HORNBILL

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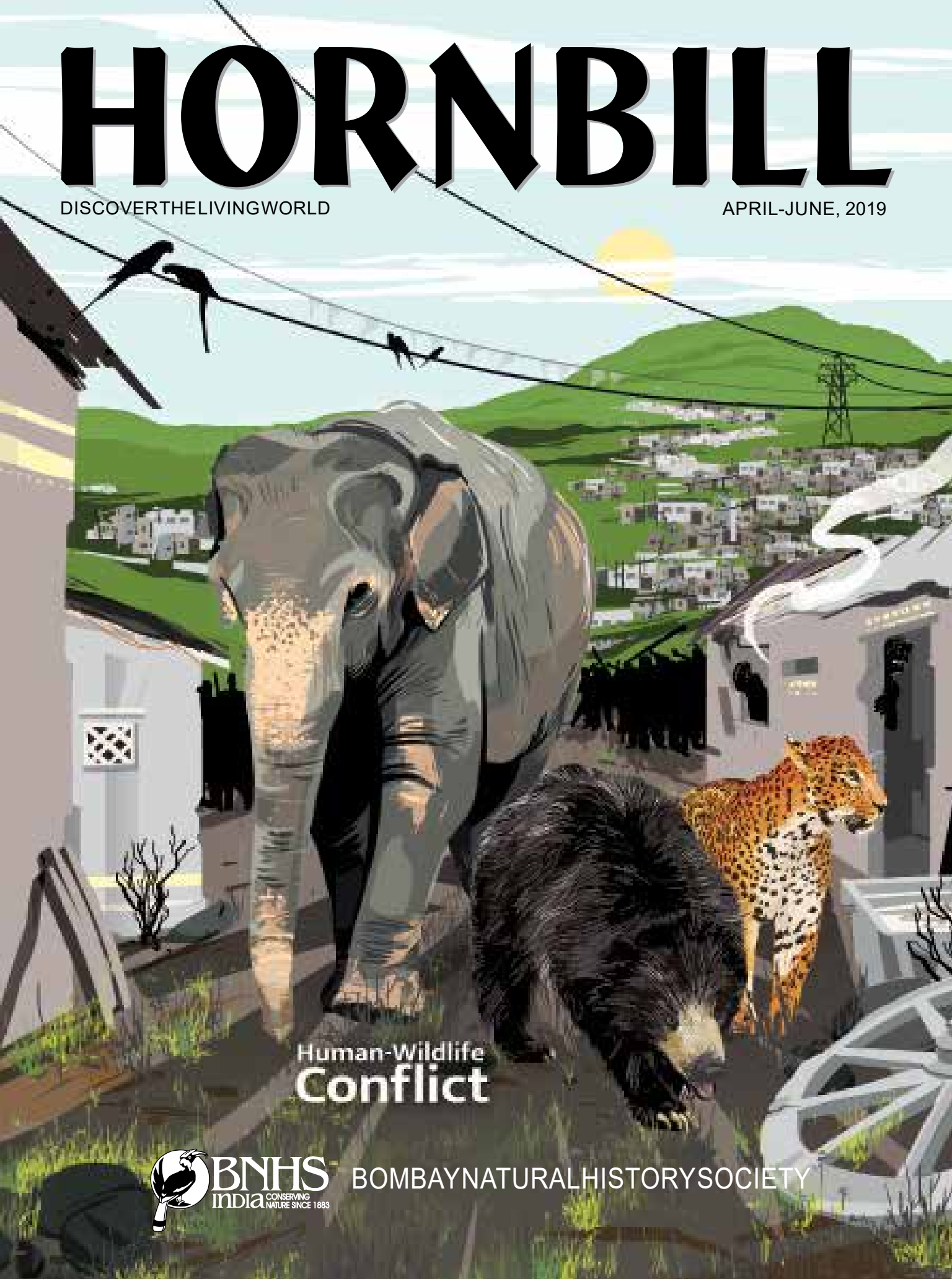
APRIL-JUNE, 2019



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Contents

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Editorial

Deepak Apte

Human-Wildlife Conflict – A Growing Dilemma

This special issue on human-wildlife conflict is part of our series of thematic issues of *Hornbill*. Nomenclature of this conservation problem has evolved over time, from man-animal conflict to human-wildlife conflict, and now to human-wildlife coexistence. Whatever may be the nomenclature and whichever way we look at it, we have a serious issue to deal with. With protected areas getting fragmented each passing day, the issue is only going to get worse with time. Typically, we defined conflict only as when either a wild animal kills a human being and vice versa, or a wild animal raids agriculture fields. But a new form of conflict, though subtle, looms large and potentially has an ability to wipe out species in a very short span of time. Take the case of great Indian bustard (GIB). Rights of people pitched against the interest of species have strong social undercurrents that lead to a conflict of another sort. Loss of GIB from Maharashtra may be directly or indirectly attributed to this issue. Thus, eviction of people for protection of GIB can prove to be counter-productive.

We also face this challenge for species like Lesser Florican, Bengal Florican, and Sarus Crane, a large part of whose life cycle is spent in human dominated landscapes such as agriculture fields. The only way forward for such species is to work with people and communities. For these species, we need people-protected areas where boundaries and management are based on compassion.

This argument, however, may not hold valid for other species, such as large carnivores like the tiger. With enhanced protection and development of tiger habitats through the tireless efforts of the forest department, we definitely brought cheer to the conservation community globally. We probably have not looked at the other side of the coin carefully while developing the conservation blueprint for tiger. What will happen when the carrying capacity of these fragmented forests is reached and young tigers start moving outside protected areas to establish their own territories? Is our theory of wildlife corridors enough to contain this problem? For me, personally, tiger conservation is at a crossroads. Tiger conservation challenges now rest at the confluence of growing human aspirations and needs of the species.

Thus, there is no one solution for the issue of human-wildlife conflict or coexistence, whatever we may choose to call it. From my point of view, this issue will assume epic proportions in times to come. Exploding human population and human aspirations are facilitating rapid expansion of infrastructure, leading to further fragmentation of habitats. Even protected areas are no longer insulated from the thrust of infrastructure development and modernization. Knee jerk reactions like permitting shooting of animals will not help. It may bring in another niche species with problems of a different nature. Sadly, there are no quick fixes for this deeply rooted problem. In such trying times, human-wildlife conflict will only divide us further with the debate 'Who comes first?' In these challenging times, the last thing we need is local communities turning against wildlife. While we intellectually debate this issue endlessly, we need to find real solutions and those will come only if we work with people who live in the perpetual shadow of this conflict.

We requested the legendary Dr A.J.T. Johnsingh to be our guest editor for this issue. His reputation in the research and conservation fraternity can be gauged from the phenomenal response that we received from authors. With 28 articles, this is one of the most comprehensive issues of *Hornbill*. ■

MANJUNATH N.

The possibilities of accidents are much more when people chase elephants

Human-Wildlife Conflict: A Review

A.J.T. Johnsingh

Human-wildlife conflict is as ancient as human history itself. In the dim distant past, cave-dwelling man was afflicted by leeches, ticks, insects, as well as poisonous and dangerous fishes and reptiles, aggressive herbivores, and carnivorous mammals including the sabre-toothed tiger. Even now, after leaving the cave and the hunter-gatherer way of life which was the primary way of life in the ancient past, humans, particularly the poor, are not safe from conflict with wildlife. The number of people dying of malaria in the Indian subcontinent each year is around 70,000, while 65,000 die of snake bite, and 65,000 from rabies largely caused by free-ranging dogs. This compilation of articles focuses on human conflict with wild mammals and birds.

When Bombay Natural History Society planned to publish this special issue of

Hornbill on human-wildlife conflict, the task of contacting the authors and compiling the articles was given to me. A decision was made that the issue should as far as possible cover all the conflict situations prevalent in the Indian subcontinent. Sadly, Singye Wangmo from Bhutan, though very keen, could not contribute her article due to inexplicable reasons. I thank Dr Deepak Apte, Director, BNHS for the opportunity given to me, as it gave me an occasion to enrich my knowledge on the conflict situation prevalent in the Subcontinent.

The articles include species such as Asian elephant written by S.S. Bist, Prachi Mehta, Lakshminarayanan and Bivash Pandav, Nishant Srinivasaiah, and Sreedhar Vijayakrishnan and M. Ananda Kumar; tiger by Ravikiran Govekar, Anwarul Islam and his team, and Sahil Nijhawan; Asiatic lion by Stotra Chakrabarti; leopard by Sanjay Gubbi; urban leopards by Nayan Khanolkar; snow leopard and associated mammals by Kulbhushansingh Suryawanshi from India, Muhammad Ali Nawaz and Fathul Bari from Pakistan, and Naresh Kusi from Nepal; bear species by Harendra Singh Bargali; rhesus and Nicobar long-tailed macaques respectively by Sindhu Radhakrishna and Ishika Ramakrishna.

Jayantha Jayewardene has written about the conflict situation in Sri Lanka; Kanchan Thapa has focused on the problems in the Nepal *terai*; Usha Lachungpa highlights the problems caused by black bear, free-ranging dogs, and Assamese macaque in the mountainous state of Sikkim; and Dharmendra Khandal and his team brief us about the situation in the arid state of Rajasthan, the largest state in India, which has the maximum number of goats in the country, where the growing population of leopards ranges even into the desert areas, and tiger conservation is welcomed in the state because of the prosperity it brings.

P.O. Nameer and M. Shaji attribute the problems in Kerala to the state's high human population density (859 people/ sq. km), which has resulted in the loss and degradation of wildlife habitats. Ranjit

MANOJ KUMAR

A tiger that had died in a snare possibly kept for wild pigs in the border of Nagarhole Tiger Reserve

A.J.T. JOHNSINGH

Crop damage caused by nilgai in its range is significant

Manakadan recollects the conflict situation he had seen in Rollapadu Wildlife Sanctuary which was primarily established to provide a home to the great Indian bustard which is rapidly racing towards extinction. Ranjit also writes on the conflict between birds and humans in another article.

Rajat Bhargava opines that the conflict situation, which farmers struggle to avoid, paves the way for poaching and smuggling of wildlife products. Kumaran Sathasivam, by reading through the first 10 volumes of *Journal of the Bombay Natural History Society*, a gold mine for biological information, throws some light on the conflict situation that was prevalent in India at the end of the 19th century.

Naveen Pandey and Andy Kopker list the numerous diseases that affect wildlife, and conclude with optimism that as domestic species act as sentinels, it may be possible to detect and address emerging diseases early in wildlife populations.

Pranav Trivedi aptly says that with an increasing human population leading to loss and degradation of more natural habitats, the nature of human-wildlife interface has acquired a bitter flavour in recent times. The obvious result of this uneasy interface, often termed conflict, has been the loss of life on both sides and bad publicity for the process of conservation.

Among all the wildlife species, elephant tops the list in the agony, problems, and pain caused to humans, particularly to the poor of the land. In this regard, the information compiled by S.S. Bist, the finest Project Elephant director the country has seen so far, is frightening. He reports that from 2013–14 to 2017–18, elephants in India were involved in the deaths of 425–565 persons per year, at least 400 persons were injured annually and most of them were maimed for life. About 10,000 sq. km of cropland and nearly five lakh farmers were affected, and about 15,000 houses were damaged or destroyed. More than 100 elephants get killed annually due to anthropogenic reasons. Jayantha, Kanchan, Lakshminarayanan and Bivash, Sreedhar and Ananda Kumar, and Nameer and Shaji too report that the majority of the deaths of people in their areas by wild animals are due to elephants.

Prachi Mehta, working with 70 or so elephants in northern Karnataka, including some areas in the adjacent Maharashtra and Goa, encompassing a habitat as large as 2,500–3,000 sq. km, is optimistic that the problems caused by elephants can be minimized by community based conflict management. I am not sure whether her methods would be able to address the serious problems prevalent in places like Assam, Bengal, Chhattisgarh, and Coimbatore Forest Division. She opines that keeping hives of the non-aggressive bees *Apis sarana indica* can deter elephants from visiting crop fields. Interestingly, Sreedhar Vijayakrishnan and Anand Kumar working

in Hassan, Nilgiris, and Anaimalais conclude that this bee species is ineffective in keeping away elephants from cropfields.

Ravikiran, who has knowledge of the entire tiger range in the country, reports that the annual average number of people getting killed by tigers in India is about 50. Sahil, who has camera-trapped tigers in Dibang valley (Mishmi Hills, Arunachal Pradesh), an exceedingly challenging landscape in which to carry out such research, believes that there could be 50 tigers in the Idu Mishmi land. No human deaths have been reported so far, but the tigers prey on the *mithun*, an extremely valuable resource for the Idu Mishmis. Yet, because of the spiritual link that Idu Mishmis have with the tiger, this predation is tolerated. Bangladesh Sundarbans has an area of nearly 6,000 sq. km, with a population of about 120 tigers, and nearly one million people use the mangrove habitat for various resources such as fish and honey. Here 23 people get killed and 10 injured annually. Sadly, the compensation for death in that poor country is a meagre amount of Rs 84,000/-, while in Maharashtra, the compensation given is Rs 15 lakhs.

Over 200 lions have died in the Gir landscape in the last two years, but there is no willingness on the part of the Gujarat government to part with a small number of lions needed for establishing a second home for the species in Kuno Wildlife Sanctuary, Madhya Pradesh, which is exceedingly important to ensure the future of the lions in the country. Stotra, who has done splendid research in the Gir landscape, may agree that the vegetarian food habit of the people living in the lion landscape is the major reason for the steady increase in the range and number of lions, as this ensures the availability of a sufficient number wild ungulates and livestock prey, but their future outside Gir forest area seems not secure, as a result of unbridled development and gradual decline in the reverence for all life, including lions, among the people of Gujarat.

NAYANKHANOLKAR

Amongst all mammals, wild pigs cause greater damage to crops in the Indian subcontinent

Sanjay Gubbi, a leading conservationist from Karnataka, highlights the capability of leopards to live in a potpourri of habitats, resulting in conflict with people; and Nayan Khanolkar, with captivating pictures, narrates the nearly unbelievable story of leopards ranging and living in the suburbs

SANJAY GUBBI

In conflict situations with leopards, mobs often go uncontrolled and kill the leopard

of Mumbai, which has a human population density of 20,000 per sq. km. Free-ranging dogs and meaty food in garbage dumps sustain the large cat. Conservation work in the high Himalaya of Pakistan, Nepal, and India shows that the best way of bringing about amity between the predators and the people is to work with the communities and get their support for conservation. The status of Pakistan in this scenario is unique, as trophy hunting of markhor and ibex brings in a substantial amount of money, the bulk of which goes to the local communities, facilitating their support for conservation.

