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Articles

Human-Nonhuman Primate Interconnections and Their Relevance to Anthropology

Agustín Fuentes

The human-nonhuman primate interface is a core component in conservation and an emerging area of discourse across anthropology. There is a growing recognition of the relevance of long-term sympatry between human and nonhuman primates. Until recently these relationships received limited attention in the anthropological literature and in the primatological construction of models for the behavior and evolution of primate societies. Most socioecological investigations into primate groups and human populations do not incorporate their interactions (beyond predation or crop raiding), potential pathogen sharing, or the role of the anthropogenically impacted environment. Current relationships between humans and nonhuman primates are generally assumed to be rooted in conflict over land use and relatively recent, and thus have limited evolutionary and long term ecological impact. To date, too few studies have attempted to incorporate specific aspects of human cultural conceptualizations of nature and nonhuman primates into explanations/examination of either human or nonhuman primate behavioral and ecological patterns. Ongoing research projects and a growing number of publications demonstrate that long-term sympatry between human and nonhuman primates results in a complex web of behavioral, ecological, epidemiological, and economic relationships, suggesting a need for increased attention by anthropologists to this topic. This essay introduces a set of articles in this issue of Ecological and Environmental Anthropology that illustrate theoretical and practical considerations suggesting the need for increased focus of the anthropological gaze towards the human-nonhuman primate interface.

Human-nonhuman Primate Interactions: the Ethnoprimatological Approach

Because of the biological, phylogenetic, and behavioral overlaps between humans and nonhuman primates, relationships between the two groups have a special significance (Fuentes and Wolfe 2002). No other organisms on the planet share as much structurally and behaviorally with humans. Humans, along with other primates, exhibit a series of primate wide trends such as grasping hands, relatively large brains, an emphasis on visual signaling, extended infant dependency, and behaviorally dynamic social complexity, for example. The existence of these primate wide trends in both morphology and behavior suggest the possibility that interconnections between humans and other primate species may differ from those between humans and other mammals. These human-nonhuman primate similarities increase both the likelihood of cultural association/inclusion of other primates by humans, and certain primates' potential to co-exist with humans. As is evident from the rapid and dramatic reduction in numbers and range, especially the great apes and the monkeys and lemurs tied to large tracts of forest cover, some species of primates do not do well when they encounter anthropogenic challenges. However, in many instances other species, members of the monkey genera *Macaca* (the macaques), *Papio* (the baboons), and *Chlorocebus* (the vervets) for example, do quite well around humans.

The ethnoprimatological endeavor (Sponsel 1997, Fuentes and Wolfe 2002, Loudon et al. 2006, Wheatley 1999, Wolfe and Fuentes 2006, see also Riley, this volume) can be seen as an outcome, or extension, of the call for a dynamic anthropological, interdisciplinary approach to the study of human-animal interactions (Mullin 1999). Rather than focusing solely on primate behavior, as in a traditional primatological program, or mainly on cultural interpretations/uses of primates, as in a socio-cultural anthropological program, ethnoprimatology attempts to merge these two approaches into a cross-disciplinary (or cross-sub disciplinary) effort. By envisioning the interconnections between humans and nonhuman primates simultaneously as products of cultural, ecological and biological linkages, a complex and dynamic pattern emerges, one that calls for multiple lines of inquiry.

The ethnoprimatological approach guides the construction of this essay and other essays in this issue of EEA. It is my contention that these articles will demonstrate both that primates play important roles in human culture and practice, and that human cultural behavior creates ecologies that differentially impact primates. This interconnection between humans and other primates can impact the behavior and ecology of both interactants.

Geographical and Temporal Contexts

While human and non-human primates share a number of interconnections, at the most basic level there is a distinction introduced by geography. When envisioning the globe there are relatively clear demarcations between zones of sympatry (geographic overlap) and zones of allopatry (lack of geographic overlap), and these patterns impact the context and content of interactions between human and nonhuman primates. The zones of sympatry fall primarily in Africa, South, East and Southeast Asia, and South/Central America and reflect the distribution of nonhuman primates for at least the last ten millennia (although one species of monkey , the Barbary macaque, may have ranged into southern Europe as recently as 2-5,000 years ago). The zones of allopatry are primarily above ~30 degrees north of the equator (above the Tropic of Cancer). Exceptions to this heuristic include East Asia where two species of macaque monkeys (*Macaca mulatta* and *M. fuscata*) range relatively far north in China and Japan, and North America, where nonhuman primate populations barely reach the Tropic of Cancer (23.5 degrees north).

