inference about the impact of the 2015 El Niño fire on the long-term stability of the population. I hypothesised that the population size and group density of gibbons within the pristine area of SWPF would decrease from 2012 to 2018 and that this may be a result of the 2015 El Niño fire.

SWPF (S1°16', E 116°54') is a 100km² lowland dipterocarp forest located 15km from Balikpapan, East Kalimantan, Indonesia (Fig. 1). During an El Niño episode in 1997-1998, fires led to cc. 60km² of the forest burning over a total of five months (Fredriksson, 2002). Similarly, in 2015, subsequent El Niño related fires led to cc. 10km² of the Once-burnt forest burning for a second time (Pro Natura Foundation, 2020). The Müller's gibbon is one of four endemic Bornean gibbon species and is currently listed as Endangered on the IUCN Red List of Threatened Species (Marshall *et al.*, 2020).

The data from the 2012 survey was obtained from the researchers who collected it (Gilhooly *et al.*, 2015), and full permission was

given to conduct further analysis of the data as part of this study. The researchers surveyed ten arrays of listening posts over 38 days, from May 20 to July 16, 2012, in the regenerating and pristine areas of SWPF (Fig. 1). For the 2018 data collection, I surveyed 14 arrays over 56 days, from April 04 to August 29, 2018. The arrays were distributed throughout the three forest types in SWPF: Pristine, Once-burnt and Twice-burnt (Fig. 1). Nine arrays were in the same location as those surveyed in 2012; five more arrays were added in new locations (Fig. 1).

Only arrays located entirely in the pristine forest and surveyed in both 2012 and 2018 were selected for the analysis (Fig. 2), as there were too few arrays in the other strata to produce robust estimates.

For both data sets, the number of distinct groups heard on each survey day and the total number of cumulative groups over all the survey days were determined through mapping. A slightly different method of determining the number of distinct groups was used for the 2012 data set as data on call times was unavailable. Both the 2012 and 2018 data were analysed using the 'Package for Calculating Gibbon Population Density from Auditory Surveys' (Vũ Tiến Thịnh & Rawson, 2011). The package generates density and population size estimates from acoustic survey data using the triangulation formula (Brockelman & Ali, 1987).

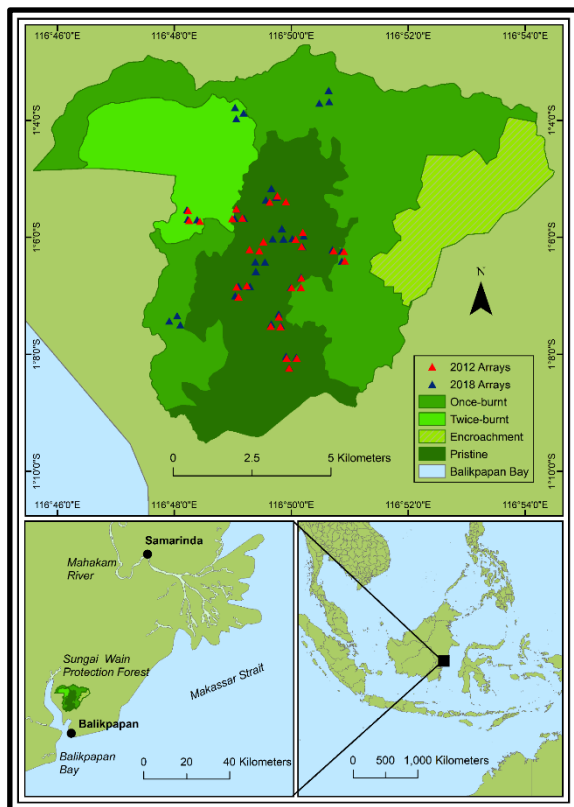


Figure 1. Location of all the listening post arrays in the 2012 and 2018 gibbon surveys in Sungai Wain Protection Forest, and the location of Sungai Wain Protection Forest in East Kalimantan and Indonesia.

My results showed a slight increase in the group density estimates in the pristine area of SWPF from 2012 to 2018. Similarly, when extrapolated to the total area of SWPF, the population size estimate also showed a slight increase.

My findings do not support my hypothesis that Müller's gibbon population size and group density would decrease from 2012 to 2018. Furthermore, my results suggest that the El Niño fire of 2015 may have led to a slight increase in both population size and group density, which may be explained by gibbons fleeing the fire affected area into the pristine core and establishing new territories

(Cheyne *et al.*, 2016). However, my results could also be explained by the different method of determining the number of distinct groups for the 2012 data set.