Harendra Bargali points out that the most dangerous animal in the Indian forests is the sloth bear, and he laments the difficulty of getting funds for research on bear species, although three bear species (brown, sun, and sloth) enjoy the same legal status as other charismatic species, e.g., snow leopard and tiger. Among the primates, most of the macaques are known for their conflict with people. Ishika Ramakrishna concludes that the conflict between Nicobar long-tailed macaque and people has intensified after large numbers of outsiders settled in the island, started growing crops and attracting the macaque from screwpine forests. Otherwise, the macaque which largely fed on screwpine fruits, was leading a nearly harmonious life with the Nicobarese. Sindhu Radhakrishna comes up with the finding that the rhesus macaque population in India, when export of the macaque for medical research was permitted, was around 20,000. Now, after the ban on the export was implemented in April 1978, the population has grown beyond two lakhs, causing immense problems to the people living in its range. The poor farmers suffer badly. The rhesus is also replacing the smaller and less aggressive bonnet macaque of South India.

Jayantha Jayewardene brings to light the predation by saltwater crocodiles in Sri Lanka, which in India is happening in the Andamans, Bhitarkanika Wildlife Sanctuary, and Sundarbans Tiger Reserve. Information from Sri Lanka, Nepal *terai*, and Kerala brings to light that wild pigs are the maximum problem-causing animals, as far as damage to crops is concerned. In India, we have two more problematic species, nilgai and blackbuck, and the best strategy to deal with these problematic species, along with wild pig, would be to plan and implement a hunting programme that would bring benefits to the local people.

K.V.UTHAMAN

Occasionally people get killed by saltwater crocodiles in Andamans, Bhitarkanika, and Sundarbans

HIRA PUNJABI

Sloth bears are the most dangerous animals to encounter in the forests of India, Sri Lanka, and Nepal

In conclusion, man-eating tigers leopards, and problem sloth bears should be removed immediately. The populations of rhesus macaque and free-ranging dogs should be controlled on a war footing. The best suggestions for managing human-elephant conflict are given by the Karnataka Elephant Task Force (KETF). KETF has recommended classification of elephant areas into three management zones. The 'Elephant Conservation Zone (ECZ)' should comprise prime elephant habitats where elephant interests should be given top priority, and emphasis should be on protecting, consolidating, and improving elephant habitats. The 'Human-Elephant Co-existence Zone (HECZ)' should comprise areas requiring equal attention to the welfare of elephants and humans, with emphasis on measures for enhancing the tolerance level of the people. The third, 'Elephant Removal Zone (ERZ)' should comprise areas where people get priority over elephants and drastic measures such as capture, mass translocation, and reproductive control of problem elephants should be implemented. Reproductive control of elephants is being successfully carried out in Africa. S.S. Bist rightly suggests that it is advisable to adopt KETF's recommendations as a policy and implement it to minimize the agony caused by elephants to the people, particularly the poor of the land.

A.J.T. Johnsingh is one of India's foremost wildlife biologists. He was the first Indian to study a free ranging mammal – his study of dholes in Bandipur forests in the Western Ghats helped unravel the secret life of dholes and highlighted their role as one of the apex predators in tropical Indian forests. In a career spanning four decades, he has worked on a wide array of taxa like mahseer, dholes, lions, elephants, mountain goats and others. After a brief stint at the Smithsonian Institution, Washington D.C., he returned to India in October 1981 and briefly worked with the Bombay Natural History Society before joining the newly established Wildlife Institute of India, Dehradun as faculty from where he retired in 2005. He now works for Nature Conservation Foundation, WWF-India, and Corbett Foundation.

Human-Elephant Conflict in India

S.S. Bist

MANJUNATH N.

People are becoming increasingly intolerant of elephants

The Problem

Human-elephant conflict (HEC) is considered to be the most serious form of human-wildlife conflict in India. Wild elephants impact humans by destroying crops and property, and by killing and injuring people and livestock. The panic created by elephants often results in villagers fleeing from their homes, labourers keeping away from croplands and plantations, traffic getting disrupted on public roads, students absenting themselves from schools, and even disruption in wildlife tourism.

As for humans, they exert a detrimental impact on elephants by disturbing, altering, or destroying their habitats, and killing, injuring, or capturing them. Elephants are killed for ivory, and sometimes for meat in north-eastern India. People resort to electrocution, poisoning, and shooting elephants in retaliation to the damage caused by them. Elephants get killed accidentally

SANJAY GUBBI

Livestock around forests compete with elephants for fodder and water, and also spread diseases

SANJAY GUBBI

Marginal farmers are the worst victims of HEC

SANJAY GUBBI

A tomato field trampled by elephants in Bannerghatta

by human-made utilities like power lines, trains, vehicles, and drains. People extract forest produce (some of which constitutes elephant food), cause fires, help to spread weeds, and pollute water sources. Livestock around forests compete with elephants for resources, and also spread diseases. Jhum (slash and burn) cultivation practised in north-eastern India leads to degradation of elephant habitats. These habitats are also adversely impacted by various infrastructure development activities such as roads and railways, hydro-power projects, irrigation canals, and mining.

About 248 districts in 23 states and union territories (UT) have reported cases of HEC

SANJAY GUBBI

Bull elephants may raid houses in search of food grains, salt, molasses, and country liquor

in recent years. Affected states include those with naturally occurring populations of elephants, namely Arunachal Pradesh, Assam, Jharkhand, Karnataka, Kerala, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh, and West Bengal. Elephants have colonized Andhra Pradesh since the early 1980s, and Chhattisgarh since 2000. HEC in the Andaman & Nicobar Islands is caused by feral elephants, while Bihar, Haryana, Himachal Pradesh, Madhya Pradesh, and Maharashtra face problems due to transient elephants from the adjoining states. Conflict is also caused by the elephant populations shared by India with her neighbouring countries.

Human casualties are the most visible and highlighted form of HEC. From 2013–14 to 2017–18, elephants were involved in the death of 425–565 persons per year. Authentic records of injured persons are not available, but it can be safely assumed that at least 400 humans are injured by elephants annually, many of them suffering permanent disabilities. Elephants kill and injure more people in India every year than all other wild animals (excluding snakes) put together.

In India, crop damage by elephants affects a large part of society, and the gravity of the problem can be gauged from the fact that most of the sufferers live below the poverty line. However, authentic and complete records of crop damage in India are not available. Most of the crop damage data comes from the records of *ex gratia* payments made by the State Forest Departments (SFDs) to affected farmers. But there is no uniformity in such records across states. A crude estimate would indicate that about 10 lakh hectares of cropland and at least 5 lakh farmers in the country are vulnerable to elephant depredations. Elephants also raid harvested crops and granaries, and occasionally kill livestock. About 15,000 houses are damaged by elephants every year, particularly village huts and plantation workers' quarters. Many people get killed or injured in such incidents.

As stated earlier, elephants also suffer on account of HEC in various ways. According to the information presented by the MoEF&CC in Parliament in February

2019, 311 elephants died in India between April 1, 2015 and December 31, 2018 due to anthropogenic reasons: 59 by poaching, 26 by poisoning, and 226 by electrocution. Most of these were retaliatory killings linked with HEC. Frustrated with the conflict, people even assault forest officials, damage government property and block public roads. The issues of deforestation, encroachments, and fragmentation of elephant habitats in various parts of India have been documented by researchers and reported by the media.

Factors contributing to HEC

Humans have been contending with elephants ever since they took to agriculture. An adult elephant weighs 3,000 – 5,000 kg, and consumes 250–300 kg fodder daily. In forests, it may spend 16–20 hours a day foraging, but in agricultural landscapes it gets a substantial quantity of nutritious food over a smaller area with minimal effort. Crop-raiding apparently becomes a habit with most elephants, but it may become obligatory if there is a scarcity of fodder within forests, and also if the elephants have lost part of their home range to agriculture. In Assam, districts which have recently undergone large-scale deforestation are facing the worst HEC. In Odisha, mining over elephant habitats is believed to be the major cause of HEC.

An analysis of cases of human death during HEC would reveal that very few elephants become habitual human-killers. Injured elephants and bull elephants in *musth* are more likely to be involved in human killings than other elephants. But most cases of killings and injuries to humans are accidental, and the probability of fatal encounters is generally decided by the lifestyle, occupation, and behaviour of the people. Human settlements inside or adjacent to forests are always vulnerable to HEC. People entering forests for grazing livestock, collecting timber, firewood, fodder, and other forest produce, or to relieve themselves, are more prone to attack by elephants.

Some elephants, particularly bulls, pick up the habit of raiding houses in search of food grains, salt, and molasses. Some develop a fondness for country liquor prepared from rice and mahua, and are drawn towards houses storing it. People get killed or injured under the wreckage when elephants break into their homes. Elephant encounters mostly occur in darkness. Labour colonies in the tea

SANJAY GUBBI

Three tuskers being followed by forest personnel in Chikkanayakanahalli talika of Tumkur district, southern Karnataka. This area never had elephants, but these individuals landed up here as they were chased by unruly crowds

SANJAY GUBBI

Elephant-proof trenches are effective only if maintained properly

gardens of West Bengal and Assam, which have electricity, are less prone to HEC than those without it.

Many human deaths and injuries occur while driving away elephants from croplands and human settlements. Keeping crowds of people under control during driving operations is a big challenge for wildlife managers. Incidents of people getting killed while trying to photograph elephants are becoming common.

Locals living close to forests harbouring elephants are usually more accustomed to the ways of elephants than outsiders, like migrant labourers, tourists, and pilgrims among victims who form a significant part of victims of elephants. A substantial increase in HEC in recent years is due to the expanding range of elephants. Elephant herds have been leaving their traditional home ranges due to deforestation, mining, or other biotic factors and colonizing new areas. Long spells of drought also compel them to look for new habitats. Wildlife managers and villagers sometimes force elephants into new areas during driving operations. New elephant territories have created new areas of HEC, which has in India expanded from 132 districts in 17 states/UT in the year 2000 to 248 districts in 23 states/UT in 2018. Elephants have expanded their zone within Jharkhand, Odisha, West Bengal, Karnataka, and Andhra Pradesh, and reached new states, namely Chhattisgarh, Madhya Pradesh, Maharashtra, Bihar, Haryana, and Himachal Pradesh, where the local people lack experience in dealing with them and suffer tremendously in the process.

Management of HEC

The policies and strategies for managing HEC in India have undergone quite a change over time. During British rule and in the initial years of Independence, human needs

were given priority over those of elephants. Population control of elephants formed the major strategy in dealing with HEC. Elephants, which enjoyed great commercial value, were captured in thousands using traditional techniques like *mela shikar*, *khedda*, and pit trapping. Elephants posing a threat to human lives and crops were shot dead and the hunters were rewarded.

The needs of elephants vis-à-vis those of humans gained recognition after the promulgation of the Wildlife (Protection) Act in 1972 (WLPA, 1972). Initially listed in Schedule II of the Act, the species was shifted on October 5, 1977 to Schedule I, endowing it with the highest degree of legal protection. The Act authorizes the Chief Wildlife Warden (CWLW) of a state to permit killing or capturing of an elephant only when it becomes a threat to human life. The Act also permits a person to kill an elephant in self-defence. It authorizes the Central Government to permit capture or translocation of an elephant for 'scientific management', which includes population management without killing. Cases of capturing and shooting of elephants for management of HEC have come down drastically. Traditional capturing methods have been replaced by chemical immobilization, though *kumki*s (trained elephants) are still used to drive/chase wild elephants and handle captured elephants. Many State Forest Departments (SFDs) have set up dedicated squads for chasing away elephants from human settlements. Some SFDs have recently begun trials with drones for tracking and chasing problem elephants.

The WLPA, 1972 also introduced translocation as a tool for managing HEC. The Act makes it mandatory for wildlife managers to attempt translocating a problem elephant before resorting to kill or capture it. But translocation is not always effective, since the elephant returns to its original habitat or continues to create problems at its new location. Local people also resent the release of a problem elephant into their neighbourhood. The MoEF&CC's guidelines stipulate that an elephant should be fitted with a GPS collar before translocation and its movements monitored. But most SFDs are unable to follow this recommendation due to lack of resources. The Act does not permit hunting of crop-raiding and house-breaking elephants, but Chief Wildlife Wardens are known to buckle under public pressure and permit translocation or capture of such animals.

The WLPA, 1972 presumes some tolerance on the part of people towards damage caused by elephants. In order to encourage and sustain this tolerance, the state governments, in the late 1970s, initiated a programme for payment of *ex gratia* relief (sometimes erroneously called compensation) to the victims of HEC. The relief package varies from state to state. Some states also provide free medical treatment to the victims. The SFDs spent about Rs 80 crore on *ex gratia* relief during 2017–18. Effectiveness of the *ex gratia* system is, however, doubtful as the SFDs often get flak on account of complicated procedures, delayed payments, and inadequate rates.

The restrictions imposed by the WLPA, 1972 forced wildlife managers to experiment with elephant-proof barriers. Elephant-Proof Trench (EPT) is the most common type of barrier. In recent years, some SFDs have also been experimenting with elephant-proof walls and mechanical fences (e.g., fences made of steel rails and crash-guard ropes). These physical barriers are very expensive and susceptible to damage by the local people, who resent restrictions on them and their livestock from accessing forest resources.

Power fences are being used in India against wild elephants since the early 1980s. These fences work as psychological barriers, giving elephants a painful yet harmless shock on contact, conditioning them to keep away from the fenced area. These fences require regular maintenance as well as protection against miscreants, which the SFDs find difficult to

do. There is a strong case for providing small farmers with cheap or subsidized power fences to wean them away from the practice of putting up illegal and dangerous electrified fences by drawing power from overhead transmission lines or domestic connections.

Human-centric strategies

During the 1980s, the MoEF&CC and the SFDs came to realise that HEC management strategies should focus on both elephants and humans. Several human-centric measures have since been initiated by the SFDs. Some human settlements within forests facing acute HEC have been relocated. Vehicular movements have been restricted on certain public roads passing through elephant habitats. Many SFDs have undertaken eco-development works in villages adjoining elephant habitats, with the objective of reducing biotic pressures and enhancing livelihood opportunities for the people affected by HEC. Some SFDs and NGOs run eco-tourism activities by involving the local people, to enhance their stake in the conservation of elephants. Some SFDs and NGOs also encourage farmers to grow alternative crops, which are not prone to damage by elephants.

The SFDs also work to enhance the capability of the villagers to protect themselves and their properties, by supplying crackers, searchlights, and other essentials. The West Bengal FD also constructs watch-towers at strategic locations to help the farmers guard their crops. Some NGOs are running Community Based Conflict Management (CBCM) projects in Karnataka and Assam, to promote community crop-guarding among the farmers, supported by watch-towers (*machan*), farm-based deterrents (e.g., chilli smoke and beehives), and inexpensive trip-wire alarms. In recent years, some SFDs, in collaboration with research institutes and NGOs, have started using radio-telemetry, sensors, camera-traps, and social media to track wild elephants and issue alerts to farmers and other vulnerable groups.