Understanding the relationships between humans and nonhuman primates requires a temporal context as well as a geographic one. Long term sympatry, especially sympatry that involves common usage of habitat can result in a form of co-ecology. That is, ecological pressures impact mammals in particular ways; and mammals that share many morphological and physiological facets in common, such as the anthropoid primates (monkeys, apes and humans), may also share similar adaptations at a variety of levels. This is important in understanding the interconnections between humans and nonhuman primates because long-term overlap and similarity in behavior/other modes of adaptation (even if slight) can impact human conceptualizations of “nature” and act to facilitate distinct patterns of integration/engagement between the humans and other primates. This pattern can arise in areas of overlap, especially areas where there is a deep temporal component. Alternatively, areas with less time overlap, especially in zones of allopatry where overlap is mitigated by captivity or other forms of limited/selective exposure, specific patterns of strong association and incorporation are expected to be uncommon. However, as with all things human, this dichotomy is far from complete. With rapid urbanization in areas of sympatry, and cultural shifts in the context and conceptualizations of nonhuman animals (especially apes) in zones of allopatry, these distinctions can become blurred or even reversed.

Human Impact on Nonhuman Primates

There are a number of areas wherein nonhuman primates and humans impact one another in significant ways. This zone of interconnection is largely theoretically and practically excluded from most examinations of socioecology/behavioral ecology of human and nonhuman primates. For example, traditional socio-ecological models used in assessing primate behavior rely on: female distribution, patterns of competition (scramble vs. contest), presence/distribution of predators, resource availability, and forest structure/composition. These elements can be substantially impacted by a variety of anthropogenic processes. Alteration of forest structure, mammalian biomass, floral composition of habitats all are part and parcel of anthropogenic engagement with environments. The patterns that these human processes involve may directly impact the pressures and structures of the basic ecological contexts/patterns we generally invoke in social-ecological explanations. It is vital to view these interconnections as more than just “interference” with, or perturbation of, a “natural” state. Rather these may be drivers for specific behavior patterns and or shifts that we observe in primates. These interconnections and anthropogenic influences may be structuring parts of primate behavior. This is different from the old and well-established interference from provisioning or habituation that researchers continue to consider and debate. It may be that part of what we consider "normative" behaviors for nonhuman primates are in fact in part stimulated by specific anthropogenic contexts.

Human alterations of the landscape including forest modification, road construction, irrigation systems, and preferential use of specific forest or other habitat areas can modify, restrict or even enhance pathways between groups in a population of primates. For example, the macaques on Bali are found throughout the island, except in the extreme urban areas such as the capital city, Denpasar. There appear to be at least 63 sites where macaques reside on the island (Fuentes et al. 2005). Each of these sites has one to three groups of macaques that range either fully within the site or the site is a part of their total home range. Each site has fifteen to over three hundred monkeys. Macaque densities at these sites range from one to over twenty individuals per square kilometer while human densities average over 500 individuals per square kilometer across the island. Over sixty-eight percent of these sites are associated with a temple or shrine. These religious complexes can be as small as a simple shrine consisting of a few stones and an altar to elaborate temple complexes that are heavily used by Balinese and in some cases foreigners (Fuentes et al. 2005). Many of these macaque groups undergo some provisioning, as sites that contain a shrine or temple complex and have temple ceremonies several times per year. A component of Balinese Hinduism is the regular placement of offerings at shrines and temples. This suggests that a large percentage of the macaque groups on Bali are food enhanced (receive some substantial or integral component of their nutritional requirements from humans or human activity-see Fa and Southwick 1988, Wheatley 1999), especially if one includes crop raiding as food enhancement.

It appears that specific land-use patterns and wet-rice agriculture combined with the complex temple and irrigation systems of the Balinese (Lansing 1991**)** has resulted in a mosaic of riparian forest corridors and small forest islands throughout much of Bali (Fuentes et al. 2005). This type of landscape fits remarkably well with the macaques' patterns of using riparian habitats and small forest clusters for residence, foraging, and dispersal. This landscape has been formed over at least the last few millennia and the pattern of distribution of macaque populations across the island suggests that the macaques are exploiting it (Fuentes et al. 2005). Recent preliminary genetic analyses of the Bali macaque popualtion support this proposal. While the females appear to exhibit extreme site specificity, the males (as measured by Y DNA markers) show clear indications of extreme mobility (Lane et al. in prep). The human alteration of the landscape combined with macaque behavior and dispersal patterns result in a population pattern of clusters of related females with males moving across groups and subpopulations acting as units of gene flow. This gene flow, however, appears to be channeled along the riparian corridors facilitated and maintained by the Balinese religious and agricultural system (Fuentes et al. 2005).