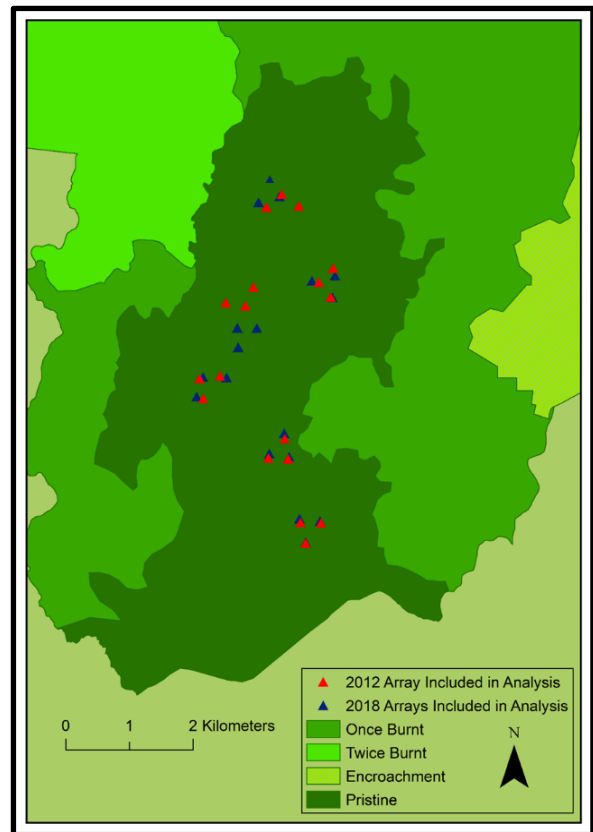


Figure 2. Location of all the 2012 and 2018 listening post arrays in Sungai Wain Protection Forest which were included in the analysis.

Further fires in SWPF could be detrimental to the Müller's gibbon population, as more groups may flee into the pristine core, potentially resulting in the carrying capacity of the stratum being exceeded. As El Niño events are predicted to increase in frequency and severity in the future, the SWPF Müller's gibbon population may struggle to recover from further fires. The population of Müller's gibbon is especially important at this site as they are the largest frugivorous seed

dispersers and therefore are vital for forest regeneration. My study highlights the importance of a longitudinal approach to assess the impact of disturbance on primate populations and shows that further fires could pose a considerable threat to the population of Müller's gibbon in SWPF.

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The ontological turn within anthropology and the ethical challenge of species loss

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Calls for the inclusion of social science within conservation practice are long-standing. While the practical challenges are often examined in detail, including different educational backgrounds, publishing in different journals and preferences for working at varying scales (Chua *et al.*, 2019), little work has been done to examine the challenges inherent within certain disciplinary frameworks themselves. Until recently, anthropologists have generally failed to consider biodiversity in their analyses. Several theoretical developments have been introduced to combat this anthropocentrism – offering metaphysical and practical approaches to the exploration of the “more than human world”. These include multispecies ethnography, which explores human ‘entanglements’ with other living beings (Kohn, 2013), and one approach which has been gaining increasing momentum as a way of thinking about and knowing the natural world(s), the ontological turn.

The ontological turn takes an aggressively egalitarian approach to anthropology and the theorization of the lives and minds of others. Proponents advocate that when encountering moments and concepts which challenge our perceptual categories, instead of attempting to deconstruct these ideas to fit them into our

pre-existing categories, we take the opportunity to use these concepts to deconstruct and reincorporate our own categories (Holbraad *et al.*, 2017). According to theorists, our impression that ideas which do not conform to our understanding of the world are “incorrect” is rooted in our inability to comprehend the worlds of others (Graeber, 2015). Indeed, this distance in comprehension is so significant that we do not have different worldviews, rather we inhabit different worlds (Kohn, 2013). It is an insistence that we do not dismiss other ways of knowing about the world as “superstitious”, “ignorant”, “silly”, or simply incorrect. This approach means taking our informants more seriously as interlocutors, allowing them to set the terms of our engagement (Graeber, 2015). Proponents argue that without the conceptual agility ontological relativization offers, anthropology risks misunderstanding, and even misdescribing the very ethnographic materials it seeks to describe (Holbraad *et al.*, 2017).

