Journal of the MSc in Primate Conservation

Canopy

Volume 12
Issue 1
Winter 2011

OXFORD BROOKES UNIVERSITY

Canopy
Journal of the Primate Conservation
MSc Programme
Oxford Brookes University

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Table of contents

Letter from the editors

Welcome again to the winter edition of Canopy, the in-house journal of the Primate Conservation MSc at Oxford Brookes University. The expression of research findings to the wider primatological and conservation communities is just as important as the studies conducted themselves, encouraging knowledge and inspiration for future projects which will enhance the protection of primates and the habitats they live in.

This edition demonstrates the positive difference which past students have had on the world of primates, inspiring the work of present and future scholars. Contributing authors offer multi-disciplinary views on how these amazing animals should be conserved, sharing their experiences and knowledge in the hope of enhancing primate welfare. The articles explore an extensive selection of topics, examining the wild world of primates, alongside local knowledge, to the lifestyle and patterns of captivity, while ranging from themes of disease transmission to enrichment. The findings of these studies approach biological, social and ecological aspects to achieve conservation goals, allowing the co-existence of primates and humans.

Together, along with hard work, enthusiasm and perseverance, we will be able to benefit the future of primates.

Thank you to everyone who has contributed to this edition.

Best wishes,

The Editors (*from left to right*)

Marlies Albers (NL)
Katherine Scott (UK)
Nicola Thurley (UK)
Magdalena Svensson (SE)
Alejandra Duarte (MX)
Katie Major (UK)

Letter from the course lecturer

The MSc in Primate Conservation is in its 12th season and this year is possibly one of the richest in changes since its beginning. Professor Simon Bearder has retired after 33 years of inspirational teaching at Oxford Brookes and a scientific career which opened new avenues of research on nocturnal primates. Simon has embodied some of the key-skills a Professor should possess, from transmitting his enthusiasm to students to advising them during the different phases of their career. When I came to Oxford for my first time in 2007 I was impressed by his ability to write letters of reference for his students, even the ones who left the University years before. I remember that I asked him how he managed to do that. He showed me a letter and by reading this it became clear to me that, even if only exposed for a short period, Simon was able to pick up the key-aspects of student' strengths and weaknesses. We all hope that Simon will continue to collaborate with us for many years.

I'm very proud to announce that I have been chosen as the person who is going to replace Simon's role for our MSc. This is an honour which I take with huge excitement. I will put all my energy and enthusiasm into keeping up the standard that has brought our MSc course to be internationally recognized for its excellence. I'm convinced this standard can be raised even higher by the beautiful collaborative environment that we have created among all members of staff during the last years. On top of all, my enthusiasm is driven by the very unique opportunity to help students who are likely to have a world-wide impact on primate conservation. As in previous years, the new cohort we have is a very diverse group of motivated students from the UK, Ireland, the Netherlands, Switzerland, Spain, the U.S.A., Mexico, Vietnam, and Nigeria. They want to make a difference. Their projects are going to cover various aspects of primate conservation with an increase of non-traditional ideas to explore new ways of helping our threatened cousins. This task-force of motivated people will spread over the different continents and a large number of them will be working in some of the most remote areas of the world. Helping them will be a challenging task but extremely rewarding both at professional and at personal level.

Congratulations are due to the editors of Canopy for producing this newsletter in time for the Winter Meeting of the Primate Society of Great Britain. The meeting this year will be held at Bristol Zoo and most of our students will be there. For many of them this will be the first occasion to show their work and/or to talk about project ideas with primatologists from outside Oxford. The PSGB meeting is focussing this year on the ecological role of the primates for forest maintenance. This is a key topic not only for primate conservation but for the very survival of tropical ecosystems. One of the invited speakers, Professor Joerg Ganzhorn, is not only a leading authority in primate ecology but possibly one of the people who did most for lemur conservation during the last two decades. Joerg was my external supervisor for my PhD project and in 1999 we went together to Madagascar to set up a field site in one of the few remaining fragments of littoral wet forest. At that time I was one of those students who started their PhD with a very theoretical framework in mind and the desire to shed light on big questions about lemur evolution. I remember that when we saw the collared brown lemurs (my study species) for the first time they were resting on a tree. I was very excited and when they moved away from us I wanted to follow them. Joerg, on the contrary, moved under the tree where the lemurs were first spotted and he collected some faeces from the ground. To my surprise,

he showed me that the faeces were in fact packed with an impressive variety of intact, large seeds. In a few seconds I realized that if we failed in conserving primates we would have lost a battle much more important than we could imagine.

I wish all the students from this year's cohort the best of luck in making your contribution to primate conservation significant. Very often the effects of your work will be not immediately evident but, hopefully, seeds will be trees one day.