Judicial Interventions

In recent years, the judiciary has been making important interventions in matters relating to HEC, and scrutinizing the actions taken by SFDs. In January 2019, the Supreme Court upheld an order issued by the National Green Tribunal to an oil company in Assam to demolish a boundary wall blocking an elephant corridor in Golaghat district. The apex court remarked that "Elephants have first right on forest." In November 2018, the Supreme Court directed the state governments to remove electric fences and barbed wire installed by resort-owners around critical elephant corridors in the country. In August 2018, the Supreme Court prohibited the use of spikes in elephant-proof barriers in Karnataka and fireballs for chasing elephants in West Bengal. The high courts have also issued some very useful orders. In particular, the Karnataka High Court set up the Karnataka Elephant Task Force (KETF) in January 2012, to examine the HEC scenario in Karnataka. KETF came up with many significant recommendations relevant for the entire country.

Priority Issues

Many initiatives and innovations have been tried in India for mitigation of HEC, but there has been no respite. The reason is not difficult to see. SFDs are unable to contain biotic pressures on elephant habitats which are becoming unsustainable with the ever-increasing population of humans and livestock in the country. Elephant habitats are also getting degraded with the proliferation of invasives like Lantana, and insufficient regeneration of forage species. A different kind of public policy and political will is required to deal with this issue.

An important issue is the movement of elephants to new territories and consequent increase in HEC. Restricting the conflict zone should be a major component of elephant management in India. The KETF has recommended classification of

HOSUR FOREST DEPARTMENT

Keeping human crowds under control is a big challenge for wildlife managers

elephant areas into three management zones, namely Elephant Conservation Zone (ECZ), Human-Elephant Co-existence Zone (HECZ) and Elephant Removal Zone (ERZ). i. ECZ should comprise prime elephant habitats where elephant interests should be given top priority, and emphasis should be on protecting, consolidating, and improving elephant habitats. ii. HECZ should comprise areas requiring equal attention to the welfare of elephants and humans, with emphasis on measures for enhancing the tolerance level of people. Finally, iii. ERZ should comprise areas where people get priority over elephants and drastic measures such as capture, mass translocation, and reproductive control of problem elephants should be implemented. It is advisable to adopt KETF's recommendation as a policy.

Lastly, the habits and lifestyles of the people contribute a lot to HEC. Providing electricity and safe toilet facilities for the people living in and around forests, designing and promoting elephant-proof housing, restricting consumption and storage of country liquor, regulating the movement of people and livestock inside forests, and adopting Community Based Conflict Management (CBCM) in the villages, are some vital requisites for ensuring peaceful human-elephant co-existence.

S.S. Bist is a former Director of Project Elephant, Government of India. He is currently a member of the National Board for Wildlife and the IUCN/SSC Asian Elephant Specialist Group.

A Way of Life with Elephants

Prachi Mehta

PRACHI MEHTA

If there is no disturbance even groups with calves do not hesitate to cross the road

North Kanara, a picturesque coastal district of Karnataka, had almost 80% of its area under forest cover till the last century. Well-known for its dense forests and rich biodiversity, the district is home to about 70 elephants, which reside in Kali Tiger Reserve. These elephants share their ancestry with the elephants of Mysore region. Since 1860, the elephants from Mysore region were known to make frequent excursions to North Kanara forests through the densely forested areas of Siddapur, Gersoppa, Sirsi, and Shimoga. In the 1960s, construction of the Linganmakki Dam on Sharavathi river disrupted their migration corridor. As a result, the elephants in North Kanara became isolated from the southern population. These isolated groups of elephants keep to Kali Tiger Reserve throughout the year, except from August to February, when they boldly raid the crop fields in surrounding areas, gaining notoriety for themselves! This is the story of the estranged elephants of North Kanara.

Since 2009, our organization, Wildlife Research and Conservation Society (WRCS), has been working on mitigation of human-

elephant conflict in North Kanara with the support of AECF and EFFI. In 2014, on a cold November evening, three members of my team and I were sitting outside Janu Vittu's farm in Choudalli village, in Mundgod Range. The sky was darkening and the air getting colder. Janu had predicted that elephants would come to his farm by 7:00 p.m., and it was already 7:15 by my watch. Janu's farm was on encroached forest land, so it was situated right on the forest boundary. Janu had harvested paddy and stacked it in three huge piles in his farm. On three nights, elephants had made forays into his farm to feed on the stacked paddy. Janu was aware that his farm was an open invitation to the elephants because of its location and ready to eat paddy, yet he was not interested in guarding his crops from the elephants. His belief was that nothing could stop elephants from feeding on the paddy, so he would rather go home to sleep and let the elephants eat as much as they wanted!

All the other people in the village had similar views, so only four of us were waiting for the elephants outside Janu's farm. Soon we realized that the elephants were already in the farm, relishing the stacked paddy. In the beam of our spotlight, we could see 15 elephants in the field. We made a lot of noise, shouting and yelling, and drove the elephants back to the forests within 10 minutes. Janu was ecstatic that the elephants had got a raw deal that night. He requested us to come each night to his farm for the next 15 days, because he felt that "the elephants are scared of city people so they go back quickly to the forest."

Janu's farm was on encroached forest land, so he was not entitled to monetary compensation for crop damage, and rightly so. However, Janu had been steadily losing crops to elephants and he planned to settle scores with them. I have heard similar sentiments from farmers across the country. The farmers' anguish is understandable. It is easy to love elephants when your paths don't cross, but for those who live in the vicinity of wild elephants, their emotions are different. Elephants are great foodies, and when it comes to paddy, sugarcane, banana, jackfruit, corn, millet, and other such delicious treats, elephants will travel that extra mile to access them. And thus begins the conflict of interest between people and elephants.

PRACHI MEHTA

Caught in the act! Elephants feel safe visiting unguarded fields

PRACHI MEHTA

Elephants meet this fate often when they frequent human-dominated landscapes

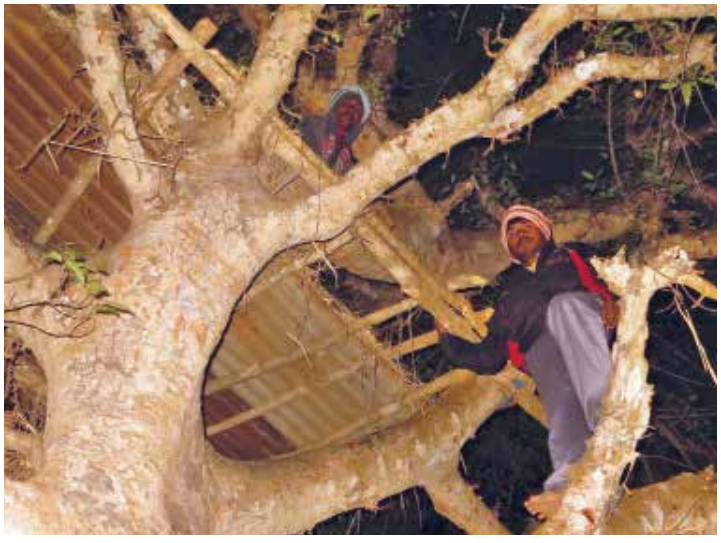
The situation often turns ugly when people repeatedly lose their crops, property, and live in encounters with elephants. The elephants are made to pay for their 'misbehaviour'.

PRACHI MEHTA

Chained forever! Life in an elephant camp

PRACHI MEHTA

Trip alarm installed along the forest-farm boundary warns the villagers if elephants enter the field



PRACHI MEHTA

Farmers guarding their crops at night from the safety of a machan

Irate farmers take drastic measures like electrocution, poisoning, or even shooting with guns to keep elephants away. And if this does not take care of the problem, Forest Department (FD) officers are subjected to public pressure to capture the elephants and send them to their 'elephant camps'. Elephant camps are no place for elephants to be in. Their legs are bound by heavy chains. They are trained to salute, stand, kneel, kick a ball, raise the trunk, roll over, and perform other such tricks to entertain people. Some of them take badly to the harsh domestication process and succumb in a short while. There is also a rising demand in the country to control elephant populations in high conflict areas, as people in such areas are becoming increasingly intolerant of sharing the landscape with elephants, though it is a national heritage species.

How to protect crops from elephants

Farmers consider elephants as the Forest Department's "cattle" and prefer to put the onus of protecting crops from them on to the FD. An oft heard refrain is "Do whatever is required, but take the elephants away from our area." This is despite the fact that most people are aware that the landscape originally belonged to the elephants. The FD tries its best to manage the problem, but faced with limited manpower and resources it often fights a losing battle. In light of this, it makes sense to empower farmers to take responsibility for protecting their crops from elephants – they have the stakes as well as the manpower. What they don't have is awareness and technical knowledge. If farmers are trained in simple and effective crop protection techniques, they should be able to protect their own crops. This is exactly what our organization is doing in North Kanara.

Farmers traditionally use noise-producing instruments such as drums and firecrackers to drive away elephants. But once elephants have started feeding, the damage is already done. Preventing elephant entry is very important

to reduce crop loss, as more damage is caused by trampling than by feeding. The FD usually employs engineering structures such as Elephant Proof Trench (EPT), electric fences, railway barriers, or spiked walls to keep elephants away. These are fund intensive and high maintenance measures, and they function well as long as they are maintained, but more often they fail due to lack of proper management.

Through our work, we are promoting Community-Based Conflict Management (CBCM), wherein we train farmers in the use of simple, low-budget crop protection techniques to save their crops from elephants. These techniques can be undertaken by the farmers themselves, and they need not be dependent on forest staff or other agencies. After a decade of continuous presence in the area, Ravi and Harin, our dynamic Program Officers, inform me that entire villages are now coming forward to implement the crop protection measures advised by us. In my view, it is essential to follow some precautions and good practices for managing elephants in human-dominated landscapes, as discussed below:

No trespassing on forest land

Elephants need large intact habitats and cannot survive in small forest blocks. Unfortunately, our forests are getting fragmented due to roads, railways, mines, dams, and agricultural expansion. Like Janu, many farmers have encroached on forest boundaries as well as deep inside the forests. Do elephants have any choice but to enter cropfields? It is crucial to maintain the integrity of forests. Urgent actions are required to halt encroachment on forest land.

PRACHI MEHTA

Chilli smoke around harvested crop helps to keep elephants away

PRACHI MEHTA

WRCS's auditory deterrent unit is useful in keeping elephants away from cropfields

PRACHI MEHTA

Log-hive fence along the farm boundary

PRACHI MEHTA

A log colonized by honey bees

PRACHI MEHTA

Elephant themed handicraft items bring in additional income

PRACHI MEHTA

Women being trained in making products with elephant applique motifs

Please ring the bell!

"But what about elephants trespassing into our farms?" many farmers ask. This is a valid complaint. After a hard day's work, it is not easy to keep awake the entire night looking out for elephants. There is a simple solution to this problem. The farmers need a warning system to alert them on the presence of elephants outside their farm. Installing trip alarms at elephant entry points is an excellent solution. Any unsuspecting animal trying to gain entry into the farm sets off the bell while pushing its way inside. In the silence of the night, the bell can be heard far and loud, alerting the entire village. Almost 500 farmers have secured their farm boundary with trip alarms, so elephants cannot enter without ringing the bell.

Vigilance is useful!

Night watch was a traditional means of guarding crops, but has lately fallen out of favour. With trip alarms installed at farm boundaries, many farmers have built machans in their farms and can sleep comfortably till the elephants' approach. Where there is a mobile network, farmers and forest staff alert others about elephant presence in their area.

Smoking is allowed!

"Chilli smoke is a joke!" I have heard this from many people, but do not agree. Chilli smoke is an effective deterrent for elephants. Slow burning of ripe dry chilli and tobacco powder releases thick, pungent smoke that makes elephants cough and sneeze. Elephants don't like this irritating smoke and prefer to go another way! Many of our farmers regularly use this method to keep elephants away.

Buzzing off elephants!

Lucy King's work on the African Elephant demonstrated that honeybees can be an effective elephant deterrent. We repeated the experiments in North Kanara and observed that elephants indeed get nervous on hearing the buzzing of bees and run away towards the forest. Encouraged by this, we installed beehive fences (*Apis cerana* colonizes these hives) on the farm boundaries, using hollow logs. Addressing all the challenges of getting bees to colonize and stay in the structures, many farmers have adopted beehive fences. They are happy that they are able to keep away the elephants and harvest sumptuous quantities of honey as well. Farmers need to keep a vigil for hornets and wasps, and also sloth bears, while adopting this elephant-deterrent practice.

Sound of a siren

Wildlife Research and Conservation Society, along with Girish Ranade from Pune, developed an auditory deterrent unit which broadcasts different types of sounds at regular intervals. This unit is deployed during the agricultural season and it has helped to keep elephants away. Nandish Patil, one of our farmers, who uses this unit regularly, says with a mischievous smile,

"Since I began using this siren, elephants have started ignoring my sugarcane field!" What more does a farmer want from elephants!

Hands on Conservation

WRCS has been training the families of farmers in making eco-friendly elephant-themed handicrafts. The beautiful products made by them are marketed by us. This activity is earning them considerable income, because of which they are participating in project activities willingly. Interestingly, their perception towards elephants has begun to change. When I hear them discussing the beauty of their elephant products with each other, I get a sense of assurance that elephants will be safe in these villages.

The way forward for elephant conservation

For agriculturists, elephants top the list of problem animals, and no single method or agency alone can manage them. All stakeholders have to collaborate to manage elephants in human dominated landscapes. Forest officers and researchers need to work together to implement elephant conservation measures. Policy makers need to be made aware that infrastructure development in elephant frequented areas comes at the cost of fragmenting elephant habitats and increasing human-elephant conflict.

Agricultural crop damage by elephants is one of the major obstacles to elephant conservation. Hitherto, the farmer, who is the most important stakeholder, has not been made a part of the solution. Our effort has been to empower farmer communities to protect their own crops using simple methods. Participation of local farmers is crucial in securing their own welfare, as well as that of elephants. People's presence in farms is the main deterrent for elephants. Farms that are regularly guarded are avoided by elephants. If all farmers take the responsibility of guarding their own farms using these easy and simple techniques, they will be able to reduce crop damage and develop more tolerance towards elephants. Changing people's attitude is a slow process but it is not impossible!

PRACHI MEHTA

Captive elephants are used in temple festivals

PRACHI MEHTA

Mother and calf – living happily in the wild

The CBCM model has the potential to go a long way towards conservation of elephants. Combined with restoring the quality and maintaining the integrity of the habitat, it will help to secure the future of elephants in the country. Finally, our way of life will decide how elephants will live theirs. You choose between the two images above – how would you like to see elephants in future?

Prachi Mehta works with Wildlife Research and Conservation Society (wrcsindia.org). Her long-term work is focused on elephants in Karnataka, and the Forest Owlet and other owls in Central India.

Undefined Boundaries, Prickly Neighbours

N. Lakshminarayanan and Bivash Pandav

N. LAKSHMINARAYANAN

Elephants raiding crops in Koriya district. Crop damage by elephants is widespread in Chhattisgarh, where paddy is the most widely cultivated crop in the northern part of the state

The monsoon rains had just ended and the leaf litter-covered forest floor was sodden as we cautiously trod through the dense sal forest with rank secondary growth, following the fresh elephant tracks. The wet leaf litter muffled all the noise. Suddenly, our trackers who were leading us, froze in their tracks and signalled us to stop. It was 12:30 p.m. on October 8, 2018, and the weather was cool as we concealed ourselves behind a large tree and located an elephant in the bush, about 30–40 metres ahead of us. We silently waited for the elephant to pass across a small clearing in front of us. It turned out to be our collared bull elephant, an enormous adult makhna, and it emerged out of the bush and went across the clearing, totally unaware of our presence.