Proponents take a constructivist approach to reality. In this view, there is no “real” world onto which we project culture. Concepts and what they pertain to are one and the same (Henare *et al.*, 2007). There is no reality that is mediated by culture, because there is only

culture, and this is what produces our perceptions of reality. Arturo Escobar (2016) has been one of many proponents of the ontological turn to link the topic to environmental degradation, although many theorists tow similar lines (Descola, 2013; Kohn, 2013; Viveiros de Castro, 2015). Escobar uses the concept of relational ontology to describe our relationships with the natural world. In such relational ontologies “nothing can pre-exist the relations that constitute it” That is, things and beings are their relations, they do not exist prior to them (Ingold, 2011). From this perspective, territories are defined not by geographical space, but by the ontologies which inhabit them (Escobar, 2016).

Proponents of the ontological turn frequently regard the spectre and reality of environmental degradation as a rallying cry for their mode of thinking (Escobar, 2016; Viveiros de Castro, 2015). The climate is a question of “common cosmopolitical concern” (Latour, 2013). However, they theorise such issues in narrow and restrictive ways. Proponents of the ontological turn accept that there are many worlds, with no worldview having greater purchase on ‘reality’ than any other. Escobar and other theorists argue that one of the most pernicious aspects of modernity is that it perpetuates the claim that there is only one, what Escobar calls the ‘One World world’. In this line of thinking, the One World world is a force unto itself, it

perpetuates a dichotomy between nature and culture and tries to transform many natures into one, and in the process, flatten and erase cultural and biological diversity, establishing monocultures across physical and mental planes. Escobar attributes environmental destruction solely to the propensity of the “One-World world” to convert everything that exists into a single “nature” and this nature into “resources”. He argues that it is through the disruption of proper relations that environmental degradation occurs, when the One-World world progressively destroys relational worlds - often those of indigenous peoples - through ontological capture and reconversion by capital and the State (Kohn, 2017). In this conception it is implicitly assumed that all indigenous ontologies inherently lead to a state of environmental equilibrium, a reification of old noble savage discourses. It is modernity and ‘the West’ that cause environmental degradation. Struggles over the environment can only be conceptualised inasmuch as they are struggles of indigenous peoples to resist environmental degradation wrought by the nebulous forces of neo-liberal capitalism and cultural imperialism. This view does not account for, nor offer any solutions to more complex and nuanced situations such as those in Madagascar where environmental degradation and potential species losses may result from the choices of local communities to support their subsistence needs through

tavy (slash and burn agriculture). This is concurrent with the ontological turn's declaration that they hold the answer to environmental degradation, as Eduardo Kohn states "an anthropology beyond the human is perform an ontological one".

The ontological turn allows us to imagine a world in which the natural world(s) is not valued for its ability to produce value in the form of capital, but for the way it enriches our social worlds. It encourages us to take our interlocutors seriously – radically so. However, there are significant flaws to this approach. The relational ontological conception of our relationship to the natural world(s) affords no value to the natural world(s) outside of human attribution within relational ontologies. Rather than moving beyond the anthropocentrism of ethnographies of old, which implicitly devalued the natural world by disregarding it, this approach explicitly devalues the natural world through an insistence that it does not have value independent of that conferred by humans. Species loss becomes an extension of the disequilibrium generated by modernity. It is true that extinction on this scale is a modern phenomenon in relation to human history, however extinction fuelled by human activity is not. Thus, it is necessary to have the conceptual tools to ethically consider 'imbalanced' relationships with biodiversity amongst indigenous peoples or local communities, something current ontological

approaches cannot offer. Debates about whether non-human species should have intrinsic value or only instrumental value are long-standing (Singer, 1975; Taylor, 1986; Ferry, 1995; DesJardins, 2005). Proponents of relational ontologies would have no choice but to tether the value of endangered species to their value in relational worlds. However, unless species are considered to have intrinsic value, irrespective of human valuation, they will be vulnerable to extinction. In some parts of Madagascar, the aye-aye (*Daubentonia madagascariensis*) is considered good luck, it is treated with such reverence that when found dead they are given full funerary rites (Besnard, 2016). In other regions the aye-aye is considered a bad omen and killed on sight (Simons & Meyers, 2001). The aye-aye is the only extant member of the taxonomic family Daubentoniidae, and it is Currently Endangered (Louis *et al.*, 2020). The aye-aye is simultaneously valued and not valued, but even in the regions where it is valued, habitat loss threatens it with extinction (ibid.). Relational ontology currently offers no tools for conceptualising this dynamic, or mediating species extinctions in these contexts. This is an ethical dilemma, as Kopnina (2012) puts it "extinction of species is not socially constructed and needs to be ethically addressed". Environmental ethics may offer a fruitful midway point allowing for collaboration between conservationists and social scientists. Environmental ethics