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An assessment of primate health in the Sabangau peat-swamp forest, Central Kalimantan, Indonesian Borneo

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The peat-swamp forests of Indonesian Borneo represent a biologically diverse and unique ecosystem, yet remain relatively understudied. There is a paucity of published literature on red langurs (*Presbytis rubicunda*) and nothing is known of factors affecting inter-specific parasite transmission and disease spread between other primate species. As part of a comprehensive ecological survey of *P. rubicunda* inhabiting the Sabangau forest catchment in Kalimantan, Indonesian Borneo, baseline parasitological data were provided for these arboreal colobines. Sympatric primate species Bornean orangutans (*Pongo pygmaeus*) and Bornean agile gibbons (*H. albibarbis*) were also examined in order to monitor changes in susceptibility and identify key traits of the primate host that may affect parasite transmission. With this research I aim to highlight the importance of baseline patterns of parasitism for monitoring wildlife and ecosystem health. Furthermore I hope to contribute to our knowledge of the directional associations between primate socioecology and parasitism.

The role that parasitism plays in the behavioural ecology and evolution of primates remains largely unappreciated and is often overlooked in ecosystem survey efforts (Huffman & Chapman, 2009). However, although often cryptic the effects of parasitism in all ecological interactions are an integral facet of ecosystem function and may even guide the evolution of primate sociality and behaviour (Freeland, 1976; 1980). Investigations into the diversity of parasites and the spread of disease provide powerful insights into ecosystem structure and the biogeography of other organisms, and inform about threats to endangered species (Lafferty & Holt, 2003).

Parasites may be important determinants of host-health and show significant influence on survival and reproduction of populations (Roberts & Janovy, 2008). On an individual level parasite burdens can have relatively low impact, but with greater infection intensity and ensuing immunosuppression nutritional intake may be compromised influencing ecological processes (Coop & Holmes, 1996). More intensive parasitosis can cause significant physical impairment to an individual, and subsequently reduce population health leading to disease outbreaks and epidemics that may result in inter-specific transmission across species (Ezenwa, 2003). Therefore, parasites may act as useful indicators for the health of individuals and provide valuable insight into the condition of the population and the threats that it faces. Identifying the factors that influence distribution of infective agents is not only important for wildlife conservation but also for human health (Rwego, 2009).

Utilising sodium-nitrate floatation methods to recover gastro-intestinal parasites, health of a primate community was assessed using parasitism as a proxy. Parasitism was measured in terms of prevalence, parasitic output, richness and multiple species infections. Within all primate species a rich diversity of parasite taxa were identified. Protozoa recovered included *Entamoeba coli, Entamoeba histolytica/dispar, Balantidium coli, Blastocystis hominis* and a symbiotic ciliate involved in cellulose digestion *Troglodytella abrassarti.* Helminths recovered included *Strongyloides* sp*., Trichostrongylus* sp*., Trichuris trichuria, Enterobius vermicularis, Ascaris lumbricoides, Schistosoma mansoni* and hookworms. Primates exhibiting the greatest similarities in socioecological factors and

exhibiting overlap in niche occupancy had greatest similarities in parasite infections. Whilst providing a baseline for parasite communities of wild gibbons and red langurs, I found a large overlap in the community assemblage of parasite species, with langurs harbouring greatest parasite prevalence and species richness. Langurs had a higher parasitic prevalence than both orangutans and gibbons. Host density and dietary composition were identified as likely determinants of parasite infections, in support of previous findings. Relationships between environmental, behavioural and ecological factors were identified as causal determinants of parasite community diversity, calling for greater incorporation of parasitic research into conservation and monitoring programs to maximise information obtained from ecosystem-based studies.

Despite the prominence of maintaining viable populations of wildlife and ensuring human health, there has been a lack of attention paid or practical input given into disease management procedures in many conservation biology projects. I argue that efficient techniques such as parasite surveillance should be integrated into systematic monitoring programs to develop our knowledge of disease transmission, reduce potential outbreaks and augment the health of biodiversity throughout the ecosystem. Greater incorporation of parasitic research into conservation and monitoring programs will maximise information obtained from ecosystem-based studies.

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Behavioural adaptation of six wild-born orphaned chimpanzees in the first phase of release

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Although African ape reintroduction is a complicated and controversial process returning captive apes to their native habitats can be advantageous both in terms of welfare and conservation. Indeed, with the expansion of the commercial bushmeat trade (Barnes, 2002), the catastrophic decline in ape populations in Equatorial Africa (Walsh *et al.,* 2003; Chapman *et al.,* 2006) and the current state of sanctuaries, which are judged to be overcrowded, arbitrary in location and continually low on funds, with enclosures reaching capacity within a year or two (Teleki, 2001), the rehabilitation of great apes in Africa has been deemed a valid conservation tool (Carter, 2003).

Evaluating the feasibility of the reintroduction of captive apes is not a simple task though. Along with the numerous demographic, genetic and ecological factors that need to be taken into consideration, a fundamental aspect of any release program is the examination of the behavioural adaptability of the release stock. Indeed, the IUCN Best Practice Guidelines for the Re-introduction of Great Apes state that 'there must be careful assessment of individual histories and behavioural competence before re-introduction' (Beck *et al.,* 2007). Furthermore, in order to be perceived as scientific and professional, reintroduction programs require careful planning a nd systematic documentation, which are unfortunately lacking in the relatively new science of reintroduction biology.

The Congolese NGO, H.E.L.P (Habitats Ecologique et Liberté des Primates) Congo set up a release project and have successfully returned 37 chimpanzees to the wild. The H.E.L.P Project followed the IUCN Reintroduction Specialist Group's guidelines concerning the decision making process about the desirability of releasing captive animals to the wild (IUCN, 1998), and continues to follow the recommendations about the high levels of investment that are required to correctly design, monitor and document the project (Tutin *et al.,* 2001).