Primates are prey items for a diverse array of human cultures in zones of sympatry, and are also captured by people from both zones for various human needs ranging from ingredients in traditional medicines to subjects of biomedical research. Differential hunting resulting in sex bias can alter the make-up of primate populations over generations and result in changes in dispersal patterns such as which sex transfers, what the success rate of dispersal is and a potentially high rate of non-dispersal from natal groups (which in turn could result in high rates of aggression). As relatively large mammals, especially in the Neotropics, primates are a common choice for hunters (Alvard et al. 1997, Amman et al. 2000, Lizaralde 2002, Shepard 2002). However, research suggests that humans do not take nonhuman primates randomly nor solely in respect to optimal prey return models (Shepard 2002). In fact, it is common for human hunters to selectively hunt specific primates over others for cultural reasons (Cormier 2002, 2003, Fuentes 2002, Lizaralde 2002, Shepard 2002**)**. For example, the Matsigenka, who live in the Manu region of Peru, preferentially hunt larger monkeys, so much so that in areas where shotgun use is practiced, the larger species (Spider and wooly monkeys) have become locally extinct (Alvard and Kaplan 1991). However, the Howler monkeys (*Alouatta seniculous*) in Matsigenka territory, similar in size to the spider and wooly monkeys, remain at viable population levels and are taken about half as often as the capuchin monkeys who are one-half their size (Shepard 2002). The Matsigeneka have two reasons for this differential predation; the Howlers are less "tasty" and are considered slow and lazy, characteristics that are believed to pass on to children who eat the Howler meat (Shepard 2002). However, this "aversion" to Howlers is not common to all Amazonian peoples, and in fact some preferentially consume them (also for practical and cultural reasons) (Cormier 2002, 2003, this volume). These examples and others suggest that humans selectively predate on primates, such that some species see greater/lesser impact than others. Given these cases, one would assume various models proposing that selective predation by humans impacts the prey populations of nonhuman primates. In fact, recent overviews have demonstrated substantial behavioral and possibly morphological changes in primates due to extant or even past predation risks caused by non-human predators (Miller 2002). However, aside from general impacts on prey densities and local extinction events there are few studies that have attempted to model the impact of human predation on nonhuman primate behavior, physiology and morphology in a manner similar to the modeling of other animals' predation on primates (Alvard and Kaplan 1991). This suggests that long-term, sustained predation by humans at a level below extinction-causing may impact the behavior and morphology of nonhuman primates. It is also possible that selective hunting for body parts or other features that are used in traditional medicines may impact primate populations. However, it is far from clear if these predation rates are high enough (relative to medical hunting in other animals and to nutrition-based hunting of primates) to have a pronounced impact.

It has long been held that researchers following specific groups may inhibit predation on those groups (or facilitate it via habituation). However, in a broader sense, might primate groups under predation pressure move into higher human density habitats to exploit this context? Could primates seek out human habitation or human modified habitats /frequently used habitats of forest areas to ameliorate predation threats? Demographic changes caused by hunting, disease, dispersal limits or enhancements can change the social ecological contexts such that predation may become a stronger/weaker pressure on a population or group. This in fact may or may not be a factor, for example in Hanuman langurs (*Semnopithecus entellus*) for which there are a variety of populations where infanticide is reported and others where it is not. This is not to say that infanticide necessarily arises from the human population induced stress, but rather that differential interactions between humans and the habitat (and monkeys) may in fact create diverse social, demographic and ecological conditions that make infanticide more or less viable as a strategy and/or as an occurrence. Therefore, one could compare elements of the human communities and their habitat use patterns across different langur sites to see of there are any correlates with langur behavior (such as infanticide).