The bull's swollen temporal glands were streaming with musth. A cocktail odour of musth and the continuous dribbling of urine permeated the air, and we could smell it as a mild breeze wafted it from the elephant towards us. In the dense understorey, we could hear other elephants nearby, but as the wind was blowing from the elephants towards us, we were not detected and were safe. We took a few photographs of the bull

N. LAKSHMINARAYANAN

Our collared bull makhna photographed in Surajpur Forest Division during October 2018. This bull is the first elephant to be collared in the Central Indian elephant population; it remained in musth for nearly three months

elephant in musth for reference and retreated from the place safely. Ever since the bull was fitted with a satellite collar in May 2018, in the Surguja region of northern Chhattisgarh, this was the first time we had observed it associating with a family group of elephants.

This bull was the first wild elephant to be collared in Chhattisgarh, as well as the first in the whole north central population that occurs in Odisha, Jharkhand, Chhattisgarh, southern Bengal, and of late in Madhya Pradesh and northern Andhra Pradesh. Our objective in collaring this bull and a few other elephants was to understand habitat use by elephants, to use that knowledge to plan strategies for the management of the growing human-elephant conflict in Chhattisgarh. By this time, we had collared three elephants in Surguja – two adult bulls and an adult cow from a family group – and they had started providing important insights into the social behaviour and movement patterns of the elephants in Surguja.

Disappearance and re-emergence of elephants in Chhattisgarh

The annals of the Chhattisgarh elephant scenario are perplexing, yet fascinating. Historically, until the dawn of the 19th century, there were elephants in central and northern Chhattisgarh. The best reference for this assertion is the classic THE HIGHLANDS OF CENTRAL INDIA, 1838–1871, by the British forester Captain James Forsyth, who wrote an engrossing chapter about his encounters with wild elephants in areas that are present day Surguja and Bilaspur. It is difficult to backtrack and fathom what led to the abandonment and total extirpation of elephants from northern Chhattisgarh during the mid-1900s – we can only conjecture. Although elephants are highly resilient to environmental vagaries, chronic degradation of their habitats possibly affected them adversely. Moreover, small populations are always vulnerable to the perils of demographic stochasticity, which affects the per capita reproductive potential of the breeding individuals. Conceivably, factors like degradation of habitats and a small population size, with poor demographic parameters, would have led to the abandonment of northern Chhattisgarh by elephants. Regardless of whether the elephants were totally exterminated from the landscape, or there were too few individuals that evaded notice by people for many decades, elephants

N. LAKSHMINARAYANAN

Lush green deciduous forests of Guru Ghasidas National Park in northern Chhattisgarh. Long-term persistence of elephants in Chhattisgarh depends on improving the resilience of relatively intact elephant habitats such as Guru Ghasidas NP, where the extent of fragmentation is less

started reappearing in northern Chhattisgarh only in the late 1980s. Since the years preceding elephant re-colonization coincided with large-scale destruction of pristine elephant habitats in the neighbouring states of Jharkhand and Odisha to exploit minerals, we can surmise that a few groups of elephants, whose native ranges were adversely affected, possibly started dispersing in search of new areas, resulting in the re-colonization of northern Chhattisgarh.

A turbulent period

The period of re-colonization of northern Chhattisgarh by elephants was far from amiable. The forests which the elephants re-colonized were highly fragmented and dotted with human settlements. As a result, degradation rapidly set in as a onsequence of unregulated and increasing resource extraction pressure by the locals, predominantly by the tribal communities. Added to this, the astuteness required to co-exist with elephants was woefully lacking, because elephants were nearly absent in the landscape for a few decades. Immediately after re-colonization, crop raiding by elephants was reportedly rife and there were sporadic human deaths, which evolved into a major political problem, prompting the Madhya Pradesh Forest Department (Chhattisgarh was then part of Madhya Pradesh) to take damage control measures. In a major operation in 1993, *kumki* elephants (captive elephants trained for wild elephant capture) and experts from the state of Karnataka were deployed, and 21 elephants were captured and held in various forest camps across Madhya Pradesh, as in Bandhavgarh and Panna tiger reserves. The respite from that capture operation was only temporary, as more elephants started coming to the landscape from the neighbouring states of Jharkhand and Odisha in the year 2000. However, this time there was a major political change in the landscape. The tribal-dominated districts of erstwhile Madhya Pradesh were consolidated and notified as a separate state named Chhattisgarh on November 1, 2000. The 'new' tribal-dominated state did not push the elephants back to neighbouring states, and as a consequence, Chhattisgarh has emerged as a full-fledged elephant-ranging state.

Idiosyncrasies of human-elephant conflict in Chhattisgarh

Elephants and animal husbandry may coexist without major tussles, but this may not be possible with human settlements and elephants. In Chhattisgarh where elephants occur, the boundaries between forests and human-use areas are highly diffused – forests are interspersed with villages and vast swathes of paddy and other crops. In this convoluted mosaic landscape, where hard edges are rare, interfaces between elephants and people could be complex and tense. Added to this, local communities are poor and highly dependent on the forests for fuel wood, mushrooms, medicinal plants, honey, and fodder. As a consequence, the remnant forests are highly degraded. As such, sal forests do not support a high large-herbivore biomass, as sal and its associates are mostly inedible for herbivores. Furthermore, because some of the rivers that originate from the stately sal forests are perennial, impetus has been given to cultivate sugarcane in some districts like Surajpur in the Surguja region, where new sugar mills have come up in recent years. As a result, Surajpur, with its abundant sugarcane cultivation, has emerged over the years as a hotbed for human-elephant conflict.

Another complexity in the landscape is the ranging patterns of elephants. The three collared elephants and some of the identified elephants (we have individually identified over 50 elephants in the landscape) that we try to follow and monitor have huge home ranges that span over 1,000 sq. km. It is natural that elephant home ranges would be larger in fragmented and degraded habitats than in intact habitats. However, in the case of Chhattisgarh, home ranges are not only large, but also appear to be highly fluid. To illustrate, during a three-year period from 2015 to 2017, less than 300 elephants in Surguja operated in an area close to 18,000 sq. km, and there were several villages which the elephants visited only for a very short duration. This conclusion is based on the well-maintained crop damage records of the forest department. The inference from this whopping elephant range in Surguja is that the elephants are continuing to explore degraded landscapes and are forced to appear in 'new areas'. Even recently, during October 2018, a group of elephants that we were following moved into Anuppur district

N. LAKSHMINARAYANAN

A herd of elephants approaching a mud-walled house during the twilight hours to raid stored grains and salt in Balrampur district in Surguja. Housebreaking by elephants is a serious problem in Surguja

of Madhya Pradesh from Koriya district of Chhattisgarh. This fluidity in ranging behaviour is a huge challenge to managing elephants in fragmented habitats, as conflict keeps shifting spatially and temporally, precluding prioritization of areas for conflict management. During the last five years, on an average, over 50 human lives have been lost every year as a result of human-elephant encounters.

In such a scenario, the conventional approach of creating and maintaining physical barriers along forest boundaries will not work in many areas in Chhattisgarh where elephants currently operate. The reasons are manifold. In fragmented elephant habitats with diffused boundaries, selecting locations for putting up physical barriers is seldom easy. Moreover, the perimeter to area ratio of the forests is very high. Simply put, it requires several kilometres of physical barriers to secure a small patch of forest, which is prohibitively expensive and difficult to maintain. Moreover, small patches of forests that already suffer degradation cannot support elephants in the long run. Elephants show clear seasonal preferences in habitat use, and containing them in small patches of forests will only rapidly accelerate the degradation of resources. Pocketed elephants in a small forest patch secured with physical barriers may challenge the barriers by developing ways to break them. Moreover, because local communities are profoundly dependent on the forests for their subsistence, maintaining physical barriers in the forest perimeter is seldom easy, as villagers and their cattle often breach the barriers.

N. LAKSHMINARAYANAN

In Chhattisgarh, the forests are interspersed with villages and cultivation. The difference between human-use area and the elephant habitat is highly diffused

The way forward

The synergy of fragmented habitats, highly dependent local communities, and displaced elephants with unpredictable and fluid ranging habits, poses a huge management challenge. Because human-elephant conflict has become a political flashpoint, and recognizing the fact that highly marginal communities are affected by conflict, trying to reduce human deaths due to conflict assumes priority in the landscape. Our field observations during the last one year show that a significant fraction of human deaths are associated with housebreaking by elephants, which is a serious problem in the central Indian elephant population. The rural populace in Chhattisgarh and other neighbouring elephant ranging states predominantly live in mud-walled huts that elephants easily push down to access stored food grains and salt. Not only were there human deaths in the vicinity of the huts, but also due to fear of housebreaking by elephants during the night, villagers resort to driving elephants during the day. Such haphazard drives are always risky and also spread conflict into new areas. By combining a good network of timely information sharing and developing physical barriers that can be easily laid around the settlements, the problem of housebreaking by elephants can be reduced. It is remarkable that sharing timely information about elephant movement is done exceptionally well in Chhattisgarh due to the dedicated efforts of the Forest Department.

While conflict monitoring and other short-term strategies continue, in the long-term, improving the overall resilience of large, contiguous habitats that remain in northern and north central Chhattisgarh, including the forests in neighbouring states, is crucial. For example, the designated protected areas in northern Chhattisgarh, such as Guru Ghasidas NP, Tamor Pingla, and Semarsot wildlife sanctuaries, have the potential to act as good elephant habitats, provided the anthropogenic impacts in these forests are minimized. Thus, instead of investing heavily on improving the quality of habitats in small fragmented forested patches, efforts should be made to create inviolate spaces within these protected areas. Conserving elephants and managing conflict is possible only when sufficient suitable habitats are secured in time. Eventually, management of such elephant populations which kill a large number of people every year should be seriously thought about, planned, and executed. The Chhattisgarh scenario already has an important lesson to offer: It is much easier to manage conflict in known, well-set elephant ranges, rather than allowing such habitats to be whittled down in the face of development pressures and displacing elephants elsewhere. Human-elephant conflicts involving displaced elephants are much harder to manage, akin to the proverbial "leaving the head and holding on to the tail".

Managing human-elephant conflict and at the same time securing habitats for conserving elephants in the mineral-rich state of Chhattisgarh requires enormous efforts and major political commitment. Nevertheless, securing habitats for elephants, which act as both flagship and umbrella species for biodiversity conservation, would help in locking up vast swathes of natural forests. The elephant habitats of Chhattisgarh act as catchment areas for major rivers like Rihand (which flows into Sone and then into the Ganga), Hasdeo (a major tributary of Mahanadi), and the mighty Mahanadi itself.

N. LAKSHMINARAYANAN

An adult cow elephant electrocuted in a sugarcane farm in Surajpur division. Local villagers resort to retaliatory killing of elephants, and such cases are sporadically reported from across the landscape

In the epoch of climate change, investment in conservation of large mammal habitats may pay better returns in the long run, while opening up natural forests for exploitation, such as mining, will yield short-term gains with long-term negative ramifications.

In the fast fading twilight, our old acquaintance Wave Ear, a large matriarch, and her family frolic in the cool waters of River Mahan in Surajpur district. Unlike humans, they appear to be living just in the moment, blissfully unaware of the destruction wrought upon their habitats by us in the past, and seemingly oblivious of the questionable future that awaits them. Only time will tell how these elephants will fare in the face of all odds.

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Bivash Pandav is a scientist with the Wildlife Institute of India, Dehradun. He is currently involved in large mammal research in various landscapes of India.

Millennial Male Elephants of the Eastern Ghats

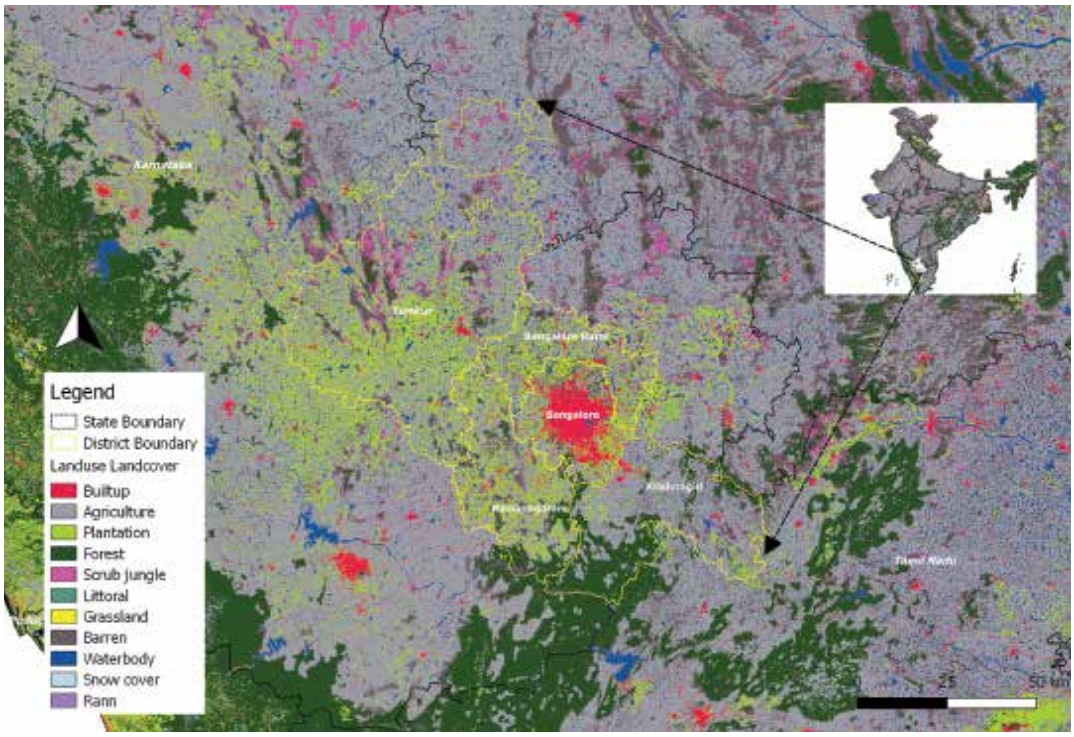
Nishant Srinivasaiah

NISHANT SRINIVASAIAH/FEP

On being chased by people, TIN, PT, and SAM (L to R) ran towards a banana grove for refuge

On an early morning in February 2010, I rushed towards T. Gollahalli village, south of Bengaluru, on getting to know that elephants were in the vicinity of the Nandi Infrastructure Corridor Enterprises (NICE) Road. I was then studying the behaviour of wild elephants in the nearby Bannerghatta National Park (BNP, 250 sq. km), about 10 km from this site and from where these elephants had come. I noted that all three elephants were adolescent males in the age group of 10 to 15 years, and I recognized them as TIN, PT, and SAM (code names I had given them) of BNP.