H.E.L.P continues its work with each new arrival and is currently using a new method of reintroduction whereby rescued chimpanzees are immediately (or as soon as is permitted) moved to the forest into which they are to be fully released. There is currently a group of six female chimpanzees (infants and juveniles) living semi-free in the first phase of release; adaptation to the wild. The chimpanzees were kept in quarantine before they were returned to the forest, where veterinary checks ensured that they did not suffer from any diseases which could be transmitted to the wild populations of chimpanzees which already live in the forest. Due to their young age and traumatic history they are accompanied by observers and provisioned twice daily. Once sexually mature, each individual female is expected to join the groups of wild congeners which live in the surrounding forests, thus completing their full release back into the wild.

In order to assess the feasibility of reintroducing these orphaned chimpanzees, the present study gathered pre-release data on the group's behavioural adaptation, comparing activity budgets to those of released chimpanzees in order to assess how closely the behaviour of the pre-release chimpanzees resembled that of released chimpanzee populations. Diet composition was examined independently. The relationships within the group which are likely to

persist once fully released were identified, and the best candidate for full release and radio collar fitting was also identified, based on age, rank within the group, average height off the ground and individual behavioural patterns.

The results showed that the chimpanzees' activity budgets did not yet resemble those of released chimpanzees. Six relationships were identified and Bianeffe was selected as the best candidate for release. Despite the fact that the activity budgets of the pre-release females in the present study did not yet resemble those of released chimpanzees, the orphans were all able to use the strata of the forest, build nests every night and forage on available wild foods. Obviously, whilst still being provisioned, the amount of forest foods that were eaten was quite low. Also, at such young ages, their level of dependence on their human caretakers was quite high, but all of these factors are expected to change once they reach sexual maturity and it is highly likely that, for at least some of them, successful reintroduction to the wild will be achieved.

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Review of local knowledge and uses for primates in the Veun Sai-Siem Pang Conservation Area, Northeastern Cambodia

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Conservation management policy often comes into conflict with local human populations because their traditional land use is either restricted or cut off completely. Often, in order to prevent this conflict, conservation projects include local ethnicities in the conservation process through introduction of tourism. In northeastern Cambodia specifically, there are several small ethnic minorities (Chinese, Lao, Kavet) that rely upon hunting and basic subsistence farming for their livelihoods (Bax, 2010). The local economic boost of tourism may provide incentive for local people to interact with their environment in a sustainable way. Many conservation areas or national parks worldwide have found that tourism-based conservation works best when local people are involved in the process (Tisdell, 1995). This approach is known as community-based conservation (CBC) and has proven successful in several areas (Khanal & Babar, 2007).

The aims of this research project were to: (1) assess the knowledge of local people concerning wildlife and their uses locally; (2) provide a resource base across the local ethnicities (Chinese, Lao, and Kavet) by conducting interviews with a sample of each population; and (3) use this information to aide in the management of a new ecotourism project in the area.

Structured interviews were used to evaluation local stakeholders' knowledge and perceptions of primates. A pilot study was conducted in week two of the study in order to understand which topics and questions would be most relevant. The second part of the study occurred in weeks six through ten. These questions focused on local knowledge and uses of the species of primate found within the conservation area: the pygmy slow loris (*Nycticebus pygmaeus*), the long-tailed macaque (*Macaca fascicularis*), the northern pig-tailed macaque (*M. leonina*), the silver langur (*Trachypithecus germaini*), the red-shanked douc (*Pygathrix nemaues*), and the northern yellow-cheeked crested gibbon (*Nomascus annamensis*). A total of twenty-eight interviews were conducted in the Chinese Village, I Tub, Kang Nuok, and the Veun Sai-Siem Pang Conservation Area headquarters.

In general, it was found that people living the closest to the Conservation Area had the most knowledge of local primate species. Seven out of eight Kavet interviewees knew all six species of primate found in the area. Of the respondents who admitted to trading primates, loris was the most often traded species, followed by long-tailed macaque. Of the ten Lao interviewees, 70% knew all six species of primate. When they were able to sell primates, it was almost always to the Chinese in Veun Sai. Sixty-seven percent of respondents from the Chinese Village were only aware of primate species used in the local pet and medicinal trade: the pygmy slow loris, long-tailed macaque, pig-tailed macaque, and northern yellow-cheeked crested gibbon. As many of the interviewees in the Chinese Village were business owners, their knowledge of local trading habits was greater than the people from other villages.

The general trading pattern listed by those who contributed to the process was: indigenous people » traders in Chinese Village » Vietnamese in Ban Lung. Of the species found within the study area, the pygmy slow loris was a priority for traditional medicine while both species of

macaque and the northern yellow-cheeked gibbon were priorities for the pet trade. In order to curb the trade, alternative sources of income must be offered to local people. This may come in the form of livelihood alternatives (farming) or tourism expansion with primates as the focus. It is also vital that patrol teams regularly visit these areas so that when someone does illegally hunt, they are caught. Without proper incentives, this trade will continue and the primate populations in the area will steadily decrease.

