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# Primatology, Biocultural Diversity and Sustainable Development in Tropical Forests

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**Abstract:**

The ongoing loss of biodiversity in response to human transformations of the environment is a critical and compelling scientific issue. Current extinction rates are approximately 1000 times higher than background rates; and there is good evidence that anthropogenic impacts are responsible. The main tool to protect biodiversity is the establishment of protected areas. However, a recent global analysis revealed that only ~50% of all reserves are effective, and many areas are being degraded by encroachment from local communities. In the developing world, these local communities are often economically disadvantaged agriculturalists, living far from urban centres that would provide jobs and medical care. In addition, living near the edge of a protected area leads to additional challenges, in particular crop destruction caused by animals ranging outside of the protected area. Thus, it is not surprising that these communities hold negative attitudes to parks that lead to encroachment and resource extraction from the protected area. Clearly, improving park-people interactions is a priority, but how? Here we demonstrate that providing health care along with conservation outreach to local communities can improve local wellbeing, improve park-people relations, and, in some cases, serve to maintain or enhance biodiversity. We evaluate two case studies: a bricks and mortar and mobile health clinic operating around Kibale National Park, Uganda and a bricks and mortar clinic near Gunung Palung National Park, Indonesia. These two case studies show that a union of health care and conservation can be forged to address delicate issues at the interface between protected areas and neighbouring communities.

# Healthcare and Conservation can form a Union to Benefit People and Biodiversity

## The Conflicting Dilemma between Human Welfare and Conservation in the Tropics

Tropical regions are the origin of some of the oldest and most complex civilizations, home to an amazing level of biodiversity, and the location of many UNESCO World Heritage sites. However, the tropics, particularly rainforests, are also the setting for a critical dilemma between conservation of the remarkable biodiversity characteristic of these habitats, and protecting human welfare. Here we propose a potential conservation tool that may resolve or relax human welfare-conservation issues – the union of healthcare and biodiversity conservation.

Ensuring healthy lives and promoting well-being for humans of all ages and socio-economic contexts is one of the sustainable development goals announced in 2017 (UN, 2017) – a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity. These goals are interconnected – often the key to success of one will require tackling the other.

With respect to health care, rural communities in the tropics face a constant struggle for survival, and one of their central issues is access to healthcare (Figure 1). Much of the suffering does not reflect a lack of effective drugs or technology, but sadly, it reflects a lack of accessibility to simple health services. For example, the Center for Disease Control estimates that 3.4 billion people (half the world's population) live in areas at risk of malaria and that in 2012, there were 207 million clinical cases of malaria that caused 627,000 deaths, with 91% of deaths occurring in Africa (Sachs and Malaney. 2002; Snow et al., 2005). This is likely a gross underestimate because many sick people do not make it to the hospital, rather they suffer and often die at home, and thus are not included in such statistics. Malaria can be easily treated if the proper medicines are available, and it can generally be prevented with inexpensive mosquito nets. Similarly, dengue is also a worldwide mosquito borne disease, and each year up to 528 million people are affected (Gubler, 1997). Again, this disease can be largely prevented with the use of mosquito nets. Another poignant example is amoebic dysentery, which affects over 50 million people a year and can easily be prevented by adequate hy-