In an opposite context from hunting, food enhancement (via direct provisioning, incidental provisioning, crop raiding, house garden raining, garbage exploitation, plantation living, etc…) can facilitate a reduction of food stress and at the same time increase risk of attack (by humans/dogs/etc) creating different patterns of stress response (chronic vs acute). Additionally, the foods being exploited can alter the metabolic patterns of nonhuman primates. These factors can then influence dominance hierarchies and behavioral profiles of a nonhuman primate group. For example, Sapolsky and Share (2004) report on the changes in a group of baboons that began focusing on a human waste dump at a tourist lodge. The group began to change their foraging range (only at the dump) and had an increased level of aggressive interactions and dominance contests. Some of the neighboring forest group males also shifted their foraging patterns to come out of the forest to forage at the dump. Infected meat at the dump initiated a tuberculosis outbreak killing nearly all of the dump group animals and many of the males from the forest group who frequented the dump (46% of them). This dramatically changed the demography of the forest group and their patterns of behavior. It turned out that those males that frequented the dump were the more aggressive males (as the dump group was quite aggrieve and feeding there entailed exhibition of frequent aggression) so the resultant group (after the disease epidemic) exhibited a peaceful profile relative to the earlier configuration. This behavior pattern is the result of interconnections with humans, changes in foraging, and patterns of individual behavior all in the context of an anthropogenic environment. Not because of one particular selective pressure or a basic ecological constraint.

Finally, noise, spatial restriction, and human activity cycles can also impact alarm and vigilance behavior in nonhuman primates and thus potentially shift activity patterns. For example, during field work on North Pagai Island, Mentawai, Indonesia, I noticed that the Pig-tailed langur (*Simias concolor*) alarm called at passing jets with regularity. This primate is the favored prey item of local humans to which it also alarm calls. It is possible that the frequent and non-functional alarms to passing jet planes could alter the reliability of alarm calls and create contexts for deception or a devaluing of the alarms and thus higher threats from predation.

Nonhuman Primates Impact on Humans

Human conceptualizations of nature influence, and are influenced, by ecological patterns and the nonhuman co-inhabitants of shared ecologies/habitats. In this context, nonhuman primates may play substantial roles. In areas of sympatry many human communities keep primates as pets. However, the present situation is largely recent as nonhuman primates, especially small monkeys, were widely available in Europe during the early centuries following colonial expansion, and both monkeys and apes were kept as pets in private menageries and homes during that time. However, due to the costs of transport and the high levels of mortality during transport, it is unlikely that the zones of allopatry ever had the levels of primate pet ownership that we see in zones of sympatry. Today pet ownership of select nonhuman primate species is widespread in Southeast Asia, and Amazonia, and occurs in South Asia, and other parts of South America and Africa as well. In Asia the majority of pets owned belong to the genus *Macaca* and *Nycticebus* (the slow loris) (Malone et al. 2002), in South America nearly all of the species found in Amazonia are kept as pets by at least some indigenous groups (Cormier this issue), and in Sub-Saharan Africa most pets are the medium-small monkeys such as vervets (genus *Chlorocebus*) and Guenons (genus *Cercopithecus*). In North Africa, the sole African macaque, *Macaca sylvanus*, is kept as a pet, and this species has also had a small resurgence as a pet in Western Europe as well (although it remains illegal). Apes are held as status pets in Asia and Africa, but have fairly low rates of survivorship in captivity as pets and are quite expensive and energy intensive to keep relative to other nonhuman primate pets. Because the pet tradition is quite old in at least Southeast Asia and South America, it is also quite likely that there is substantial bi-directional pathogen transmission between humans and their primate pets (see below). It is possible that there are physiological changes, even adaptations, in populations of human and nonhuman primates the overlap extensively, such as pets, humans, and the local populations that the pet primates come from, as a result of these intensive interactions.

Crop raiding and related resource exploitation patterns by nonhuman primates are the traditional reference point for human-nonhuman primate interactions and have been extensively reviewed by numerous researchers (see summaries and updates in Patterson and Wallis 2005). These competitive relationships can have substantial impacts on human nutritional intake and agricultural patterns. Sympatric primate populations may prey on human agricultural lands resulting in increased time spent by humans in protection of the fields and potentially decreased yields per human labor effort (see Paterson and Wallis 2005). However, it is also the case that nonhuman primates can be used as economic tools by humans in South, Southeast and Northeast Asia.

While there is reference to crop picking macaques across much of Southern Asia, the best current studies of human utilization of primates come from Thailand where males of one species of macaque (*M. nemestrina*) are kept, raised, and trained to pick coconuts (Sponsel et al. 2002). In this case, humans in Southern Thailand capture macaques as young individuals and then invest substantial time and energy to train them to be effective coconut pickers. This system can be highly efficient for the humans, as a well trained macaque can harvest between 500-1000 coconuts per day and do so with a lower cost and higher return than a human could (the other harvesters are young human boys). Sponsel et al. (2002) present this situation as an example of a possible adaptive shift from a predator-prey relationship to a cooperative human-monkey economic relationship. They argue that cultural and agricultural systems have favored a move from conflict between humans and macaques over crops to a synergistic relationship wherein the humans capture, train and maintain the macaques as they serve their economic role (job). Similar engagements of nonhuman primates by humans occur in various iterations across Asia, whereas economic exploitation by humans in allopatric contexts tends to be in the raising and use of nonhuman primates as laboratory animals or circus performers/display animals.