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Effect of early familiarity between male western lowland gorillas (*Gorilla gorilla gorilla*) on their affiliative relationships in later life: Implications for aiding captive bachelor group stability

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Western lowland gorillas (*Gorilla gorilla gorilla*) are Critically Endangered within the wild (IUCN, 2011), with captive populations subsequently being managed both through international and regional cooperative breeding programs.

Photo by Katie Quantrell

Polygamous species such as gorillas that typically live in uni-male multi-female groups (Parnell, 2002) often produce a problem in captivity in terms of their housing, due to the un-equal sex ratio within such groups inevitably resulting in some males not being able to be placed within these typical social units. The formation of all-male 'bachelor' groups was therefore proposed in the late 1980's as a potential solution for the housing of such 'surplus' males (Harcourt 1988; Johnstone-Scott 1988), with such groups subsequently being formed within several zoos across Europe and the United States (ISIS, 2010). Initial indications have shown that bachelor groups are indeed feasible over the short term, but for such housing to provide a permanent solution to the 'surplus' problem, these groups need to be able

to function as stable cohesive social units over the long-term.

One factor that has been show to enhance group cohesion and consequently stability is the presences of affiliative behaviours between resident individuals i.e. play fighting, social grooming, and social resting (Lehmann *et al.*, 2007). Managing bachelor groups to enhance the presence of such affiliative behaviours is therefore seen as being important for aiding their ultimate success.

Affiliative relationships within breeding gorilla groups are typically recorded as occurring between closely related individuals (Gouzoules, 1984), however initial findings from bachelor groups has found no such trend (Pullen, 2009). Captive bachelor groups are often highly manipulated however with individuals often originating from different natal groups, or having been temporarily housed within gorilla 'nurseries'. This therefore often results in resident males having degrees of familiarity which are not linked to their degree of relatedness. Therefore unlike in breeder groups, individuals may have more familiarity with non-kin rather than kin individuals. The importance of early familiarity in forming kinship bonds (Gouzoules, 1984) therefore could explain the absence of an effect of relatedness within these bachelor groups as well as indicating the potential importance of early familiarity in contributing to the formation of strong bonds between non-kin individuals (Westermarck 1891; Shepher 1971).
The current study therefore set out to determine the effect of early familiarity on the rates of affiliation displayed between these males within bachelor groups in later life.

A multi-institutional study was conducted which utilised behavioural data from six captive bachelor groups from zoos across Europe and the United States. The frequencies of affiliative behaviours (play fighting, social grooming and social resting) between each of the dyads within each of these groups was calculated, with this subsequently being analysed alongside demographic and social history data extracted and compiled from international studbooks. All data was analysed using generalised liner mixed models.

Dyads that had first been introduced while one individual was under the age of five and that had shared co-residency for longer than one year during the critical period of early familiarity, were found to display significantly higher rates of affiliation than those where this period of early familiarity was not present.

This finding therefore demonstrates the importance of early familiarity in aiding the formation of strong social bonds between these male gorillas and consequently highlights the potential importance of taking this into consideration when forming bachelor groups. To help maximise the potential of bachelor groups in providing a long-term husbandry solution to the male surplus problem therefore, it's advised by the current study for individuals to be integrated into bachelor groups ideally before the age of five, where this is not possible individuals should preferentially be integrated into bachelor groups with which the male is known to of had previous early familiarity with.

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Assessment of the effects of visitors on four species of lemur (*Lemur catta*, *Varecia variegata*, *Varecia rubra*, and *Eulemur rufifrons*) at the Wingham Wildlife Park

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There has been conflicting evidence regarding the effect that visitors have on the lives of captive animals. The field has increased in popularity in recent years, and there is now an emerging literature about animals' responses to visitor variables such as visitor presence, density, activity, and position. The present study was designed to increase our understanding of visitor effect by assessing the relationship between visitor presence and the behaviour of a group of ring-tailed lemurs (*Lemur catta*) housed in a walkthrough enclosure. Moreover, the relationship between visitor presence and group cohesion (spread) of three other separate groups of lemur species: the red-ruffed lemur (*Varecia rubra*), the black-and-white-ruffed lemur (*Varecia variegata*), and the red-fronted brown lemur (*Eulemur rufifrons*) was also investigated. In addition, the distance between each individual to the path, in both human absence and presence, was also studied as well as the distance from each individual to the nearest human. These four species were studied intensively for a total of 35 days throughout the months of April to August at the Wingham Wildlife Park, UK. The interactions were recorded using both focal time sampling and group scanning. Non-parametric analyses were performed, revealing that, in fact, the lemurs are largely unaffected by the presence of humans (P >0.05). This is not the case for human proximity, however, where separate analyses found that the ruffed lemurs and the red-fronted brown lemur are indeed influenced by the distance of zoo visitors (P <0.05). Results are discussed in the context of recent findings regarding visitor presence and zoo animal welfare. The latter part of this study supports

previous behavioural research that visitors have a meaningful impact on primates in zoos.