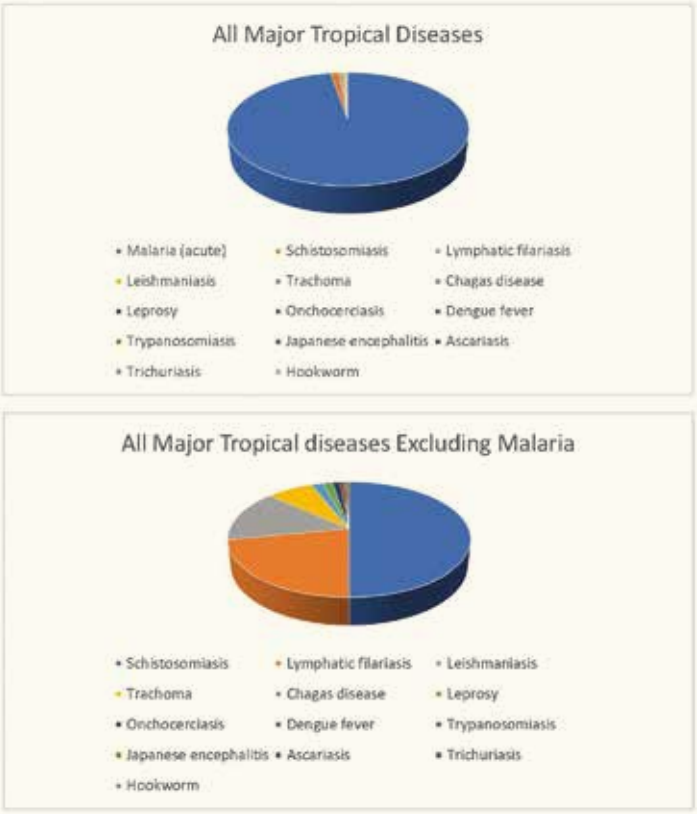


Figure 1. a) World Health Organization's 2002 determination of the Major tropical diseases of the world and b) the same determination, except malaria is excluded (WHO 2003, 2004; Mathers et al. 2007). The number of cases tropical diseases include the following: Malaria (acute) 408,250,000; Schistosomiasis 5,733,000; Lymphatic filariasis 512,000; Leishmaniasis 1,691,000; Trachoma 837,000; Chagas disease 217,000; Leprosy 175,000; Onchocerciasis 141,000; Dengue fever 73,000; Trypanosomiasis 46,000; Japanese encephalitis 44,000; Ascariasis not determined; Trichuriasis not determined; Hookworm not determined.

giene and boiled drinking water (Byrne, 2008). Typhoid fever was estimated to have affected 22 million people in 2000 (Crump and Mintz, 2010), and this disease can be prevented by proper sanitation. These are but a few examples of diseases that affect people in the tropics that can be treated or prevented. For people living near national parks, the situation is often intensified by the remote location of many protected areas and the potential zoonotic transfers from wildlife to people.

With respect to biodiversity loss, estimates indicate that ~100 million ha of tropical forest was lost between 1980 and 2012 (Hansen and deFries, 2004; Chapman et al., 2006; Hansen et al. 2013; Estrada et al., 2017). This loss corresponded with an increase in agricultural land in the tropics, which expanded by 48,000 $km^2$ per year between 1999 and 2008 (480,000 $km^2$ in total), largely at the expense of forest (Phalan et al., 2013). These changes are ultimately driven by increasing human population size and consumption, and it is estimated that between 1.2 and 1.5 billion people rely on tropical forests for food, timber, medicine, and ecosystem services (Lewis et al., 2015). One study suggests that ~1 billion ha of new land – an area larger than Canada – primarily in developing countries, will be needed for agriculture by 2050 to meet the demands of the growing human population (Laurance et al., 2014). Given these pressures on tropical forests and the fact that over half of the world's species are found in

the tropics (Scheffers et al., 2012), it is not surprising that the most valuable tool used by conservation biologists to protect the world's biodiversity is the establishment of protected areas. The area protected globally reached 24 million km$^2$ in 2006 (Butchart et al., 2010; Rands et al., 2010). However, in an analysis of the world's protected areas, researchers considered only ~50% of all reserves to have been effective over the last 20-30 years, while the remainder of the reserves are experiencing an alarming erosion of biodiversity (Laurance et al., 2012; Tranquilli et al., 2014).