In some parts of the sympatric range nonhuman primates are also integrated into a different cultural and economic practice: monkey performance. This is a blend of the economic and social inclusion facets of the monkey-human relationship. Monkey performances include a variety of theatrical performances by trained nonhumans primates (usually monkeys), where the monkeys mimic human cultural behavior via a series of staged interactions with their trainer, the audience and, in some cases, other monkeys. Generally, the audience provides monetary contributions at the conclusion of the performance. These funds are the income of the trainer and are used to maintain both the monkey(s) and the trainer's family. While these performances are widespread across Asia, they also occur in Northern Africa, and historically in Europe as well (Janson 1952). The most in-depth study of these practices come from Emiko Ohnuki-Tierney's work on Japanese monkey performances. Ohnuki-Tierney (1987, 1995) presents the notion that in Japan the monkey performance, and the macaque monkeys themselves, act as a mirror for humanity "playing a powerful role in their (humans') deliberations of who they are as humans vis-à-vis animals and as a people vis-à-vis other peoples" (Ohnuki-Tierney 1995, pg 297). The integration of economic and cultural roles for macaques in Japan results in a distinct and complex cultural relationship between humans and monkeys that exists at the same time that increasing conflict over land and crops emerges as a predominant pattern of interaction between humans and "wild" macaques in Japan (Sprague 2002, this issue).

In addition to the impacts on cultural patterns and perceptions, the spatial overlap and interactions between humans and nonhuman primates can create an environment where more than space is shared; there may also be co-mingling of infectious agents. While it is generally assumed that human-non-human primate infectious agent "sharing" has deleterious repercussions, our understandings of the patterns and contexts of these shared environments and their evolutionary implications remains rather incomplete (Engel et al. 2002, Jones-Engel et al. 2005). Close contact and range overlap between humans and nonhuman primates does introduce a very real and potentially dangerous situation of disease transmission (Engel et al., 2002, Fa, 1992, Jones-Engel, et al., 2005, Wallis and Lee, 1999). In these cases, humans risk exposure to a number of simian viruses, including simian T cell lymphotropic viruses (STLV), simian retrovirus (SRV), simian foamy virus (SFV) and Herpes B virus in addition to other known infectious agents (Engel et al*,* 2002, Jones-Engel et al*.,* 2005, Wolfe et al., 2004). It is also important to point out that nonhuman primates are potentially at risk from human pathogens as well, including measles, influenzas and other respiratory pathogens such as parainfluenza and tuberculosis (Jones-Engel et al., 2001). Additionally, both humans and nonhuman primates can act as reservoirs for shared pathogens or potential pathogens that moves across species boundaries, such as with SIV/HIV and Ebola (Roquet et al 2005).

An Engaged Perspective of Human and Nonhuman Primate Relationships

As evidenced from this brief essay, human and nonhuman primates overlap in an increasingly complex array of contexts (Fuentes and Wolfe 2002, Patterson and Wallis 2005). These contexts range from forests, to rural villages to urban environments and from prey, to pets, to vectors of serious pathogens. As such, the role of nonhuman primates may be significant in human ecologies. Additionally, humans rely substantially on symbol/myth in the construction of daily life, and nonhuman primates are potent symbols in many cultures that overlap sympatrically with the monkeys, apes and prosimians. Because of these factors, anthropologists need to be aware of the role and structure of the human-nonhuman primate relationships. Primatologists must also see this nexus as an important focal area for research activity and recognition as a significant force in shaping primate behavior and ecology. Ignoring this interface may remove influential variables in analyzing behavioral and ecological patterns for both humans and nonhuman primates. Strong apriori primatological models for patterns of behavior that do not include recognition of this interface can provide false affirmations or refutations of predictions due to missed variables. Ethnographic models and ecological assessments of humans that ignore the potential role and impact of nonhuman primates risk oversimplifying the ecological and symbolic contexts and overlooking epidemiological and historical relationships that may significantly impact human populations. Observed patterns in both human and nonhuman primates may reflect adaptations or behavioral strategies that can only be fully understood when both participants are included in the analyses. A truly engaged anthropological context includes human-nonhuman primate relationships.