Research about the effects that zoo visitors' have on the welfare of nonhuman captive animals has intensified in the last 30 years due to the imperative need to understand the relationship between visitors and animal welfare (Chamove *et al*., 1988; Mitchell *et al*., 1991). Consequently, evidence already exists to prove that the presence of visitors, together with their density, activity, and position, are associated with animal behavioural changes (Davis *et al*., 2005; Davey, 2007; Todd *et al*., 2007). These changes are interpreted as either negative (undesirable), positive (enriching), or simply a changing variable that has no effect, in terms of animal welfare (Margulis *et al*., 2003).

The aim of this research is to gain an understanding of the welfare of these captive animals. This will be achieved by studying their behaviour which will essentially portray their current captive state, and therefore any indication of a negative response to visitors will reflect in the results. If the outcome reveals the presence of stress, via unnatural and abnormal behaviours, or that the group cohesion (spread) and/or the other distance factors is significantly reduced when humans are present, this will indicate that the animal is negatively affected by the presence of visitors (Chamove *et al*., 1988; Davis *et al*., 2005; Wells, 2005). It is then recommended that this information be used appropriately to amend husbandry protocols, further ensuring that these animals' best interests are and remain a priority.

Statistical analyses revealed non-significant results indicating that the ring-tailed lemur, red-ruffed lemur, black-and-white-ruffed lemur, and red-fronted brown lemur are not affected by the presence of zoo visitors. However, significant results (*P*-value = <0.05) were found for human distance suggesting that the red-ruffed lemur, black-and-white-ruffed lemur, and red-fronted brown lemur are influenced by visitor proximity.

There is a general consensus that visitors can have a negative impact on zoo animals, acting as a source of stress for primates (Chamove *et al*., 1988; Hosey, 2000). A study by Chamove *et al*. (1988) found the grooming and resting behaviours of ring-tailed lemurs to decrease when visitors were present. Conversely, the present study revealed an increase in grooming behaviour in human presence and no change in the level of inactivity indicating that the ring-tailed lemur is unaffected by human presence.

The discovery that the ruffed lemurs and the red-fronted brown lemur are unconcerned by zoo visitor presence is to some extent surprising due to the expression of stereotypies witnessed during data collection. Stereotypies include bouncing on the spot, observed in the red-ruffed lemur, and wall licking seen in the black-and-white-ruffed lemur. These findings are in agreement with the Mallapur *et al*. (2005) study in which the level of abnormal behaviour in lion-tailed macaques was found to increase by 30% during times of visitor presence. Both this study and that by Wells (2005) offer examples of visitors influencing the behaviour of captive primates in a negative way suggesting that visitor presence might adversely affect their welfare.

According to Hosey (2005), whether zoo visitors have stressful effects on animals seems to depend on factors such as the presentation of the animals and the behaviour of the visitors when interacting with the animals. The observer comments on the disruptive behaviour of a group of visitors coupled with the negative response of the lemur individual. A red-ruffed individual jumped up at the glass in an aggressive manner at a group of visitors standing too close to and banging on the window. This confrontational behaviour was also observed in the red-ruffed lemur by Elisa *et*

al. (2004). The characteristics of this behaviour respond to the ones described in the compulsive-obsessive behaviour typical of highly stressed and bored captive-bred animals (Mendoza *et al*., 2000).

Many enclosure designs allow the animal to remove itself from public view (Mitchell & Hosey, 2005) however none of the enclosures that house the four lemur species studied here provide this option, thus may be a reason why the inhabitants can become uncomfortable with visitor presence and proximity (Wells, 2005) especially when many visitors were observed to behave intrusively anyway to the animals' already limited privacy.

The distance of the animal from the audience, as studied here, is of significant importance when investigating the effect of visitor presence as this reveals the degree to which the animals can avoid the visitors (Mitchell & Hosey, 2005). It has already been disclosed that all four lemur species are impassive to visitors and appear unstirred whether humans are around or not, providing, of course, that their distance and behaviour are not perceived as being intimidating.

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Disease transmission risks tourists pose mountain gorillas (*Gorilla beringei beringei*) of Bwindi Impenetrable National Park, Uganda

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Bwindi Impenetrable National Park (BINP), Uganda contains a great deal of wildlife diversity including the mountain gorilla (*Gorilla beringei beringei*), which is International Union for Conservation of Nature (IUCN) listed Critically Endangered C1 (IUCN, 2010). About half the mountain gorilla population, an estimated 320 gorillas, 30% of which are habituated for research and ecotourism live in BINP (Cranfield, 2008). This population is extremely small and susceptible to a number of human induced threats such as illegal hunting, bushmeat trade, civil unrest, and infectious diseases (Cranfield *et al*., 2002; Woodford *et al.*, 2002). The primary concern for the mountain gorilla, however, is the transmission of fatal diseases into the population that would greatly reduce population size. Mountain Gorilla Veterinary Project reviewed causes of mortality of over 100 mountain gorillas and the greatest cause of mortality was trauma and second was respiratory disease (Cranfield, 2008). Ecotourism provides a significant amount of economic revenue to the country of Uganda and has acted to save the mountain gorilla (Sandbrook & Semple, 2007). However, a single tourist out of thousands per year that arrive at BINP could pass pathogens like tuberculosis to the gorillas (Cranfield *et al*., 2002). A recent case in Rwanda showed two wild mountain gorillas died during a respiratory outbreak in 2009. The Human metapneumovirus (HMPV) infection showed a close relationship to South African human isolates, leading many experts to believe that it was a result of tourism (Palacios *et al.*, 2011). Ecotourism and other threats will continue to increase (Wilson, 1995; TIES, 2006). Appropriate research and preventative measures need to be rigorously implemented to protect the last individuals of mountain gorillas (Wallis & Lee, 1999; Cranfield, 2008).