On being chased by people, they took refuge in a nearby banana grove, much to the dismay of the plantation owner. What were these males doing in a human-use area? Where were they heading? Why were they all males? A number of questions popped up in my head that warranted further investigation. Little did I realize then that I would be witness



FEP/FERAL

Land use/land cover map of the study landscape, showing the districts in which elephants were observed

to some dramatic twists and turns in their lives over the next 10 years.

The three elephants continued their journey northwest of Bengaluru across a highly human-dominated landscape, for another 100 km, to reach Tumkur district in a span of three months. The districts of Bengaluru Urban, Bengaluru Rural, Ramanagara, and Tumkur in Karnataka that they traversed have seen rapid change in land use as a result of urbanization and development (see map) in the last decade. Areas close to urban centres, such as Bengaluru, and Hosur in Krishnagiri district of Tamil Nadu, have witnessed a real estate boom, resulting in either complete cessation of traditional subsistence farming or transformation into farms growing cash crops.

In rural areas identified as industrial corridors, the land value has increased, and farmers are selling their land or growing timber trees such as Acacia and Eucalyptus that require lower maintenance, but do fetch revenue. Regions relatively further away from urban centres, however, continue to be agriculturally viable. With the increasing

NISHANT SRINIVASAIAH/FEP

Young male elephant collecting sugarcane to feed on, near Bannerghatta National Park, Karnataka

NISHANT SRINIVASAIAH/FEP

SAM and TIN in the agricultural areas of Tumkur district in Karnataka, spending most of their time during the day in large waterbodies, surrounded by human habitations

NISHANT SRINIVASAIAH/FEP

A large group of bulls taking refuge in the middle of a waterbody in the human-dominated area of Ramanagara district, Karnataka

use of groundwater-based irrigation through bore wells and improved canal systems, piped water, primarily for drinking and agricultural purposes, has been made available in many parts of the rural areas in Tumkur and Ramanagara districts. Good irrigation facilities have resulted in significant changes in cropping patterns – from rain-fed agriculture to the growing of water-intensive crops such as banana, areca nut, sugarcane, and paddy. Farmers who used to grow just a single crop a year now manage up to three crops, largely due to the availability of adequate water, which acts as a magnet for elephants.

For elephants such as TIN, AIR, and PT Jr, and the others in my long-term study, conflict had become a norm. Growing up as they have, close to agricultural areas, these elephants have responded to the changes in agricultural practices in a number of ways. They now forage in highly human-dominated, exclusively 'production landscapes', with little or no refuge in terms of natural forest patches, such as in Tumkur, for more than five years now. The increasing agroforestry practices in villages were also drawing the elephants closer to human habitations, as they used these forest patches for refuge during their movements, and even to reside in at times. Moreover, the ready availability of highly nutritious crops throughout the year has led to a rapid escalation in the frequency of their visits and duration of stay in these areas. This has typically resulted in high levels of negative interactions between people and elephants, as this conflict is consumptive in nature. That is, negative interactions between elephants and humans, in this case, over a valuable but limited and perishable resource such as forage/crops.

In a few instances, elephants have even become resident in such areas – these are mainly young adult and adolescent male elephants, which I call the millennials. What is even more striking, however, is the appearance of unique behavioural adaptations among such individuals. These may include remaining in deep, large waterbodies close to villages during the day, avoiding feeding during the daytime – occasionally even for 12 to 14 hours duration – and foraging exclusively on crops at night, under the cover of darkness, all presumably in response to human activity in the surrounding areas and the absence of forest patches. These adaptations seem to be extraordinary, as elephants are known

NISHANT SRINIVASAIAH/FEP

Social interaction between POI and LTA in Hosur district, Tamil Nadu. A young male elephant displaying affiliative behaviour by mounting another male

to usually feed about 18 hours a day, and require forested areas to reside in.

Between the sexes, females seem to use a risk-averse strategy as they have dependant calves, so they were largely seen within the protected forested habitats of BNP, which has more natural resources and is significantly less disturbed by human activity than the surrounding landscape. In contrast, males ranged across a spectrum of land use and human activities, at times exhibiting risk-prone behavioural strategies. 'Novel' but stable all-male groups, with large numbers of young adult and adolescent individuals, have also begun to emerge over the last two decades. They appear to constitute a new form of social organization in the species, especially as a response to highly fragmented habitats with poor inter-patch connectivity and high human density.

It was in this human-use area that I acquainted myself with the most charismatic bull elephant I have ever known. I named him HIR (meaning king in Elvish language), otherwise most fondly called Rowdy Ranga by the locals of Bannerghatta. Like most other males, HIR too had moved into this 'production landscape' as an adolescent. He then grew big and bold, learning the ropes of living in a high-risk environment and very successfully feeding on the nutritious agricultural crops. In the day, he would take refuge in small plantations or large waterbodies, moving out at the first hint of darkness to feed from crop fields. Given his

NISHANT SRINIVASAIAH/FEP

Two young males, POI and AMA, in close physical contact while displaying dominance interactions

NISHANT SRINIVASAIAH/FEP

HIR in full musth inside Bannerghatta National Park in July 2015, sniffing out females in estrus

NISHANT SRINIVASAIAH/FEP

A critically injured young male, MAK Jr, being moved for treatment after being hit by a bus on the Bengaluru-Chennai highway

experience of navigating this unpredictable and risky landscape, a number of young and older males found it beneficial to associate with him. At the individual level, the observed variation in social strategies and activity profiles prevailing in the study elephants could largely be explained by the idiosyncratic behaviours of certain adult males such as HIR and his close associate, a tuskless male I named MAK, and their influence on the behaviour of associated conspecific, usually younger, individuals such as AIR, TIN, SAM, and PT Jr.

It was the end of March 2015, the summer heat had set in but the region around Tumkur was still flush with crops, thanks to the water diverted into its numerous waterbodies from Hemavathi river in the Western Ghats through an interconnected canal system. HIR was well-fed, he scored four upon five on my Body Condition Index sheet. Young males which were often seen associating with HIR began to maintain a respectable distance from him. There could only be one reason for such behaviour to emerge, HIR was coming into musth, a periodic state of heightened sexual activity in male elephants, characterized by increased testosterone levels with temporal flow of musth fluid and urine dribbling.

Sexually and socially mature adult bulls such as HIR, when in musth, begin to move from their foraging grounds in the Tumkur area towards the protected forests of BNP, synchronizing their arrival with the migratory movements of large herds of female elephants (up to 100) into BNP from the neighbouring forested regions of Hosur in Tamil Nadu. Around October, when musth subsides after nearly six months, and the female elephants too start moving away from BNP, these males begin their arduous journey back into the agricultural areas. Sometimes the dispersing adolescent males of the protected areas associate with these older, now non-musth bulls, on their journey from the forest to the agricultural areas. On these long-distance sojourns, the elephants

NISHANT SRINIVASAIAH/FEP

A small group of male elephants led by PMA leaving the safety of the forest to feed on crops in agricultural areas around Bannerghatta National Park and North Cauvery Wildlife Sanctuary

have to negotiate four- and six-lane highways with heavy motor vehicle movement, broad-gauge railway lines, electricity lines, deep irrigation canals, illegal electric fences, and a rapidly urbanizing landscape. As a result, a number of elephants die due to bus or train collisions, electrocution, and death or injury by falling into ditches. Between 2015 and 2018, eight known adolescent and six known adult male wild elephants were lost due to human-related causes, including captures. An equal number of human deaths occurred too, forcing the concerned authorities to take punitive action.

A sudden spurt in deaths of both humans and elephants (three humans and two elephants) in Ramanagara in September–October, 2017, prompted the capture of HIR and his associate AIR. Unfortunately, both of them died in captivity almost a year later, HIR from a heart attack and AIR from being hit by a speeding bus. Capture of male elephants in conflict has multiple negative consequences, not only for the well-being of the individual captured, but also on the sociality of elephants. For instance, the removal of key individuals such as HIR from a human-dominated area resulted in the scattering of the younger, inexperienced males. The absence of experienced bulls in the group also resulted in the younger males behaving erratically, due to stress brought on by the lack of older bulls to reassure and lead them into safe zones, and due to their inexperience of human-dominated areas.

Crop-raiding elephants are usually managed by driving them away from crop fields into nearby forest patches, using torch lights and firecrackers. With the older and experienced bulls around, this was fairly easier, as they know how to respond to a drive. In their absence, though, such a drive can turn into a potentially explosive situation, posing great risks to the lives of the villagers and forest staff, as inexperienced younger males may respond unfavourably

to humans in close proximity. The increasing aggressiveness of elephants in response to negative human interactions over time becomes detrimental to conflict mitigation and for the long-term coexistence of the two species in the region. Drives also result in elephant groups splitting, especially in the absence of lead males such as HIR. The younger individuals are forced to explore new areas during such drives.

On January 5, 2019, four young male elephants came onto the traffic-laden NICE expressway, which now acts as a peripheral expressway for Bengaluru City instead of the proposed six-lane Bengaluru-Mysore expressway. They had come to a stretch of the expressway that was way off the regular route of HIR and others that avoided the NICE road. Were they finding it difficult to get their bearings in the absence of the elder knowledge keepers of their elephant society? To me, the effect of removing key individuals from a human-use area was all too clear. Older bulls were using the 'production landscape' as their foraging grounds, while the protected forested areas with females were their breeding grounds. The young males were utilizing the production areas for multiple ends, including gaining body mass, coming of age, and also to disperse across a human-dominated landscape in search of a forested habitat with unrelated individuals.

It is also very clear that the millennial elephants, especially males, were making forays into high-density human-use areas to feed on nutritious crops, emboldened by their familiarity with persistent human presence and activities. What is often not recognized is that some of the frequent and intense negative human-elephant interactions, such as drives, could also serve to habituate elephants to humans.

What may have triggered the initial movement of elephants out of the forested habitats of this region could be the extensive degradation, within their home range, of large forest patches south of North Cauvery Wildlife Sanctuary and Bannerghatta National Park because of cattle grazing and other human-induced disturbances. Therefore, our priority should be to provide space, time, and safety to elephants within

VINOD MOSES

Young male elephants led by POB leave human habitation when chased by people, Hosur, Tamil Nadu

NISHANT SRINIVASAIAH/FEP

MAK and SAM under a high-tension electric wire in the agricultural landscape of Tumkur district, Karnataka

the forest and to improve their habitats south of these two protected areas. The forest would then be more attractive to elephants in terms of availability of resources and lack of disturbances. This is no doubt a herculean task, very easy for foresters and researchers to talk about, but it is easy to lose focus and target the elephant instead. Immediate 'conflict management' in this highly volatile landscape, where the main issue is crop damage and human and elephant deaths, should not be focused on capture and removal of male elephants, but on landscape-level planning and modifying lifestyles and farm-based practices of humans in and around the conflict areas. Such a strategy would help reduce risks of injuries and deaths for both people and elephants, and also crop loss due to elephants. The key to resolving human-elephant conflict may lie in the behavioural adaptability of both people and elephants to changes that occur in their environment. The age of the millennial bull elephants is finally here!

Acknowledgements

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An Elephantine Conundrum

Sreedhar Vijayakrishnan and Mavatur Ananda Kumar

SREEDHAR VIJAYAKRISHNAN

Elephants using remnant riverine vegetation on the Valparai plateau

With increasing interface between humans and wildlife, and forests adjoining agricultural lands, intense conflict between these two forms of life has become a common sight. Farmers waking up in the morning to see their paddy field trampled by an elephant in the wee hours of the morning (more than 90 days of hard labour nullified in a matter of minutes) has become a routine affair in several human-use landscapes occupied by wildlife. The mere movement of the three- to five-ton animal through the field costs the farmer weeks, months, or perhaps years of hard work; episodically, such elephantine visits could also lead to loss of human life or injury. And it is this conundrum that farmers are trying to address, not just across the country, but also across elephant ranges where the species and humans share spaces.

Wildlife authorities, researchers, and conservationists have joined league with farmers to identify potential long-term solutions to mitigate the larger-than-life

ANEESH S.

Maize plants trampled and destroyed

SREEDHAR VIJAYAKRISHNAN

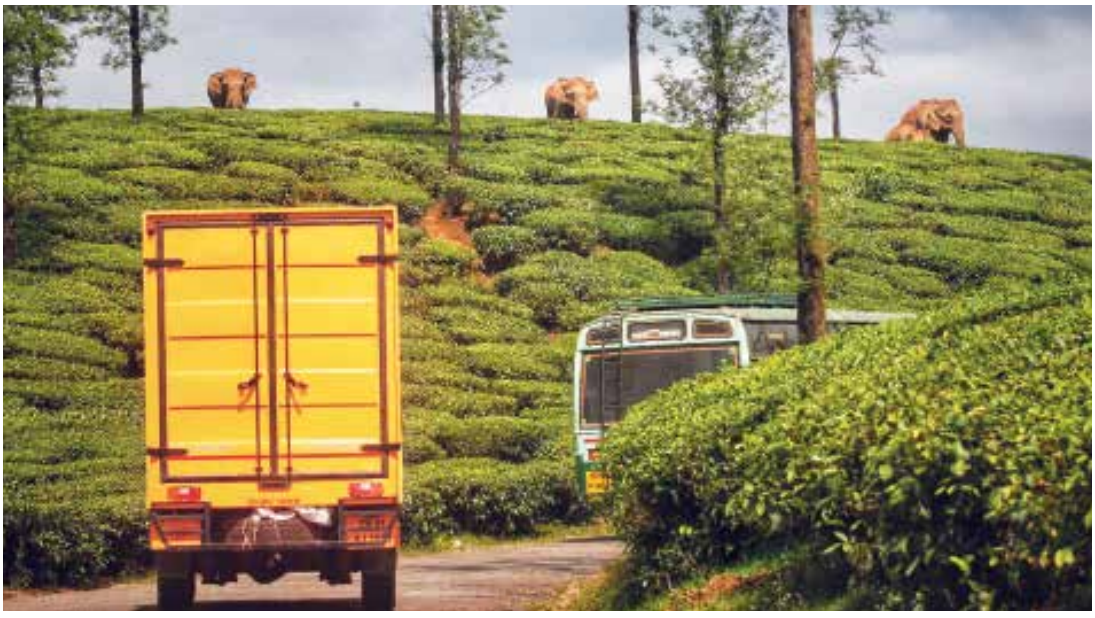
Bull elephant feeding on new flush of grass

problem of human-elephant conflict (HEC). But often, the solutions suggested and implemented remind one of an old folktale – the one about blind men groping an elephant. One who felt the trunk thought the elephant resembled a snake, another who felt the leg concluded that it was more like a pillar, while yet another who felt the tail believed it resembled a broom, and so on. Never did they comprehend the complete picture of the elephant. And such is the case with several of the conflict mitigation interventions; the missing parts of the jigsaw lead to continuing problems on either side.