The essays that follow in this issue of Ecological and Environmental Anthropology are a reflection of this engagement by practicing anthropologists.

Paul Grobler and colleagues report on the genetics and social contexts of the human-nonhuman primate relationship in their assessment of primate sanctuaries in South Africa. The relationship between humans and non-human primates in South Africa is complex. Vervet monkeys are crop raiders and classified as “vermin” species slated to be eradicated (producing orphaned infants). Many vervets are also kept as pets (illegally) and are confiscated if discovered. These patterns have resulted in a sanctuary network in South Africa with potential impacts on both the economic contexts of local humans and the genetic structures of monkey populations.

Alejandro Estrada tackles the perception that agricultural activities are the primary threat to primates in the tropics. He argues that in fragmented, heterogeneous Neotropical landscapes some agricultural practices may favor primate population persistence in these human-modified landscapes. He examines human population growth and economic pressures on forested land in Mesoamerica and the Amazon basin regions, and combines this investigation with surveys of the presence and activities of primate populations in agroecosystems. He suggests that there are possible benefits of primate presence to agroecosystems, and stresses the relationship between primate conservation and some agricultural practices in the Neotropics.

Loretta Cormier provides an overview of "ethnoprimatology" in the Amazonian region. She reviews a number of ethnographic works that incorporate information about the roles of monkeys in the cultures of varied Amazonian groups, specifically in the contexts of predation ecology and symbolic ecology. Her review establishes a strong basal dataset for understanding the use of primates as food including preferences, avoidances, and taboos, and the role of monkeys in myths, folklore, and in delineating the humanity/animality divide.

David Sprague and Nobusuke Iwasaki examine the very complex, modern day relationship between Japanese farmers, tourists and macaque monkeys. They note the increase in conflict between farmers and monkeys and that historically, rural grasslands and pine woodlands restricted monkey distribution. However, the once rural landscape is now semi-suburban or a tourist attraction. They argue that the Japanese people face a cultural and ecological challenge in seeking a new relationship between themselves and monkeys. Integrating a cultural approach examining the Japanese concepts of co-existence and exclusion, they note that today in Japan people disagree on what they want from the interaction, if any, with monkeys and that the monkeys cannot negotiate. They conclude that applying ameliorative technology effectively to potential conflicts requires large organizations and funding, and that any effective division between the two species is precluded by the inter-mingled geographies of human and monkey habitats.

Karen Strier and colleagues report on the long-term research and conservation efforts at Estação Biológica de Caratinga/RPPN-Feliciano Miguel Abdala, in Minas Gerais, Brazil, where nearly 25% of the remaining Northern Muriqui monkeys exist. They point out that while the research and monkeys have received considerable attention, and educational campaigns have been highly effective, little attention has been paid to the human dimensions of this situation. In their article they examine the role of Brazilian students in the research, the multiple levels of interactions among researchers and different spheres of the local farming community, and the development of partnerships involving national and international NGOs and the Brazilian government. They conclude by describing the synergist interactions between each of these human dimensions, which have contributed to both the research and conservation of northern muriquis.

James Loudon and colleagues use ethnographic, primatological, and parasitological methodologies to investigate the relationships between, ring-tailed lemurs, Verreaux's sifaka, and humans who live in sympatric association in and around the Beza Mahafaly Special Reserve, Madagascar. They suggest that a fusion of these methodologies provides a holistic understanding of the advantages and disadvantages of human-nonhuman primate sympatry. They also stress that incorporating local peoples into conservation initiatives requires an understanding of human-nonhuman primate interconnections, the perspective of local peoples regarding their surroundings, knowledge of nonhuman primate behavior, and epidemiological factors.

Finally, Erin Riley argues that the emerging field of ethnoprimatology has real potential to bridge the subfields of cultural and biological anthropology. She supports her argument by discussing the theoretical rationale of an ethnoprimatological approach in the context of perceptions of "natural environments" in primate ecology and conservation, as well as in anthropology in general. She highlights the practical rationale of such an approach in the contemporary era where anthropologists and others are increasingly realizing that conservation must take place within a broader ecological framework that includes the human dimension, and that ethnoprimatological approaches provide a robust set of methodologies with which to tackle such contexts.

Read these articles with an open mind and an eye for their relevance to Anthropology and the linkages they create and illustrate across cultural, biological and ecological approaches. They effectively represent the diversity in practitioners and topics that characterizes the investigation into the human-nonhuman primate interface.

Bibliography

Aggiramangsee, N. 1992. Survey of semi-free ranging macaques of Thailand. Natural History Bulletin of the Siam Society 40:103-166.