challenges the anthropocentrism of modern ethics by extending the object of our duty to future generations and non-human beings (Yang, 2006). Paul Taylor (1986) argues that because all organisms have a telos or “purpose”, this gives all organisms inherent worth. Because each organism has a purpose, fulfilment of that purpose is good, and to thwart this purpose is bad. This is just one example of an approach from the perspective of environmental ethics.

Proponents of the ontological turn argue that the merit of anthropology as a discipline lies not in engaging the details of present problems, but through using what we learn to reimagine the world (Bessire & Bond, 2014). That is, political action is diverted from examination of the lived reality of the challenges of the present, and considerations of how this could be changed, to an imagination of how the world could be, what the authors describe as a “persuasive and unmoored form of speculative futurism”. A vital weakness of ontology is the absence of a theory of action or practice, to link the speculative ideal future, to our present, banal modernity. In imagining how the world could be, relational ontologies offer no tools for working within the world as it is. As indigenous scholar Zoe Todd (2016) critiques, proponents of the ontological turn laud the possibility of indigenous discourses to transform the world without actually listening to or engaging with indigenous discourses to

transform the world. The link between tavy and present-day forest degradation is a good example to think through this dilemma. Historical factors which can be linked to the “West” and “modernity” can be linked to the emergence of relations which have led to overexploitation (Scales, 2014). However, there is a limit to the extent that this matters at present. Lemurs are endemic to Madagascar, and they are the most threatened mammal group on Earth (Schwitzer *et al.*, 2013). Forest degradation threatens almost every species of lemur, and the historical context has little bearing on the question of what must be done to prevent species extinction.

The ethical challenge facing anthropologists at present is not simple. If species extinctions and future climate threats are the ethical responsibility of anthropologists, this may necessitate a shift in dynamics between informants and ethnographers which have been maintained for a long time. If anthropologists decide these challenges are not their responsibility, they must develop an ethical case as to why. Anthropological perspectives in relation to conservation and climate change are beginning to emerge. In the introduction to a recent synthesis on the anthropology of climate change, Hans Baer and Merrill Singer (2018) argued that anthropologists need to become involved at a “local, regional, national and global level” as “observers and engaged scholars”. Gardner

and Lewis (2015) argue that at present the application of anthropology in attempting to construct a better world is as vital as ever. Kopnina (2012) calls for a 'Conservational anthropology' which is "a conscious, ethical, political, and practical call to include the rights of non-human actors in the discussion of environmental justice."

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Is there a preference for the conservation of endemic versus foreign species through viewing wildlife documentaries?

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In recent years, there has been a debate as to whether wildlife documentaries play a role in creating and promoting conservation values. Some scholars believe that these films are great for introducing audiences to foreign species, while others believe that an inaccurate depiction of the world's wildlife may lead audiences to believe populations are stable, thus doing more harm than good with respect to conservation initiatives. While the debate continues to play out, few literary sources have attempted to discuss the relationship between the audience and the films viewed, with respect to how aspects of culture can influence species perception. This article makes a small contribution to help fill the present gap in the research literature. It provides a glimpse into how factors such as gender and generation impact individuals, and, in turn, influence species preference and willingness to contribute to conservation initiatives. It also examines how elements of film are received by viewers in an attempt to understand how they help or hinder an audience's ability to connect with on-screen species. Conducted in Houston, Texas, this study compared viewer preferences for endemic versus foreign flagship species represented in wildlife documentary clips

easily accessible on YouTube. The findings suggest that variables including gender, generation, and film attributes play a role in how audiences perceive both endemic and foreign species. The findings also suggested that while viewers found the clips interesting, they did not feel motivated by the clips to take conservation action. Viewer needs that must be met to create conservation values are influenced by culture and vary across a wide spectrum. Film attributes can play a major role in how viewers determine which species they prefer and therefore must be taken into account.