Tourists viewing gorillas in BINP under the seven-metre rule. Photo by Allison Hanes.

In the Democratic Republic of the Congo and certain habituated research gorilla groups in gorilla ranging countries, extra protocols have been put into practice. It has been long discussed by non-governmental organizations, wildlife authorities, and veterinarians within these countries as to whether face masks should be implemented. Through the distribution of self-reported questionnaires (N=141) and semi-structured interviews (N=25), a six-week study showed tourists pose health risks to the mountain gorillas of BINP and tourists are willing to take extra precautions in order to prevent disease transmission.

Tourists know general disease transmission concepts but are unaware of case examples. Although they most often come from wealthy countries, tourists have poor vaccination recall and vaccination date recall. Respiratory disease transmission from tourists to gorillas in particular is a primary concern to veterinarians and staff. Tourists that reside in temperate

regions are often more prone to various strains of influenza are usually not advised influenza and many vaccinations before viewing the apes (Muehlenbein *et al*., 2008). Tourists come from numerous countries around the globe and travel often, regularly into more disease risk prone regions (72% travelled to developing countries within the past year, N=135) (The World Bank, 2011). Interviews show tourists encounter gorillas under the seven-metre rule or experience direct contact. Of 25 interviewees, the average closest distance the gorillas came to the interviewee was approximately 2.20 metres and five had physical contact with a gorilla. Tourists admit to tracking sick and also state they will track with illness symptoms. The majority of tourists are open to new disease transmission protocols, specifically face masks.

In order to lower disease transmission risks I advise that the seven-metre distance be strictly enforced, face masks be worn by all personnel including tourists, and additional recommendations be carried out for the best interest of the remaining Virunga volcanic mountains and Bwindi Impenetrable National Park mountain gorilla populations. These include properly enforcing current regulations, a one-week quarantine period, a 100% gorilla tracking refund, mandatory lodge staff participation, a gorilla tracking health declaration form/consultation, disinfectant footbaths and antibacterial hand sanitizers, mandatory vaccination records, disease transmission cases examples and N95 face mask effectiveness information, detailed education of gorilla biology, health and regulations available from tourist's home country until trek, better interpretation centre/video, and refresher trainings for all Uganda Wildlife Authority (UWA) staff.

Data from this project show the use of face masks and recommendations will improve the experience of tourists and not compromise gorilla tourism revenue in Uganda. Improved protocols and recommendations will need to be monitored closely by staff and appropriate alterations made as needed. To assess more specifically the risks of disease transmission at this field site, I am using polymerase chain reaction techniques to detect pathogens within the saliva of tourists, UWA staff, and tourist habituated gorillas.

Seven-metre reference at the Uganda Wildlife Authority briefing point BINP. Photo by Allison Hanes.

The results of this complimentary study will be made public as soon as possible and a follow up study interviewing tourists and staff about these recommendations would be beneficial one year following their implementation.

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Farmers' outlook on wildlife crop raiders in Shimla, Himachal Pradesh: determinants, underlying causes and consequences

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In the state of Himachal Pradesh, India, the policy to plant fast growing conifers in preference to native tree species is a growing concern (Pirta *et al.*, 1993). This, combined with human population growth, and agricultural expansion has driven the rhesus macaque *Macaca mulatta* into closer contact with humans, thus intensifying crop raiding. When natural foods are limited, high quality, easily digested human foods provide an alternative

source of nutrition for primates, so crop raiding can intensify (Lee & Priston, 2005). In the past, religion has played an important role in the tolerance expressed towards the rhesus macaque *Macaca mulatta* in India (Lee & Priston, 2005). However, when farming is predominantly the main occupation of the people of this region, economic loss through crop damage is not tolerated.

This study characterizes the perceived risks of crop-raiding in four beats within the Theog forest division in a northern state in India, through Rapid Rural Appraisal methods such as village walks, ranking exercises, constructing seasonal calendars, and semi-structured interviews. Forty-nine semi-structured interviews were conducted to collect data on (i) farming patterns (ii) factors perceived to cause significant crop damage, (iii) animals perceived to be most destructive, (iv) the extent to which these animals are perceived as "pest species", and (v) protection methods employed in the four study sites.