Alvard, J. and Kaplan, H. 1991. Procurement technology and prey mortality among indigenous neotropical hunters. *In* Human Predators and Prey Mortality. M.C. Stines, ed. Pp. 335-387. Boulder: Westview Press.

Alvard, M.J., J.G. Roninson, K.H. Redford, and H. Kaplan. 1997. The sustainability of subsistence hunting in the neotropics. Conservation Biology 11:977-982.

Amman, K., J. Pearce, and J. Williams. 2000. Bushmeat: Africa's Conservation Crisis. London: World Society for the Protection of Animals.

Cormier, L. A. 2002. Monkey as food, monkey as child: Guaja symbolic cannibalism. *In* Primates Face to Face: The Conservation Implications of Human-Nonhuman Primate Interconnections. A. Fuentes and L. D. Wolfe, eds. Pp. 63-84. Cambridge: Cambridge University Press.

Cormier, L.A. 2003. Kinship With Monkeys: the Guaja Foragers of Eastern Amazonia. New York: Columbia University Press.

Engel, G.A., L. Jones-Engel, K.G. Suaryana, I.G.A. Arta Putra, M.A. Schilliaci, A. Fuentes, and R. Henkel. 2002. Human exposures to Herpes B seropositive macaques in Bali, Indonesia. Emerging Infectious Diseases 8(8):789-795.

Fa, J.E. 1992. Visitor-directed aggression among the Gibraltar macaques. Zoo Biology 11:43-52.

Fa, J.E. and Southwick, C.H., eds. 1988. Ecology and Behavior of Food-enhanced Groups. New York: Alan R. Liss, Inc.

Fuentes, A. 2002. Monkeys, humans and politics in the Mentawai Islands: no simple solutions in a complex world. *In* Primates Face to Face: The Conservation Implications of Human-Nonhuman Primate Interconnections. A. Fuentes and L. D. Wolfe, eds. Pp. 187-207. Cambridge: Cambridge University Press.

Fuentes, A. and S. Gamerl. 2005. Characterizing aggressive interactions between long-tailed macaques (*Macaca fascicularis)* and human tourists at Padangtegal Money Forest, Bali, Indonesia. American Journal of Primatology 66:197-204.

Fuentes, A. and Wolfe, L. D., eds. 2002. Primates Face to Face: The Conservation Implications of Human-Nonhuman Primate Interconnections. Cambridge: Cambridge University Press.

Fuentes, A., M. Southern, and K.G. Suaryana. 2005. Monkey forests and human landscapes: is extensive sympatry sustainable for *Homo sapiens* and *Macaca fascicularis* in Bali**?** *In* Commensalism and Conflict: The Primate-Human Interface. J. Patterson and J. Wallised, eds. Pp. 168-195. American Society of Primatology Publications.

Janson, H.W. 1952. Apes and Ape Lore in the Middle Ages and the Renaissance. Studies of the Warburg Institute Vol. 20. University of London.

Jones-Engel, L., G.A. Engel, M.A. Schillaci, R. Babo, and J. Froelich. 2001. Detection of antibodies to selected human pathogens among wild and pet macaques (*Macaca tonkeana*) in Sulawesi. American Journal of Primatology 54:171-178.

Jones-Engel, L., G. Engel, M.A. Schillaci, A.L.T. Rompis, A. Putra, K. Suaryana, A. Fuentes, B. Beers, H. Hicks, R. White, and J. Allen. 2005. Primate to human retroviral transmission in Asia. Emerging Infectious Diseases 7(2):1028-1035.

Lane, K.E., N. Johnson, L. Watanaskul, A.L.T. Rompis, I.G.A. Arta Putra, I.N. Wandia, L. Jones-Engel, A. Fuentes, and H. Hollocher. In prep. Assessing genetic structure in Balinese macaques and its implications for disease transmission.

Lansing, S.J. 1991. Priests and Programmers: Technologies and Power in the Engineered Landscape of Bali. Princeton: Princeton University Press.

Lizarralde, M. 2002. Ethnoecology of monkeys among the Bari of Venezuela: perception, use and conservation. *In* Primates Face to Face: The Conservation Implications of Human-Nonhuman Primate Interconnections. A. Fuentes and L. D. Wolfe, eds. Pp. 85-100. Cambridge: Cambridge University Press.