The influence of generation

One of the most interesting aspects of this study revolved around the differences in the thought patterns underlying generational preferences for species. Participants were selected from three different generations: the Baby Boomers, Generation X, and Generation Y. Each of these generations were influenced by unique life events that likely had an impact not only on their world-view, but also on their thoughts and actions. Baby Boomers grew up in the face of conflict, born at the end of World War II and the beginning of the Cold War. In response to political tensions, this

generation is known for introducing the concept of “free love” and nonviolent protests (Pipher, 1999). They also grew up in households where mothers were in charge of child rearing and fathers were often out of the house. Technology for the purposes of entertainment was beginning to evolve during this era, with the transition away from radio and toward television.

Generation X, born between 1962 and 1981, is composed of individuals that feel disconnected from members of other generations, and therefore believe that they are misunderstood (Novak, 2015). Gen Xers are often referred to as self-absorbed, and they view themselves as survivors. Unlike the Baby Boomers, this generation often had households where both parents worked full-time, so children were looked after by older siblings. Technology, specifically advanced communication technology, was used frequently by this generation, but their lack of exposure to computers has led them to feel disconnected from younger generations.

Generation Y, the youngest generation in this study, is often referred to as the “Echo Boomers” since their large size echoes that of the Baby Boomers (Morton, 2002). Whether they grew up in dual or single parent households, this generation was nurtured and supported by their parents, unlike Generation X who labelled their parents as “absent”. After living through the 9/11 terrorist attack, the War on Terrorism, and the 1999

Columbine shootings, this generation witnessed a world-wide tightening of security measures. For this reason, it is possible that Generation Y has become preoccupied with safety and self-defence. Members of this generation are also more likely to be labelled as racial or ethnic minorities than members of previous generations were, and often prefer teamwork rather than carrying out individual tasks (Fry & Patten, 2015). Unlike the previous generations, Generation Y grew up surrounded by technology and view technology as an absolute necessity.

When looking at the influence that generation had on this study, results were found to be statistically insignificant which could be attributed to the small sample size used. However, the transcripts from each focus group conducted did reveal interesting trends in thought patterns underlying generational preferences. The free love, non-violent Baby Boomers were anti- pygmy marmoset (*Cebuella pygmaea*) because they felt that this primate was too aggressive towards neighbouring groups and did unnecessary damage to the trees on which they feed. In contrast, Generation X preferred the pygmy marmoset over the Texas kangaroo rat (*Dipodomys elator*) because of the presence of inter-group cooperation. This generation liked the fact that the primates could organize an uprising in order to acquire additional resources. Like the Baby Boomers, Generation Y felt that the pygmy marmoset was too

aggressive. They preferred the kangaroo rat because of its “underdog” status – it looked weak initially, but proved that it was more than capable of warding off predators when necessary.

The Chinese pangolin (*Manis pentadactyla*) won the vote of the Baby Boomers because its diet relied heavily on the consumption of termites. They felt that this species would be highly beneficial with respect to protecting homes from termite infestations. This is likely tied to this generation having a high rate of home ownership in comparison to previous and younger generations (United States Congressional Budget Office, 1993). Meanwhile, Generation X chose the nine banded armadillo (*Dasypus novemcinctus*) because they felt that this species was an important symbol representing the state of Texas. Generation Y shared this sentiment, but preferred the Chinese pangolin because they viewed the species as adaptable. Generation Y saw this species as nonviolent, but capable of adapting in the face of unfavourable conditions in order to survive.

Baby Boomers had a hard time choosing between the American black bear (*Ursus americanus*) and the Sumatran orangutan (*Pongo abelii*) because the clips of both showed that each species had strong mother-child bonds. This is likely because (1) the family structure for this generation was one where the mothers were responsible for all child-rearing responsibilities, and (2) because

the majority of the Baby Boomer participants were female, so this depiction of child-rearing played on their maternal instincts evoking a strong emotional response. Generation Y was faced with a similar dilemma, as they were found to have a great deal of respect for single mothers who had to raise children with absent fathers. This generation grew up understanding that divorce was socially acceptable and therefore believed that a single parent household could function just as efficiently as a dual parent household. The parent generations for Generation Y are also described as being very nurturing toward their children, which could be indicative of Generation Y having a greater respect for their parent(s) and their role as caretakers (Novak, 2015).

While this study could not confirm a direct correlation, it is possible that the shared views between the Baby Boomers and Generation Y are evidence that older generations have influenced younger generations. As their character profile suggests, Generation X did not appear to share the views of the other two generations. This generation appeared to have more anthropocentric views, in that when it came time to choose a species, preference was often determined by which species would provide the most benefits for the human population. Each generation had its own voice and distinct opinions, reflecting their unique values, which in turn had an influence on their

species preferences.