The main source of income is derived from farming for 89% of the respondents. Eighty three per cent of the sample practice cash crop farming only, whereas the remaining seventeen percent practice both subsistence and cash crop farming. Farmers reported an average of 12 different crop species being cultivated in the study area including vegetables, fruits, beans and grains. The most frequent crops grown are also the highest raided crops across the four beats in the study area: *Apple, Snow pea and Cabbage*. With respect to the farming calendar, the majority of respondents reported June, July and August as the three months where crop-raiding increased significantly (40%, 62% and 61% respectively). Interestingly enough, these months comprise of the monsoon in the Himalayan region, and therefore are also the period when many crops are either half, or completely ready to be harvested. This is in line with other studies where crop damage is reported to paramount during the harvesting period or right before harvesting when crops are ripe (Tweheyo *et al.*, 2005). ***"****In July, the apples are big and red, the red monkeys come when they see them" said one farmer.*

Hail damage was also reported by 57% of respondents as the most limiting factor to crop yields, especially on farms at higher altitudes. Thirty percent of respondents ranked raiding activity as the highest crop damaging factor. Ten animals are reported to cause damage to crops and the three highest ranked species in terms of crop damage are the rhesus macaque, wild rabbit, and parrot. The rhesus macaque is considered the most destructive in relation to financial damage,and thus perceived to be a significant risk to crops in all four study sites. The interviewees reported seven different crop protection methods. The most common deterrence methods employed by farmers in each study area are guarding and using dogs to keep animals off the farm. However, guarding farms can be both costly and time consuming

Contrary to what was expected, 70% of participants considered the conservation of wildlife including primates to be important. Several farmers who reported 50% crop loss still considered wildlife conservation important. Thus, in agreement with other conflict studies in Asia, there is a certain level of tolerance among most people in this study towards primates in comparison to other studies in Africa (Southwick & Siddiqi, 1994; Wang *et al.*, 2006). However, responses given to the importance of wildlife conservation are not reflective of thoughts and reactions towards primates in the area. Even though the majority considered conservation of wildlife important, almost all of the interviewees and the general public, complained at the mere mention of the word "monkey". Moreover, a significant number of participants responded to the importance of wildlife conservation with a "Yes, but".

"Yes, but killing them is also important"
"Yes, but when they do so much damage, then we feel like they should be gone"
"Yes, but not monkeys"
"Yes, except crop raiders"
"Yes, but a second option is necessary".

Whether their responses were influenced by the presence of a researcher or forest official cannot be confirmed. The truth may be that these farmers have but no choice of living peacefully alongside wildlife especially primates as they are protected under the Wildlife Protection Act (1972). In Nov-Dec 2010, when farmers filed for shooting permits (a significant number from the study area), a stop was put to the issuing of these permits by the high court. Thus farmers are now compelled to resort back to their initial guarding and chasing techniques to protect their crops.

The current relationship in this region between humans and primates remains volatile in nature. Oak and other broad leaved trees constitute less than 5% of the tree species in these forests. Hence, with decreasing wild sources of food, the problem may only increase (Dickman, 2010). This situation could change at any given time, and then the long term survival of primates will be at risk, not only from diminishing human tolerance, but also habitat degradation (Altmann & Muruthi, 1988). In the past, studies have noted the impact on primate populations on account of changing local traditions and attitudes. Local perceptions of wild animals are critical as they dictate the onset of a conflict situation. Therefore, studies are needed to understand determinants behind farmers perceived crop risks and steps taken to protect crops from those risks. Understanding the perception of the animal instead of the conflict situation itself is crucial. By acquiring such data, further research can help identify and prioritize mitigation efforts.

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Do enrichment devices continue to be enriching in the long term? A study using captive Javan gibbons (*Hylobates moloch*)

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Captivity is an extremely unnatural situation for primates, and as such has the possibility to cause a large number of maladaptive behavioural responses and physical and psychological implications. Appropriate species specific captive management of primate health and wellbeing is necessary to ensure that the potentially damaging effects of the captive environment are avoided (Boere, 2001). In the wild primates are kept mentally and physically exercised by the unpredictable and changeable nature of their environment. Foraging, relationships with conspecifics and vigilance against predator attacks require alternative and diverse strategies and the ability to react to novel stimuli on a daily basis (Boere, 2001). In captivity primates are forced to deal with an environment that contrasts sharply with the conditions under which they evolved, without the ability to exercise a natural behavioural repertoire frustration, boredom and stress can result in severe behavioural abnormalities, known as stereotypic behaviours (Mallapur & Choudhury, 2003).

The principle means by which abnormal behaviours are "treated" or guarded against is environmental enrichment, whereby the captive environment is made more stimulating and biological relevant to animals in captivity (Newbury, 1995). Habituation is a major problem for enrichment, beyond the effect of novelty of changes to a captive environment or introductions of devices or toys there is very often a steady decrement in the effectiveness of enrichments following their original introduction (Tarou & Bashaw, 2007). For enrichment devices which seek to improve the long term wellbeing of captive animals rates of habituation, then make a very clear difference between what can be defined as being an effective enrichment and what in the long-term proves to be ineffective.

For this study I conducted a follow up study to an enrichment programme that was introduced a year ago to the Javan gibbons at Howletts Wildlife Park in Kent. The Javan gibbon (*Hylobates moloch*) is a species that is in decline in its native habitat and has received little scientific attention both in-situ and ex-situ (Nijman, 2006). Understanding this species is vital if the most appropriate husbandry and captive conditions are to be provided to the small captive breeding population.