Perhaps Palakapya, the sage who wrote the magnum opus, *Gajashastra*, never thought then that the context in which he narrated the whole volume would recur after centuries. King Romapada of the Anga kingdom (present-day Central India) had summoned

SREEDHAR VIJAYAKRISHNAN

Elephant amidst a tea plantation in Valparai



SREEDHAR VIJAYAKRISHNAN

Vehicular traffic is a threat to elephants during local migration

SREEDHAR VIJAYAKRISHNAN

An elephant drive being conducted using vehicles

his men to capture all elephants that created issues amongst the agrarian populace of the land. Seeing the plight of the elephants post-capture, Sage Palakapya nursed them, and later narrated the *Gajashastra* to the king. He recited verses about the care these complex social beings require, in the absence of which they would perish.

Centuries down, elephants continue to be captured from across India in the name of conflict mitigation measures. Loud outcries are heard everywhere that the problem has intensified, losses have increased, and humans are losing the battle to these quick-learning, well-adapted pachyderms. Media reports throw in ideas of problem individuals, sketch them as dreaded beasts, often comparing them to terrorists or brigands, and worsen the ground situation by affecting local tolerance. The quick fix in

most of these cases is to banish the animal, either to another forest area, often after fixing a collar to track the animal's further settling and movement patterns, or to send it to a forest camp setup where it would be locked up in a large wooden enclosure, called kraal, followed by rigorous training that varies in its techniques based on the communities in that particular region associated with the mahout profession. The latter, though technically the last resort, has in many areas become the immediate step in the wake of a "conflict" event. Even with translocation, if not executed with rigorous planning and awareness of the landscape, it can only worsen the situation.

A recent instance of the tusker Chinnathambi being translocated from Coimbatore to the Anaimalais due to alleged instances of crop raiding, and him wandering kilometres through urban spaces to reach places where elephants have never been before, shows how some unplanned management actions can worsen an existing situation. Despite all these examples within and across the country, these kneejerk reactive measures continue to be implemented and threaten the very existence of the species.

Hassan, in Karnataka, is an example of how large-scale captures have been adopted as conflict-mitigation strategy in a conflict hotbed, the coffee-paddy dominated region of Alur, Sakleshpur, and Yeslur talukas. Following pressure from the public, 2013–14 witnessed the largest capture ever, wherein 22 elephants were caught, five released after collaring, and 17 taken into permanent captivity. Despite more than 50 elephants being removed from the landscape in a span of about two decades, the area continues to witness conflict in the form of crop loss, as well as human casualties and fatalities. Lack of understanding of elephant numbers, movement patterns, and seasonality in elephant-use of habitats, and patterns of conflicts, have led to the conclusion that

SREEDHAR VIJAYAKRISHNAN

Elephants navigating traffic in the Anaimalais

SREEDHAR VIJAYAKRISHNAN

Elephant feeds from a jackfruit tree inside a residential colony in Valparai

removing existing numbers of elephants would solve the issue. But following every removal, more elephants from neighbouring areas move in to colonize, and the problem continues. Our team's tracking information reveals that the study landscape spread across 205 villages in the aforesaid Alur-Sakleshpur-Yeslur belt currently has about 35 elephants that use the human-use areas quite extensively.

Conflict mitigation is more of a social issue, and the situation in Hassan indicates how the lack of public transportation, absence of street lighting in some critical residential localities, and lack of safety at work are potential causes of loss of human lives, besides surprise encounters with elephants. Recent attempts to aid people in avoiding accidental encounters with elephants in the form of early warning systems seem to have gained acceptance, like in Valparai (Anaimalai Hills of Western Ghats), an initiative was started by our team in the earlier part of this decade. The Valparai model of conflict mitigation, an example of how long-term understanding of the problem has assisted in bringing down the problem significantly, is discussed in greater detail further in this essay.

A broad attempt at identifying the causal factors influencing conflict patterns firstly reveals the pertinent issue of fragmentation and habitat loss, which has escalated existing issues over the years, and continues to do so. Peter Leimgruber and colleagues in 2003, based on an analysis done using satellite data, found that elephants lost more than 50% of their habitats to fragmentation in a span of about three decades. This has resulted in most major elephant habitats becoming small islands in a large ocean of human-use areas.

In the south, the Nilgiris and the Anaimalais of the Western Ghats, spread across 12,600 sq. km and 6,500 sq. km respectively, continue to hold two of the largest contiguous elephant habitats. But with increasing anthropogenic pressures, the focal points of tourism in the Nilgiris (Ooty, Gudalur, Kotagiri, and Wayanad) continue to ecologically deteriorate – besides the historical exploitation of forests for plantations and habitations, which reduced forest availability for elephants. These increasing pressures have led to a gradual increase in human-wildlife conflict in these areas associated with macaques, gaur, large carnivores, and more importantly, elephants. Similar is the case

with several other production landscapes that have witnessed large expanses of forest giving way to monoculture and agriculture.

With tea, coffee, and cardamom plantations being established on the plateau regions of the Anaimalais in the late 1880s and 1890s by pioneer planters like Carver Marsh, A.H. Sharp, and others, parts of the landscape such as Valparai and Munnar evolved into production regions. This meant large-scale transformation of once extensive, contiguous, evergreen forests, and an influx of about 1,00,000 people from the plains as plantation workers. About 130 years of intensive commercial agriculture changed the landscape for its native flora and fauna. In his account of the exploration of the landscape, Carver Marsh writes about encountering elephants on the way uphill, and the species continues to use the landscape despite the transformations. This has led to significant spatial overlap between elephants and humans, sometimes culminating in negative interactions or HEC.

Frequent movement of elephants through tea plantations and habitations in Valparai lead to episodic instances of them breaking into residences, granaries, and warehouses. These traumatic events often lead to loss of local residents' tolerance for the species. Rare accidental encounters of humans with elephants, leading to death or injury, have aggravated the situation. It was in the early 2000s, at a stage where the problem had intensified, that our team started off understanding spatio-temporal patterns of conflict in the landscape. With clear patterns emerging out of the data collected over the years, on the reasons for loss of human lives and property damage due to elephants, the team identified what could be appropriate mitigation strategies for the issue.

It was evident that 80% of deaths happened as a result of people being unaware of elephant locations and movement patterns. Initiated in the form of manual information sharing exercises, the efforts were later expanded in the form of alert messages on local TV channels, SMS based early warning, and elephant location alert lights. Over time, with increased community participation, the initiatives started gaining acceptance and found expected results in terms of decline in the number of human deaths and property damage. A place that had once witnessed

SREEDHAR VIJAYAKRISHNAN

Radio-collared bull in a sugarcane field

severe protests and socio-political issues as a result of increasing conflict could now be featured as a conflict-reducing elephant range.

Early warning techniques similar to those in Valparai were tried out in other areas, but the results were dull, mostly owing to blind replication of techniques with a lack of site-specific understanding of the ground situation. This goes back to the problematic initiation of conflict mitigation measures without a comprehension of the location-specific issue. And it also highlights the importance of efforts such as those in Hassan, wherein efforts followed years of assessment of the ground situation.

Among newly promoted techniques are honeybee fences that were tried out in several parts of the country. While the extremely defensive-aggressive African Honeybee *Apis mellifera scutellata* managed to defend croplands from African elephants, their less aggressive, smaller Indian counterparts *Apis florea* or *Apis cerana* failed to keep elephants at bay. Trials were carried out in several parts of the Western Ghats, such as Wayanad and Nilambur. Elephants with their high adaptability and learning skills realized that in the case of use of bee sounds, stings seldom accompany bee noises. Research shows that with benefits or gain being much higher from croplands, the extent to which elephants take risks to get at the same will also be equally high. One can imagine that elephants would continue their attempts to negotiate novel barriers or preventive measures.

In the longer run, fences are perhaps one mitigation measure that, if installed and well-maintained, could prove effective in saving crops from elephants. In Sri Lanka, for example, seasonal or temporary fences seem to work well in protecting short-term crops such as paddy from elephants, owing to periodic monitoring and maintenance of the units. Government agencies installing such fences may not work the same way, as neither of the stakeholders takes on the responsibility of maintaining them. Other physical barriers such as elephant-proof trenches, concrete walls, and railway fences, besides being expensive, may not work owing to lack of feasibility and local conditions.

The buzzword today in conflict mitigation, especially in southern India, is *kumki*, referring to trained wild-caught or captive-born elephants used for driving and capturing wild elephants in problem locations. Several Indian states are now interested in maintaining a *kumki* force, to

VINOD KRISHNAN

A bull elephant in a paddy field

KALYAN VARMA

Capturing a mother and calf as part of conflict mitigation

deploy whenever the need arises. With its increasing stock of captive elephants, the state of Karnataka has provided several other states with *kumki*s that are now being used for drive, capture, and patrol operations. Countries like Myanmar and Indonesia have similar anti-depredation squads that are used for protecting crops. This, again, may not serve as a sustainable solution, considering the costs involved in maintaining the captive stocks, besides high manpower and resource requirements.

Capture, which is supposed to be the final resort but is often employed as an immediate measure, also proves to be inefficient in terms of the costs involved, post-capture management conundrums, and uncertainty in ensuring the absence of future conflict incidents. One also needs to understand that conflict is bi-fold, with crop/property losses on one side, and casualties/mortalities on the other, and any attempt to address the issue should see it as two separate components, rather than as one.

It is a more scientific proactive approach that is required to resolve the issue (not just Valparai or Hassan, but other HEC landscapes), which is extremely dynamic in nature, on a long-term, sustainable basis, rather than to continue pondering, like King Romapada, as to what needs to be done to keep humans and their belongings safe, or like Sage Palakapya, to wonder what will happen to the elephants post-capture.

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Insights into Human-Tiger Conflict in India

Ravikiran Govekar

ZAIDUL HUSSAIN

Human-Tiger interface, a contentious space in the Tadoba landscape

By saving the tiger in the world, we save complex ecosystems and habitats that otherwise would be destroyed in the relentless march of human need and, all too often, greed.

– Richard Burge, 1999

An incident of villagers forcibly entering and indulging in retaliatory killing of a tiger inside Pilibhit Tiger Reserve in Uttar Pradesh; the heart-breaking sight of the carcasses of three innocent tiger cubs dismembered by a train on a railway track in Chandrapur in Maharashtra; an instance of tiger getting poached inside Kawal Tiger Reserve in Telangana; and a private hunter killing a problem tigress, who was allegedly involved in the killing of villagers in the Pandharkawda region of Maharashtra, had evoked a series of responses among the media, conservation community, and civil society in the recent past. The responses largely ranged from extreme empathy towards the tigers to the extreme outpouring of anger against the government, and also contempt for the villagers who entered the tiger's territory.

RAJA MOHAN

A tiger in a sugarcane field near Pilibhit Tiger Reserve

Every year in India, there are numerous such outbursts, wailing, anger, and public protests over animal related issues. These issues range from the villagers getting killed by the tiger, stealthy leopards or ponderous elephants, to crops getting devastated by deer, antelopes, monkeys, wild pigs, and elephants, to cattle getting killed by carnivores, and in response, people indulging in killing wild animals using guns, snares, poison, and electricity!

Let's look at another scenario. A leopard breeding in sugarcane fields preys upon wild pig, resulting in a reduction in crop damage; lions in the Gir landscape keep away nilgai and wild pig from crops, enabling farmers to have a satisfactory harvest; and insectivorous birds control insect pests that are detrimental to crops. All these examples indicate a set of interface situations between humans and wildlife. If the result is mutually beneficial, we call it positive interaction. If it is detrimental to one or both of them, this interface results in a situation that we call conflict.

India is home to about 70% of the world's wild tigers, and is one of the two most populous nations in the world. Its profile presents a mosaic of forest and human habitation areas, where the people are heavily dependent on forest resources. India is, therefore, home to the highest number of human-tiger conflict incidents too.

India's tiger landscape and the conflict scenario

India is traditionally and culturally associated with tiger conservation. The names of several of our village deities demonstrate an association with *bagh* or *wagh*. The last more than hundred years, however, have witnessed a shift from flourishing tiger populations with liberal hunting programmes to an era of abysmally low tiger populations, followed by a period of extremely stringent protection regimes, when hunting has become a punishable offence. Tiger related conflicts too have a similar history. Worshipping and hunting of tigers often went on together. The same landscapes witnessed cohabitation and antagonism. The ups and downs in tiger conflict cases got correlated with the upward and downward

SANTHOSH GUBBI

Nylon net fencing in Sundarbans that has reduced the number of tigers straying into villages

trends in the tiger population and manifold increase in the human population and associated anthropogenic activities.

Research indicates that human-wildlife conflict, including human death and crop depredation, existed even about 10,000 years ago. The compulsion of sharing space and natural resources for the existence of different species is attributable as the main reason for such conflict. The changing population dynamics of both humans and tigers, land use changes which affect tiger habitat integrity, and the level of management of tiger habitats, are other associated reasons. The entire saga of human-wildlife conflict in present India, however, revolves mainly around the existing socio-political acceptance, resilience, and tolerance level of the local people towards the tiger.

Nature and extent of human-tiger conflict

In India, tigers occur in 18 states, and the latest addition is Sikkim. Population ranges from a single digit to more than 300 in some states. The main tiger populations in India are the Western Ghats population, Central Indian population, Sub-Himalayan and *Terai* population, Eastern and North-eastern population, and the Sundarbans population. Among these landscapes, Pilibhit region in Uttar Pradesh, Sundarbans in West Bengal, Chandrapur district in Maharashtra, and the Bandhavgarh landscape in Madhya Pradesh, where human-tiger interactions boil down to high human as well as high tiger mortality are the prominent conflict hotspots. A tiger that strayed into Gujarat after almost 30 years met with a premature death.

In Sundarbans, life in the mangrove and marsh habitats is equally challenging for both tigers and the locals. People venture deep into mangrove forests in search of honey and crabs, and fall prey to the tigers, whose behaviour differs a bit from their mainland counterparts, probably because of the struggle for survival in a difficult terrain with scanty resources. Men crawling through dense mangrove bushes are often mistaken

MP FOREST DEPARTMENT

Electrocuted tiger in Katni, Madhya Pradesh with injury mark

NITIN DESAI

Tiger killed by jaw trap in Gondmohadi, Gondia district, Maharashtra in buffer area

BANDU DHOTRE

Tiger cub killed in train accident in Chandrapur, Chandrapur district, Maharashtra

RAVIKIRAN GOVEKAR

Rescuing a snared tiger in Tipeshwar Sanctuary, Yavatmal, Maharashtra

for prey. Tigers sneaking into the villages and crossing the creeks were not uncommon till the recent past, and villagers indulging in retaliatory killing were also reported. Since 2009, some 71 persons have been reported killed and two injured in tiger attacks. In poaching related activities, 11 tigers have lost their lives since 1998. However, the real magnitude of the conflict can be understood by the number of incidents of tigers straying into human-dominated areas. Since 1996, over 234 such cases were reported, some of which resulted in serious conflict. Such incidents, however, have been reduced to almost nil due to extensive nylon net fencing in recent years.