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Challenges of conserving transboundary species: with a focus on northern white-cheeked gibbons (*Nomascus leucogenys*)

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Wildlife populations do not align with international borders and can range across several territories. These populations are referred to as “trans-boundary species”. There are several challenges associated with the conservation of trans-boundary species, including difficulties conducting population surveys, a lack of knowledge sharing due to language barriers, and mistrust across borders (Lieu *et al.*, 2021; Ma *et al.*, 2021). These factors make the effective conservation of trans-boundary species challenging.

A trans-boundary species in need of conservation intervention is the Critically Endangered northern white-cheeked gibbon (*Nomascus leucogenys*) (Fig. 1). Northern white-cheeked gibbons are extant across Lao PDR and Northern Vietnam. Historically, they ranged to the Yunnan Province of China, however, since 2009 their ecological



Figure 1. Male northern white-cheeked gibbon
(Source: ZSL.org)

extinction in China has been widely accepted (Fan *et al.*, 2009). The primary threats to northern white-cheeked gibbon populations in Lao and Vietnam are hunting for the pet trade and habitat destruction, degradation and fragmentation (Syxaiyakhathor *et al.*, 2020). Survey data in Vietnam has identified several locations where the species persists

alongside potential population estimates. However, within Lao PDR very little is known about the remaining population of northern white-cheeked gibbons (Syxaiyakhamthor *et al.*, 2020). Although Syxaiyakhamthor *et al.* (2020) has estimated that due to suitable habitat availability Lao potentially has the largest population of northern white-cheeked gibbons.

Trans-boundary surveys

Accurate population surveys are the vital first step to initiating conservation action and guiding management plans. A limitation of surveying trans-boundary species is that populations can be significantly over or under estimated. This is because population data can be skewed by more extensive population surveys on one side of the border (Ma *et al.*, 2021). Ma *et al.* (2021) investigated the trans-boundary conservation of cao vit gibbons (*Nomascus nasutus*) and found that past surveys on either side of the Vietnam and Chinese border had underestimated cao vit gibbon populations. Furthermore, in some locations surveys are not undertaken close to political borders due to security concerns, which might lead to the underrepresentation of populations (Ma *et al.*, 2021). Similarly, animals that actually live across political borders may lead to the overestimation of populations as surveyed individuals may be counted twice, once on each side of the border (Vitkalova *et al.*, 2018).

In the case of northern white-cheeked gibbons there are enormous knowledge gaps and increased population surveys are an urgent requirement to improve our understanding of the species and their presence within Lao and Vietnam. However, as a trans-boundary species, the most effective way to target northern white-cheeked gibbon conservation would be to conduct population surveys on either side of the Vietnam and Lao border. Knowledge of population size, dynamics, density and distribution can be used to inform action planning and management decisions.

Successful transboundary conservation

Since 2011 Vietnam and China have adopted a cooperative conservation approach to protect the Critically Endangered cao vit gibbon (Ma *et al.*, 2021). This cooperative conservation approach has seen both nations agree on several conservation measures including:

- Agreements on approaches to stop the hunting of cao vit gibbons (Ma *et al.*, 2021).
- Measures to protect the species from catastrophes such as forest fires (Ma *et al.*, 2021).
- Each nation hosts a bi-annual meeting during which knowledge is shared (Ma *et al.*, 2021).

Furthermore, to ensure the most effective conservation approach a trans-boundary action plan was developed for cao vit gibbons (Ma *et al.*, 2021).

The cooperative conservation approach adopted by Vietnam and China for cao vit gibbons effectively reduces or resolves the common challenges associated with transboundary species of conservation. Therefore, I recommend that this model is used as a basis for a new cooperative conservation approach between Vietnam and Lao PDR. To inform conservation planning for northern white-cheeked gibbons increased surveys are required with some urgency. Several important recommendations can be drawn from the cooperative approach used by China and Vietnam including:

- Increased communication between both nations improving knowledge sharing.
- Regular meetings between both nations to allow them to adopt cooperative solutions to several key issues including how to approach the hunting of northern white-cheeked

gibbons, education initiatives and enforcement of legislation.

- A cooperative approach to crucial research, including increased trans-boundary population surveys which would improve our understanding of how threats are impacting northern white-cheeked gibbon populations.