The aim of the study was to evaluate the responsiveness the gibbons displayed towards two of the original three enrichments introduced a year ago and any effects that the enrichments continued to have on their behaviour. The enrichments re-evaluated were a foraging box, which was aimed at increasing foraging time by making the food inside difficult to access; and a scent mat, an olfactory enrichment designed to increase wellbeing by the introducing traditionally relaxing scents into the gibbons' environment. A year ago the foraging box was shown to be used the most of the enrichments introduced. This year I introduced a novel enrichment, a timed ice feeder, to act as a similar enrichment that I hypothesised would be comparable in terms of use and behavioural effects. The timed ice feeder was designed to increase foraging time by allowing food to only be accessed only once the ice inside a wooden box had melted.

The study subjects were ten gibbons, five males and five females, divided across four groups consisting of three adult male-female pairs, and

one family group of an adult male-female pair, a female juvenile and a male infant. Scan samples were conducted on each group four times a day, twice in the morning and twice in the afternoon and the behaviour and position in the enclosure of gibbons at each sample point recorded. Data was collected over two months, four days a week.

Female gibbon interacting with a timed ice feeder

The results indicated that the feeding enrichments had the greatest influence on gibbon behaviour as well as encouraging the greatest amount of contact. Both the timed ice feeder and foraging box conditions demonstrated a significant increase in the amount of time gibbons spent feeding and foraging compared with the control. Gibbons also devoted a significant proportion of their time to these enrichments when compared with the scent mat, and the enrichments compared well in terms of the amount of contact gibbons made with them (9.79% foraging box; 8.89% timed ice feeder).

In contrast the scent mat appeared not to have made an observable difference to the gibbons' daily behaviour. The activity budget for the scent mat and the control period were very similar with very little difference between the proportions of time spent engaged in each activity. Contact with the scent mat as opposed to the timed ice feeder and foraging box is also far less frequent, 8.28% and 9.18% less frequently respectively.

Enclosure use was also shown to be effected by the enrichments, with gibbons spending significantly more time in the lower-front portion of the enclosure when the feeding enrichments were present compared with the control period. This is likely due to this being where the enrichments were placed, and suggests that the enrichments were powerful influencers on how gibbons utilised their space. In addition the scent mat was shown to be related to a non-significant increased use of the top-back of the enclosure, perhaps suggesting they were attempting to move away from the scent.

The results for the foraging box compared well with the results of the study of the previous year, with a moderate level of contact still being present and the foraging box continuing to influence gibbon feeding and foraging behaviour, suggesting that habituation has not taken to place to a critical degree. In contrast, the scent mat no longer appeared to exert any real responsiveness from the gibbons. Where previously it had reduced incidences of moving and increased foraging, there was no evidence of this being the case currently, suggesting that the gibbons had habituated to its presence and it was no longer enriching.

A year after its initial introduction the foraging box continued to incite significant increases in feeding and foraging as well as moderate levels of contact, suggesting that the gibbons have not habituated to its use, and continue to find the device enriching. In demonstrating initial levels of use that compare favourably with the foraging box, I would expect the timed ice feeder to follow a similar pattern of use over time, maintaining mid-range contact levels and a positive effect on feeding behaviours. The scent mat failed to demonstrate any significant effect on behaviour and had decreased in use since a year ago, I would suggest that either presentation of the scents is revised or the device be abandoned as an effective enrichment in gibbon in favour of enrichment types that have proved to have a greater influence on behaviour and are likely to be more biologically relevant to gibbons as a species.

Cheap, effective, and biologically relevant, feeding and foraging based enrichments should be the main focus of enrichment strategies for gibbons for use in the long term, rotating a range of feeding/foraging based devices and alternating presentation is likely to be the most valuable way to proceed in the future.

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Clear Labels, Not Forests

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In March 2011, the Sumatran Orangutan Society (SOS), in conjunction with other conservation charities, launched a campaign called 'Clear Labels, Not Forests' aimed at encouraging companies to switch to sustainable sources of palm oil. After campaigning tirelessly for months, the hard work bore fruit and resulted in a new EU regulation, making it mandatory for specific vegetable oils, including palm oil, to be labelled on food packaging.

Palm oil is currently in high demand as a food ingredient and one of the most productive seed oils in the world. It is found in up to half of all packaged food products in supermarkets and is a relatively cheap oil compared to many others; however it comes at a cost to the unique biodiversity found on our planet.

Currently around 10% of the global palm oil supply is certified as sustainable and many supermarkets and other retailers have joined the Roundtable of Sustainable Palm Oil (RSPO) in order to become more socially responsible. It has been found that an ever-growing number of consumers are demonstrating an increased awareness of where their food comes from and the effects items such as palm oil have on the environment.

When the new EU regulation comes into place in 2015, it will no longer possible to label palm oil as just 'vegetable oil'. Presently palm oil comes under a variety of guises, where it is also known as 'palmate' or 'hydrated palm glycerides'; this has previously caused confusion for consumers wanting to purchase responsibly.

The new directive will also enable companies that purchase responsibly to display a 'certified sustainable palm oil' (CSPO) logo, in order to highlight their growing contribution to green food production and to differentiate from those that don't. It is hoped that this labelling will push more companies not signed up, to make a sustainable commitment to the way they operate and clean up their supply chains in the process. Consumers will be able to make informed decisions that will enable the world's biodiversity hotspots to remain protected for years to come.

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