With respect to the union of health care and conservation, it is clear that extreme poverty, poor health, and the rapid loss of biodiversity are intimately linked with hotspots being geographically coincident (Cincotta et al., 2000; Brooks et al., 2002). Many communities living close to parks have negative attitudes towards them because their livelihoods depend on natural resources, but their access to protected areas that harbour many such resources is restricted (Newmark et al., 1993; Mehta and Heinen, 2001; Jacobson, 2010; Coomes et al., 2011). Further, for predominantly agricultural communities whose livelihood depends on food crop production, attitudes are often negative because of the crop destruction caused by wild animals foraging outside of the protected area (Naughton-Treves, 1997, 1998, 1999; Archabald and Naughton-Treves, 2001; Adams and Infield, 2002; Mugisha and Jacobson, 2004; Naughton-Treves et al., 2011). Crop raiding impacts can be substantial, but the people affected receive no, or insufficient, compensation for their losses (Fungo, 2011; MacKenzie et al., 2011; Karanth et al., 2013; Chapman et al., 2016). The situation is exacerbated by the fact that protected areas are often located far from economic centers that provide jobs, higher education, and health services. Thus communities living next to parks are often poor and suffer from diseases that can often be easily treated or prevented if health care access was available (Brandon and Wells, 1992; Naughton et al., 2011). It is not surprising that people living next to protected areas often harbour negative attitudes to the park, which can lead to encroachment for resources, or other negative consequences. Thus, one potential strategy to improve park protection, human health and attitudes toward protected areas, is to provide health care that is seen as an initiative of the park. If such health care is accompanied by outreach education on health and conservation, local attitudes are likely to improve, with the conservation benefit of reduced encroachment and illegal harvest of park resources.

Here we present two case studies where healthcare has been provided along with conservation messages and incentives to local communities bordering two national parks: Kibale National Park, Uganda and Gulung Palung National Park, Indonesia. The goal of presenting this information is to evaluate the potential effectiveness of the union of conservation and health care since there is a general societal wish to see improvement in both. While we know of other locations where this union has been presented, the groups operating the initiatives have not published descriptions of their efforts or effectiveness.

Kibale National Park, is located in western Uganda at the foothills of the Rwenzori Mountains and primarily supports moist-evergreen forests (Chapman and Lambert, 2000). In general, the park is well protected, but there are problems associated with

Figure 2. An elephant which has placed his trunk in a snare and is now injured.

the setting of snares for bushmeat, primarily for duiker, and the extraction of fuelwood. In addition to catching the desired bushmeat, snares capture larger mammals that pull the snares from their attachment resulting in inhumane injuries to chimpanzees, baboons, elephants, ungulates and carnivores (Figure 2). The long-term effect of the harvesting of fuelwood is not known.

In an effort to work with the local communities to curb these activities in Kibale National Park and to bring the people health services that they requested, a brick and mortar clinic was built (Chapman et al., 2015); and, subsequently, a mobile clinic was established (Kirumira et al., submitted) (Figure 3). Prior to this, health care for villages surrounding the park was only accessible at government clinics, which were often understaffed or lacked needed supplies, or were at distant and expensive regional hospitals (Chapman et al., 2015). Health clinics and hospitals considered by the local community to offer suitable services often cost the equivalent of a days' wage for a local labourer. The mobile clinic, a refurbished ambulance, travels around the park, bringing basic health care, family planning, deworming, HIV/AIDS treatment and counselling, vaccinations, and health and conservation education (e.g., water sanitation, the value of mosquito nets) to remote communities. The mobile clinic provides a festive atmosphere, which has proven to boost attendance at the education/outreach sessions (Vidal-Garcia et al., 2016). The mobile clinic initially had only one nurse to provide services, with a doctor available for consultation, but UWA (Uganda Wildlife Authority) immediately realized this was insufficient and requested assistance from the Ministry of Health and 3-4 nurses from the local clinics to join in the daily operations. The brick and mortar clinic provides discounted service to about 400 people a month (a rise from 280 people per month from 2008-2012 (Chapman et al., 2015), while the mobile clinic delivered medical treatment to approximately 1000 people a month, and it is estimated that UWA staff and the nurses delivered health and conservation education to 10 times that number (Kirumira et al., submitted). These events also allowed the community to interact with park staff to express their grievances and understand the park's side of the conservation situation, which the


Figure 3. The mobile clinic operating around Kibale National Park, Uganda to provide health care, education, and promote conservation.

wardens have noted as important to smoothing people-park relations. At the same time, it is also possible to provide outreach and educative material about the importance to protect the wildlife and conserve nature.