Pilibhit and environs in Uttar Pradesh is probably one of the top two conflict areas, along with Chandrapur district in Maharashtra. Since 2010, Pilibhit Tiger Reserve and its surrounds witnessed about 12 tiger deaths, 30 human deaths (11 from inside the core zone) and 18 instances of human injuries. Out of the 30 mortalities, 19 took place within just one year from October 2016 to October 2017. This only indicates the gravity of the human-tiger conflict, extent of fear psychosis among the people that the incidents would cause, and the intense pressure under which the forest department will be forced to work. This area is surrounded by sugarcane fields harbouring

BANDU DHOTRE

Tiger death due to falling into an open well in Chandrapur

MP FOREST DEPARTMENT

Tiger that had fallen in a canal near Gosikhurd dam, Bhandara

prey species for tiger, hence it is extremely volatile most of the time.

The story of Chandrapur district in Maharashtra is altogether different. The district has a recorded history of human-tiger conflict over 100 years. Maharashtra's first man-eater was declared as early as 1995 in this district. After more that 10 years, another problem tiger was shot dead in Brahmapuri in 2007. During the last six years, seven tigers were declared "problem" tigers for taking appropriate action under the provisions of the Wildlife (Protection) Act, 1972. One of them was shot dead in 2014. Chandrapur district (total area 11,400 sq. km; forest area *c.* 4,800 sq. km) harbours 115–120 tigers, 50% of which stay outside the Tadoba Andhari Tiger Reserve.

Many of the well-established tiger reserves would be envious of Brahmapuri, a

small territorial division within Chandrapur, with an estimated tiger population of 40 to 45 in an area just about 1,200 sq. km. Perennial water, ample livestock prey, some natural prey, proximity to Tadoba, and a mosaic of forest and agricultural fields, have created a liveable habitat for the tiger. There are about 300 villages which live under the shadow of problem tigers in this division. Since 2002, 139 human deaths due to tiger alone were reported in the district, which witnessed a total of 226 human deaths due to tiger, leopard, and wild pig. In the last 10 years, 73 human injury cases and more than 10,000 cattle depredation cases were reported, the majority of them attributed to the tigers. The district also has a high number of tiger mortality and injury cases due to poaching attempts (snaring, electrocution, poisoning), and road/rail accidents. Since 2010, 63 tiger mortalities were reported in the district, 20 of which can be attributed to conflict.

The Umaria division, buffer area of Bandhavgarh Tiger Reserve, and adjoining tiger bearing areas have constantly been under intense human-tiger conflict. People have resorted to arson, attack, and road blockade in the past, following human deaths. Tiger deaths due to electrocution have also been a major issue in this region, with one radio-collared tiger getting electrocuted in 2014. In the same year in another incident, there was massive arson at the Khitauli range forest office after a tiger killed a village teacher. Deaths of tiger due to poisoning and road accidents are also reported from this landscape. Large-scale cattle lifting by tigers is also reported, especially in places like Manpur range.

Some incidents are reported from the peripheral areas of Bandipur-Nagarhole-Wayanad landscape. Though not as intense as in Chandrapur or Pilibhit, this contributes to people's negativity towards the forest department, and is also linked with human-elephant conflict. The massive 2012 protests against a so-called problem tiger in Wayanad, Kerala, are worth mentioning, where the forest department was ultimately forced to shoot the tiger. Three more cases of human mortality were subsequently reported in 2015 in Wayanad Wildlife Sanctuary, while six casualties have been reported outside Bandipur since 2013.

Pandharkawda, an insignificant place in Maharashtra, suddenly appeared on the global conservation map in 2018 after more than a dozen human deaths were reported in less than three years. The entire discussion revolved around a tigress named PKT1, who was found responsible for some of these deaths. Whether she was at fault or the villagers, whether she was a man-eater or not, whether she should be captured or killed, whether private hunters should be involved in the operation or not, whether to hunt her or not when she was with cubs, and whether it was prudent to focus on saving a single individual tiger or the tiger as a species, were some of the key questions in the Pandharkawada case. Much activism and litigation followed, and is still continuing, and the rescue operation of her cubs is still under discussion. Such lesser known places as Pandharkawda are constantly added to the conflict list.

At the pan-India level, the National Tiger Conservation Authority's database indicates

PENCH TIGER RESERVE, MAHARASHTRA

Human death in tiger attack in Chandrapur

that from 2010 till December 2018, there were 331 human deaths reported from just 12 tiger states out of 18. West Bengal tops the list with 96 deaths, followed by Maharashtra with 70. Uttar Pradesh ranks third, with 62 deaths in tiger attacks, followed by Madhya Pradesh with 55. A maximum of 64 deaths in a single year were reported in 2016. The total ex gratia paid amounted to Rs 736.7 lakhs. Maharashtra paid the highest amount, Rs 308 lakhs, followed by Uttar Pradesh with Rs 158 lakhs. MP came third with Rs 58 lakhs. It was observed that the number of human males killed was almost thrice the number of females.

Why is human-tiger conflict so intense in these areas?

We know that interface or interaction is the essential component of the conflict, and the area must have both human activities and tiger presence. In the Indian context, there are broadly three types of conflict situations.

First of all, the areas where the tiger resides are mainly in the inviolate areas, like the core area of tiger reserves. Negative interactions normally occur when villagers enter the inviolate areas. Conflict due to honey and crab collectors venturing inside the core area of Sundarban Tiger Reserve and people entering the core areas of other tiger reserves for various other activities fall under this category.

In the *second category*, the conflict zone is a traditional tiger bearing area with a mosaic of forests and habitations, with a long history of co-occurrence and often co-existence, where tigers and humans venture into each other's domain regularly. Examples include areas like Brahmapuri and Central Chanda divisions in Maharashtra; Umaria, Satna, Katni, Obedullaganj-Raisen divisions in MP; South Khairi division in Uttar Pradesh; and buffer areas of tiger reserves like Dudhwa, Pilibhit, Tadoba-Andhari, Bandhavgarh, Sundarbans, Corbett, Bor, Mudumalai, and nearby areas. Wayanad may also fall under this category.

Thirdly, certain areas show the presence of tigers unexpectedly, which may be attributed to the dispersal of spill-over population or to the creation of better habitat conditions in such places. In such situations, serious conflict is inevitable. Some of the examples include conflicts in Pandharkawda division during 2016–18; breeding tigresses residing near the thermal power station in Chandrapur and creating panic during 2018; a subadult tiger moving from Tadoba to Satpura in 2018

RAVIKIRAN GOVEKAR

Forester showing property ransacked by villagers after a tiger killed a village teacher in Khitauli range, MP

NITIN DESAI

Irate mob vandalizing forest department vehicles in Chandrapur after villagers were killed by large felids

A.J.T. JOHNSINGH

Doddabetta man-eater about to be cremated, 23rd January, 2014

after covering a distance of over 500 km and coming into conflict with people en route; a tiger from the low altitude Mudumalai dispersing and killing three people in Doddabetta area in the Nilgiris in 2014; the tiger moving from Pilibhit to Shahjahanpur, Barabanki, Lucknow up to Faizabad, covering a distance over 300 km and creating panic during 2008–09; and lastly, the conflict related to the translocated tigers in Satkosia Tiger Reserve in Odisha during 2018, where a tigress allegedly killed a woman and a male tiger was allegedly killed by the people.

The intensity of human-tiger conflict is extremely high in the *category two* scenario, because there has been regular movement of tigers and humans in each other's areas. People depend heavily upon the forests for minor forest produce and for grazing, whereas tigers often enter agricultural fields and human habitations during dispersal, or for prey species that are attracted towards high-nutrient agricultural crops and water.

Strategies and policies for tackling human-tiger conflict

Gone are the days when there was enough space for tigers even in absence of protected areas. Anthropogenic activities inside the forests were limited then; people's tolerance and resilience was much higher, while human life and tiger life were not weighed in a fine balance as they are done today. Killing of man-eating tigers was seen as an act of bravery, and was even rewarded; and human deaths inside forests were seen as inevitable. Such deaths used to catch serious media attention only after the situation became acute. But over the last few decades, there has been a change in the ground scenario, outlook, policies, and strategies. Tiger population, which had a drastic decline during the 60s and 70s, has been recovering. The number of protected areas and tiger reserves has increased over the years, with about 50 tiger reserves notified so far. Policies and laws have become stronger and the public voice in favour of tiger conservation has grown louder. There has been, however, some waning in the acceptance of tigers by people in certain areas. A tiger showing up in a new area is often taken both ways, with ecstasy as well as anxiety.

Whatever the response of people in various quarters, the fact remains that in India, people and tigers have to cohabit in

RAVIKIRAN GOVEKAR

Unregulated cattle population inside forests can result in more habitat loss and more human-tiger conflicts

future too, with some exclusive, inviolate areas earmarked for tigers, and some areas where they may live with people in peace and at acceptable levels of conflict. Over the years, various strategies have been adopted to deal with conflict scenarios. These range from elimination of problem tigers, to compensation for loss of life, to adopting mitigation measures, to legal measures for safeguarding tigers.

Managing human-tiger conflict

There are basically two approaches to deal with such conflicts. First, preventive and ameliorative measures to minimize the instances of conflict and second, post conflict measures, mainly to mitigate the ill effects.

- Preventive and Ameliorative measures include: legal and policy-level measures, such as notifying inviolate areas for tigers, voluntary rehabilitation of the affected villages, creation of buffer zones, making a stringent law against tiger poaching, regulatory mechanism for developmental projects inside tiger reserves, treating conflict related matters as a state disaster as in Uttar Pradesh, or bringing payment of ex-gratia under Right to Service, as in Madhya Pradesh and Maharashtra. Efforts are made to ensure human-tiger co-occurrence turns into co-existence through eco-development, because conflicts are reduced only when people accept tigers, and they feel that the presence of tigers in their vicinity is a boon rather than a threat. Dr Shyama Prasad Mukherjee Jan Van scheme of Maharashtra, for example, is one such innovative scheme whereby Rs 25 lakhs are provided to each Eco-development Committee, and activities reducing human-wildlife conflicts like providing LPG, construction of toilets and parapet walls to open wells, phasing out unproductive cattle, and providing solar fencing for agricultural fields are undertaken. Alternative livelihoods are promoted to reduce peoples' forest dependence. Village-based ecotourism, as in Agarzari in Tadoba, Chhotkei in Satkosia, and Shahnoor in Melghat, is promoted to involve people in management and to reduce their dependency. Ecotourism income is also used for eco-development through various tiger conservation foundations. Special

programmes like IUCN's Integrated Tiger Habitat Conservation Programme (Vidarbha landscape) and Corridor Conservation Programme (Brahmapuri) are taken up to address conflict issues and promote human-tiger coexistence.

Tiger habitat improvement is another strategy where efforts are made to enhance forage, water, and cover inside inviolate areas to build up wild ungulate prey, with the hope that more tigers will remain mostly within the inviolate area. Sensitization and education of the people is a very important tool in conflict management. Many conflict prone areas get the support of various non-governmental organizations for such activities.

Science and technology have been in use to monitor tigers, identify problem tigers and potential threat areas, to suggest mitigation measures for developmental projects, and for identification of tigers using camera traps or delineating corridors using satellite imagery, and in developing safety gear. Early warning system in collaboration with Defence Research and Development Organisation (DRDO) is being attempted in Pilibhit, while e-surveillance is in force in Corbett and Kaziranga tiger reserves and Ratapani Sanctuary, while drone based monitoring called 'project e-bird' is also in the pipeline.

Measures like creating crossover structures, including underpasses or overpasses (as in NH-44), and deploying surveillance and warning systems along linear structures (roads and railways) are being attempted to minimize accidental deaths of tigers. Various coordinated efforts are being taken up to reduce deaths due to electrocution. Declaring no development or no go zone for identified sensitive pockets around tiger reserves, as in Corbett and Tadoba-Andhari tiger reserves, are some other strategies.

RAVIKIRAN GOVEKAR

MAHARASHTRA FOREST DEPARTMENT

Underpasses change a killer road into a crossover point near Pench Tiger Reserve, Maharashtra on NH-44

Apart from this, states like Maharashtra are working on providing easements to affected people who cannot carry out farming or other activities due to the presence of potentially dangerous animals in their fields. Other policy measures like Community Nature Conservancy and conservation translocation of excess tigers from high density to low density areas are also being attempted.

- Measures undertaken to deal with post-conflict situations include: paying timebound ex-gratia for human and cattle deaths, and crop losses. The amount varies from state to state. Maharashtra tops the list with Rs 15 lakhs, followed by Kerala with 10 lakhs and other states, with 4 to 5 lakhs. In most of the states, financial support is also provided for injured persons.

During actual conflict situations, rapid rescue teams and Special Tiger Protection Force are deployed to handle law and order situations and to undertake rescue operations. Efforts are made to keep people out of the conflict areas or to capture the problem animal as per the existing protocols. In some places, village primary response teams have been created, which help the forest department in emergency situations. Rescued tigers are either released in the wild or sent to a rescue centre, as per the circumstances. Rescued sub-adults and cubs are often rewilded, so as to release them in the wild subsequently.

Future challenges

Developmental activities in India are often planned in isolation, affecting critical tiger habitats and corridors. A push-through tendency, with lack of or poor mitigation planning, does serious damage to wildlife habitats in the long run. Cumulative or strategic impact assessment is not done for a given landscape. Rail and road networks cut across almost all major tiger bearing areas. Good conservation efforts made by India resulted in a rise in tiger population, as envisioned in the tiger recovery policies of the government, but the paucity of space and fragmented connectivity impair the tiger's natural activities. Dedicated programmes like growing fodder and firewood in the villages to stop people entering the forest for such resources should also be thought of immediately.

DCF BRAMHAPURI

Tiger approaching its cattle kill

RAVIKIRAN GOVEKAR

Creating alternative livelihood opportunities for community youths in Pench Tiger Reserve

Future challenges include dealing with the ongoing and upcoming linear developments inside tiger reserves like Bandipur, Melghat, Corbett, Rajaji, Kaziranga, and Tadoba landscape. Vehicles and trains kill and injure large numbers of tigers, and some tigers fall into open canals like the one in Gosikhurd project in Vidarbha, and will continue to do so unless suitable ameliorative measures are taken.

Issues related to the effective management of some important tiger bearing areas also need to be addressed. Threat of diseases like canine distemper virus needs to be tackled through actions such as stronger disease monitoring mechanisms, rigorous immunization, quick threat identification and its redressal.

The biggest challenge, however, lies in how to take local people aboard and build up greater resilience and better socio-political acceptance for tigers. The advance planning to deal with such conflicts, and readiness to tackle anticipated problems is a priority now. There is urgent need to shift our focus to active conflict management, and to win over the people towards meaningful coexistence. We need to learn from our avoidable past follies as well. Ultimately, we as the wisest species on the globe, with all the resources at our disposal, have to work together sensibly and effectively to safeguard the future of the tiger, one of nature's finest creations.