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Interview with Dr Susan Cheyne

Dr Susan Cheyne is a lecturer at Oxford Brookes University, where she teaches modules on captive management, apes in the Anthropocene, and oversees independent research at the postgraduate level. Many students know her for her kindness and support of the students along with her many accomplishments working with large and small apes. She is the co-director of the Borneo Nature Foundation and Borneo River Initiative for Nature Conservation and Communities (BRINCC). Borneo Nature foundation is known for its long-term ecological monitoring and primate surveys, as well as for its reforestation campaigns, community development,

and other outreach programs. BRINCC focuses on collaborative, community-based work within Borneo. Furthermore, Susan is the Vice Chair of the IUCN's Primate Specialist Group's Section on Small Apes (SSA) and worked with a team of student volunteers to celebrate International Gibbon Day on the 24th of October. In honour of the passion that this year's cohort has for gibbons, primate conservation, and this semester's issue, Dr Susan Cheyne has answered a handful of questions for those interested in a career with gibbons.

What has been your favourite experience/moment while working with or studying gibbons?

Gosh so many. Maybe the most memorable would be the first time a wild gibbon accepted my presence in her territory and did not run away from me. This was in 2005 in Sebangau National Park and the gibbon was an adult female called Cokolat (from our Group C). We were still habituating the gibbons to the presence of researchers and there was one day she just stopped and looked at me and did not run but turned around and kept on eating. The next morning I was able to stand under the exact tree in which she was singing and listen to her and watch her visual display at the same time. Magical. I never lose the excitement of taking people into the forest to see their first wild gibbon. Their awe and wonder reminds me of that day when I was accepted by a wild gibbon.

What are your goals for the Borneo Nature Foundation?

We started as a single-species focused organisation and are now studying many species, large and small, landscape level change, working with communities, working for conservation education and empowerment as well as engaging government and other Indonesian universities. I hope we can continue to grow and learn and never assume we are always doing the right thing without evidence. So using science (biological and social) to ensure we have evidence for our actions. I hope we can also continue to expand our knowledge gained over the last 20 years to help other organizations and landscapes.

How would you describe your current work on gibbon behaviour, population density, and distribution? What sparked your interest in this work?

I first met gibbons in 1997 when I volunteered at a rescue centre in Thailand during my undergraduate degree. At the time, rehabilitation and reintroduction of gibbons was in its infancy and was not done based on objective science but subjective opinions of managers at the centre. I fell in love with the singing, swinging wee apes. Still now much less well known than their big ape cousins. I wanted to do something to help. This led to a PhD and working in Indonesia since 2002. I believe a complete understanding of a species and the landscapes they inhabit is critical to plan for

conservation actions and to determine if your conservation actions are effective (and if not then why?). So this means behavioural and social ecology including ranging, diet, infant development, where they live and at what density and how that density is changing over time.

What are the major threats facing gibbons today, and why is it so vital to conserve these species?

Gibbons face many threats, not unique to them sadly: forest loss through logging, conversion, fragmentation and fire. They are hunted for medicine, for traditional cultural practices and for the illegal pet trade. Gibbons are seed dispersers and play an important role in forest ecosystems as well as having a very important cultural connection with local people through myths and legends across most of their range from China to Indonesia, from India to Vietnam. To be honest we barely understand the complex links in ecosystems so cutting one thread will likely have drastic consequences, maybe not immediately, but certainly for the future. So we need to preserve and conserve all species.

For those interested in researching gibbons, what advice would you give them?

There is so much that has been done for gibbons it can seem like there is nothing else left to do. This is SO far from the truth. Gibbons have a very small proportion of publications compared to the big apes and there are many gaps in our knowledge. Wild rescue centres, zoos, distribution, genetics, welfare, species recognition, education and outreach and awareness, tackling the illegal wildlife trade - just some possible topics. The best advice is to ask an expert, view projects which work on gibbons and visit the SSA website to find experts to reach out to <http://www.gibbons.asia>

What do you think the future direction of gibbon conservation should be or looks like?

I believe it will involve more researchers and conservationists from habitat countries really leading gibbon conservation in their home countries. It will involve training the new conservation generation to have the skills to carry out conservation of forests, to work with people from all walks of life from village to government and to effect change. International Gibbon Day is a chance for these small organisations to showcase their work and to get additional recognition for their work through the IUCN Section on Small Apes platform.



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