These actions appeared to have been appreciated by the local community as a survey conducted before and two years after the implementation of the mobile clinic documented an increase in the proportion of people who 'liked' the park and a decreased the number of people that 'disliked' the park. We believe that the people who dislike the park are the members of the local community most are likely to take negative actions against the park. In terms of protecting biodiversity, the activity of the mobile clinic was coincident with the community perceiving that encroachment into the park was declining; however, the number of incidences of encroachment recorded by the park rangers increased, particularly the setting of snares. This increase in encroachment resulted in or corresponded with UWA increasing the frequency of patrols (Kirumira et al., submitted). Explaining this increase in poaching is difficult. The people may be appreciative, but not so much that they are willing to alter their behaviour; or their behaviour may change slowly and it may take longer than two years to detect the positive effects of health care on biodiversity. The tradition of bushmeat hunting is well established (Solomon et al., 2015) and the need for the bushmeat is great (e.g., the need among the very poor to feed their family or send a child to school).

The second case was founded in 2007, Alam Sehat Lestari (ASRI) is partnered with Health in Harmony and has a similar philosophy and seeks to improve physical and financial health of the local community, while mitigating environmental degradation around Gunung Palung National Park (GPNP) in West Kalimantan, Indonesia. The park serves as a water source for approximately 60,000 people, harbours remarkable plant and animal richness, and is a major site for orangutan conservation. As with Kibale, ASRI learned, through community dialogues, that the financial stress felt by families after a medical emergency was a major factor driving encroachment into the

park. To address the environmental degradation, ASRI built social capital through provision of low-cost, high quality medical care, raised awareness about the community health benefits of forest conservation, and facilitated meaningful community dialogue to develop programs that reduce forest degradation. ASRI then provided training in alternative livelihoods and provided positive incentives for positive conservation outcomes. For example, they offered a 70% discount to villages that worked to stop illegal logging. The program had a positive impact and between 2008 and 2012, the number of active loggers declined by 68%. Of those loggers that quit logging, 52% chose to become farmers and nearly all loggers expressed willingness to quit logging if offered a viable alternative livelihood. One logger summarized the prevailing sentiment: "If there was any other stable work other than being a chainsaw operator that would be better." ASRI provided training in sustainable agriculture, livestock husbandry, and reforestation to provide stable work options. Furthermore, health has improved, reducing household expenditures and, subsequently, deforestation pressures.

Whether or not offering health care services will improve biodiversity conservation, our results are mixed. In Kibale it did not reduce poaching, while in Gunung Palung it did decrease logging. However, the jury should still be considered to be out, and examining this over a longer period is warranted because education needs time to have an impact and benefit more people. In addition, evaluating changes in the impact of other factors that could affect poaching and timber harvesting is needed (e.g., school fees increased sharply at the time the mobile clinic started operating in Kibale). We do see evidence of attitude changes that are positive. Of course, it is also possible that the health care initiatives may be welcomed, change attitudes, but are not sufficient to offset the perceived need for park resources. In our second case study, ASRI, we have more evidence for the benefits of the human health-conservation union on all fronts, a very encouraging case, which we hope has broader application.

Overall our results indicate that offering health care is a tangible benefit to these communities and is an effective way to influence attitudes towards conservation. People appreciate direct individual benefits more than communal benefits and thus individual benefits are more likely to influence positive attitudes towards conservation (Ferraro and Kiss, 2002; Mackenzie, 2012). When one's life, or that of a loved one, is in danger, health care is viewed as critical (Fink et al., 2011; Goldberg et al., 2012). However, unfortunately for communities surrounding remote national parks, health care is typically a 'luxury' that is simply not available (this sentiment was frequently stated during conversations with the local communities around Kibale and 'luxury' is the term most often used). The Millennium Assessment states that health care is a "right" of every individual (Sachs and McArthur, 2005). Thus, the unfortunate scarcity of health care can be turned into a win-win opportunity for conservation and neighbouring communities.

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