Loudon, J., M. Howell, and A. Fuentes. 2006. The importance of integrative anthropology: a preliminary investigation employing primatological and cultural anthropological data collection methods in assessing human-monkey co-existence in Bali, Indonesia. Ecological and Environmental Anthropology 2(1):2-13

Malone, N., A.R. Purnama, M. Wedana, , and A. Fuentes, 2002. Assessment of the sale of primates at Indonesian bird markets. Asian Primates 8(1-2):7-11.

Miller, L.E. 2002. Eat or be Eaten: Predator Sensitive Foraging Among Primates. Cambridge: Cambridge University Press.

Mullin, M.H. 1999. Mirrors and windows: sociocultural studies of human-animal relationships. Annual Reviews of Anthropology 28:201-224.

Ohnuki-Tierney, E. 1995. Representations of the monkey (*Saru*) in Japanese culture. *In* Ape, Man, Apeman: Changing Views since 1600. R. Corby and B. Theunissen, eds. Pp.297-308. Evaluative Proceedings of the Symposium Ape, Man, Apeman: Changing Views since 1600, Leiden the Netherlands, 28 June- 1 July, 1993. Department of Prehistory, Leiden University.

Ohnuki-Tierney, E. 1987. The Monkey as Mirror: Symbolic Transformations in Japanese History and Ritual. Princeton: Princeton University Press.

Patterson, J. and J. Wallis, eds. 2005. Commensalism and Conflict: The Primate-Human Interface. American Society of Primatology Publications.

Rouquet, P., J.M. Froment, M. Bermejo, A. Kilbourn, W. Karesh, P. Reed, B. Kumulungui, P. Yaba, A. Délicat, P.E. Rollin, and E.M. Leroy. 2005. Wild animal mortality monitoring and human ebola outbreaks, Gabon and Republic of Congo, 2001–2003. Emerging Infectious Diseases 11 (2):283-290.

Sapolsky, R.M. and L.J. Share. 2004. A pacific culture among wild baboons: its emergence and transmission. PLoS Biol 2(4): e106.

Shepard, G.H. 2002. Primates in Matsigenka subsistence and world view. *In* Primates Face to Face: The Conservation Implications of Human-Nonhuman Primate Interconnections. A. Fuentes and L. D. Wolfe, eds. Pp. 101-136. Cambridge: Cambridge University Press.

Sponsel, L.E. 1997. The human niche in Amazonia: explorations in ethnoprimatology. *In* New World Primates, Ecology, Evolution and Behavior. W. Kinzey, ed. Pp. 143-165. New York: Aldine de Gruyter.

Sponsel, L.E., N. Ruttanadakul, and P. Natadecha-Sponsel. 2002. Monkey business? The conservation implications of macaque ethnoprimatology in Southern Thailand. *In* Primates Face to Face: The Conservation Implications of Human-Nonhuman Primate Interconnections. A. Fuentes and L. D. Wolfe, eds. Pp. 28-309. Cambridge: Cambridge University Press.

Sprague, D.S. 2002. Monkey in the backyard: encroaching wildlife in rural communities in Japan. *In* Primates Face to Face: The Conservation Implications of Human-Nonhuman Primate Interconnections. A. Fuentes and L. D. Wolfe, eds. Pp. 254-272. Cambridge: Cambridge University Press.

Wallis, J. and D. R. Lee. 1999. Primate conservation: the prevention of disease transmission. International Journal of Primatology 20(6):803-825

Wheatley, B.P. 1999. The Sacred Monkeys of Bali. Prospect Heights: Waveland Press.

Wolfe, L.D. 2002. Rhesus macaques: a comparative study of two sites, Jaipur, India, and Silver Springs, Florida. *In* Primates Face to Face: The Conservation Implications of Human-Nonhuman Primate Interconnections. A. Fuentes and L. D. Wolfe, eds. Pp. 310-330. Cambridge: Cambridge University Press.

Wolfe, L.D. and A. Fuentes. 2006. Ethnoprimatology: contextualizing human/primate interactions *In* Primates in Perspective. C. Campbell, A. Fuentes. K. MacKinnon, M. Panger and S. Bearder, eds. Pp. 691-701. Oxford: Oxford University Press.

Wolfe N.D., W.M. Switzer, J.K. Carr, V.B. Bhullar, V. Shanmugam, U. Tamoufe, A.T. Prosser, J.N. Torimiro, A. Wright, E. Mpoudi-Ngole, F.E. McCutchan, D.L. Birx, T.M. Folks, D.S. Burke, and W. Heneine. 2004. Naturally acquired simian retrovirus infections among Central African hunters. Lancet 363: 932-37.