In Jim Corbett's words: "The tiger is a large-hearted gentleman with boundless courage, and that when he is exterminated – as exterminated he will be unless public opinion rallies to his support – India will be poorer, having lost the finest of her fauna."

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Human-Tiger Coexistence in Bangladesh

Md. Abdul Aziz, Md. Mahbubul Alam, Nasir Uddin, Muntasir Akash, Gawsia W. Chowdhury, and Md. Anwarul Islam

MD. ABDUL AZIZ

Tigers of the Sundarbans depend on two major prey species – chital and wild boar

The tiger is the most iconic animal in the world, more so in Bangladesh. This awe-inspiring and majestic animal is feared for its ferocity, but also admired for its elegance and its largeheartedness, to use Jim Corbett's phrase. Until the first half of the 20th century, tigers occurred all over Bangladesh, but due to enormous increase in human population, habitat loss, unprecedented anthropogenic pressures, and hunting, tigers are now confined to the Sundarbans mangrove forest in the southwestern part of Bangladesh. In 2015, Bangladesh Forest Department estimated the population of tigers in the Sundarbans as 106 individuals, while a scat-based

MD. ABDUL AZIZ

Local women collecting leaves from the Sundarbans rivers for cooking

DNA-fingerprinting study in 2017 put the number at 121 (https://doi.org/10.1016/j.gecco.2017.09.002). The latest national report published on May 22 , 2019, by the Bangladesh Forest Department and WildTeam with support from USAID Bangladesh has estimated 114 tigers in the Sundarbans of Bangladesh. The 10,000 sq. km Sundarbans mangrove forest shared by Bangladesh and India is the largest mangrove area in the world, of which 6,017 sq. km constitutes the Bangladesh part (hereafter Sundarbans) while the rest is in India. Not only are these mangroves a unique habitat for tigers, these two parts together support one of the largest contiguous populations of tigers in the world, with an estimated 146–254 tigers.

Although the tiger is the supreme predator in the Sundarbans, humans are capable of decimating this charismatic species in its ancestral home. Their forest home in the Sundarbans is now being overly shared by an increasing number of humans, almost one million people in the immediate vicinity, and

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Crab collectors often stay together at night in narrow creeks

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Fishermen putting out nets in the creeks for shrimp fry

is the basis for the survival of several million more people, who rely at least partly upon the forest and aquatic resources of this mangrove ecosystem. As a consequence, competition and conflict between humans and tigers is widespread, and this is the major challenge facing tiger conservation in the Sundarbans.

Human-tiger conflict

Human-tiger conflict takes several forms: tigers severely injure or kill people while they are engaged in resource collection within the forest; they severely injure or kill people and after another almost throughout the year. A repository maintained by WildTeam, a conservation NGO in Bangladesh and charity in UK, reports a total of 263 human-tiger conflicts between 2008 and 2018. This resulted in the death of 185 persons and injuries to 78, with an average of 23 deaths and 10 injuries per annum. About 99% of these incidents occurred inside the forest during resource collection. Crab collectors and honey collectors were the major victims of these tiger attacks, presumably as they are completely engrossed in their work in

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Submerged pneumatophores in the Sundarbans

livestock in the villages close to the forest. People kill tigers when they stray into human habitations.

Most of the human injuries or deaths occur in the forest while people are engaged in collecting forest and aquatic resources. Locals collect seasonal resources like honey, nipa palm, fishes, and non-timber forest products, and these activities continue one the forest and in the narrow canals bordered with dense mangrove vegetation, and fail to notice an impending attack.

Secondly, according to WildTeam's unpublished data, from 2008 to 2018, tigers were recorded to have strayed into nearby villages on 145 occasions. Nine tigers were killed and one tiger was injured in these incidents. Tiger killing in these situations was

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Bangladesh Forest Department, Village Tiger Response Team (VTRT), and WildTeam members rescuing an immobilized stray tigress for the first time in the history of Bangladesh

mainly attributed to retribution for human or livestock kills by tigers. Evidence suggests that tigers that stray into villages are injured animals, with injuries either from territorial fights among themselves or from snares put out for chital. Old tigers as well as transient young tigers also stray into villages where food is available in the form of livestock.

Thirdly, killing of livestock by tigers inside and outside the Sundarbans is a cause for concern. WildTeam's records show that a total of 365 livestock were killed by tigers from 2008 to 2017, with an average of 33 kills per year. The livestock commonly killed were goats, sheep, and cattle, with goats ranked on top. In several incidents, free-ranging dogs and cats were also preyed upon, which could pose the potential risk of canine and feline diseases being transmitted to tigers.

The above accounts do not end the story of the problems of tiger conservation. This peerless top predator also faces deadly snares

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VTRT members in a training session, discussing the human-tiger conflict situation

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Hon'ble Prime Minister Sheikh Hasina with #iStandForTigers campaign, organized by USAID's Bagh Activity, implemented by WildTeam

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Students visiting a TigerCaravan during a nationwide awareness campaign, organized by USAID's Bagh Activity, implemented by WildTeam

and bullets from poachers. Its major prey, chital, is poached by the locals. Furthermore, the habitat is getting gradually degraded and its very existence is threatened by climate change and predicted accompanying rising sea levels. An article published in *Oryx* (2013, Prioritizing threats to improve conservation strategy for the tiger *Panthera tigris* in the Sundarbans Reserve Forest of Bangladesh https://doi.org/10.1017/S0030605311001682) documented a wide range of increasing threats, of which four were related to tigers, two to tiger prey (largely chital, as the local population being Muslim do not kill wild pigs, the only other major prey), and 17 documented threats to the habitat of Sundarbans. The inflow of water into the Sundarbans is also getting reduced with the years, due to uncontrolled use upstream. Firewood and timber collection and smuggling, fishing, collection of honey, and harvesting of aquatic resources like crabs and prawns also cause immense problems, including disturbance and degradation of the habitat. Pollution of Sundarbans waters is also a serious threat from upstream industries, cargo vessels that use the rivers and channels, and oil spill from capsized vessels through Sundarbans rivers. All the abovementioned problems, which are on the increase, are extremely difficult to address.

The term 'problem tiger' used frequently in old literature of this region refers to the 'man-eating tiger'. This term is used for tigers that repeatedly stray into human habitations and attack humans and livestock. However, at present, man-eaters have been rather rare in the Sundarbans. For example, in a period of ten years from 2008 to 2018, only one tiger repeatedly strayed into the villages in the eastern Sundarbans, which was later killed by the locals.

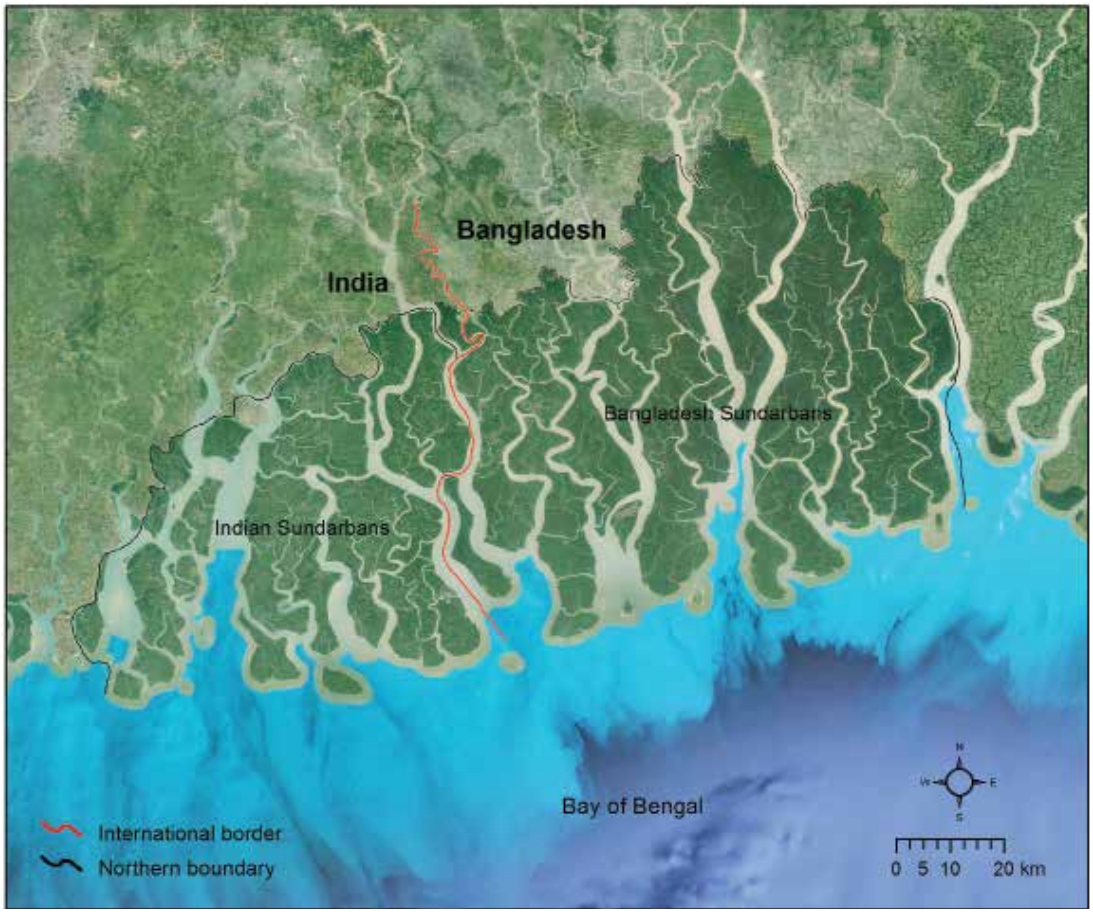
Loss of human lives due to a tiger attack causes severe agony and leaves a deep scar in the minds of the bereaved families. Often, the person killed could be the only earning member of a family – a fisherman, woodcutter, or a crab collector. If the father of the family is killed or severely injured, it places the victim's family in a long-term financial and social crisis. The financial crisis forces other members of the family, often the wife or one of the grownup children, to venture into the forest to pursue the profession of the deceased. Eventually, the victim's family loses its social bonding with the neighbourhood and is tagged as the 'wife of the tiger victim' or as an 'unfortunate' person. A recent study in the Indian Sundarbans found that more than 44% of these 'tiger widows' experienced cultural and social stigma, fear, negative feelings,

and discrimination. Understandably, such economic, social, and psychological distress undermines the tolerance of the local people towards tiger conservation.

Human-tiger coexistence

It would appear that human-tiger coexistence is practically unworkable, given the foregoing accounts of hostile human-tiger interactions. However, practical and sustainable initiatives in dealing with human-tiger conflict situations around the Sundarbans by WildTeam, in association with Bangladesh Forest Department and local communities, have yielded promising results. These efforts include forming community-led conflict management teams and a compensation scheme for tiger victims' families, and improving the skills of resource collectors to avoid tiger attacks.

Two types of community-led conflict management teams, namely Village Tiger Response Team (VTRT) and Forest Tiger Response Team (FTRT) were formed in 2007. VTRT involves people from the villages who have been volunteering to protect tigers and other wildlife along the fringe of the Sundarbans. Having trained in conflict management situations, VTRT assists the Bangladesh Forest Department to push back the tigers that stray out of the forest. They help in managing crowds that become a huge problem when such an incident occurs. They also provide advocacy support for tiger conservation. As of now, 49 VTRTs comprising 340 members are working in 26 villages along the borders of Sundarbans, assisting the Forest Department in conflict situations and providing moral support to the local people. As a result of their dedication,



PREPARED BY M.A.AZIZ USING GOOGLE EARTH

Sundarbans

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A VTRT member receiving the Bangabandhu Award for Wildlife Conservation from the Hon'ble Prime Minister of Bangladesh

VTRT members are recognized as heroes by their community and this is a classic example of community support and engagement in wildlife conservation. The volunteers are trained by WildTeam, and some incentives like torches, raincoats, and umbrellas are given, but no money is paid to them.

Forest Tiger Response Team (FTRT) has been developed along with the community team, and this is a boat-based team that patrols forest and community borders on all days and helps in recovering or rescuing tiger victims. The team also provides first aid to the injured and transports victims to the nearest hospital. Given the constraints of logistics and financial issues, only one FTRT team has been formed, which is working in the Satkhira range. The team also supports VTRT members when tigers stray out, and conducts joint patrols with the Bangladesh Forest Department. To date, these community-led teams have managed to rescue and release at least five stray and injured tigers back to the forest, following the standard protocols of immobilization and translocation. The teams have also managed more than 30 tiger straying incidents successfully by gently driving the tigers back to the forest, and this was achieved remarkably well without injury either to the tiger or to the participating team members. In 2016, the VTRT received the Bangabandhu Award for Wildlife Conservation from the Prime Minister of Bangladesh, in recognition of their contribution to addressing conflict management in the Sundarbans.

Several other initiatives such as TigerScouts and BaghBandhus, involving students and community leaders, have been instrumental in bringing about a positive attitudinal change towards tigers and the Sundarbans, across communities. WildTeam with support from USAID has also established and resourced TigerLibrary in four ranges of the Sundarbans, which are immensely popular and useful to students and communities, to enrich their knowledge about the tiger and its threatened and fragile habitat. All these efforts generate a great deal of hope for the Sundarbans and their tigers.

Capacity development of the team members and local resource collectors forms

the core of skill training and community works provided by WildTeam in association with the Bangladesh Forest Department. Resource collectors are being trained on safety issues during work inside the forest, stray tiger handling, and mob management.

Another large component of human-tiger conflict management is to organize regular community-based awareness programmes, of which 'behaviour change campaign' was the most successful component, as it achieved community support for mitigating conflict and achieved ownership for tiger conservation activities. Under this campaign, 'Mother-like Sundarbans' and 'Tiger Caravan' were able to capture enormous countrywide attention and draw public support for the Sundarbans and the tigers. These much appreciated activities were organized by WildTeam with support from Bangladesh Forest Department, Zoological Society of London, US Fish and Wildlife Service, and USAID Bangladesh.

The Bangladesh Forest Department has institutionalized a compensation policy for permit-holding resource collectors who venture inside the forests, and for humans and livestock living around the forests. This policy has been in place since 2010, with BDT 100,000 (approx. US$ 1,200) for deaths and BDT 50,000 (approx. US$ 600) for severe injuries. Until 2016, a total of 53 tiger victims and their families had received compensations under this policy (see Bangladesh Tiger Action Plan 2018–2027, Bangladesh Forest Department).

Conclusion

To sum up, millions of people depend on the forest and aquatic resources of the Sundarbans for their survival. At the same time, this forest is the last stronghold for tigers in Bangladesh. Therefore, the challenges of tiger conservation in the Sundarbans are enormous and securing the future of both these major stakeholders poses a mammoth task. Programmes for comprehensive initiatives to increase tolerance and capacity building among the communities through training, incentives, justified benefit-sharing of conservation, as well as generating alternative livelihood options should be augmented. Such initiatives can help minimize conflicts and ensure coexistence between humans and tigers, the two major stakeholders in the Sundarbans, and help secure a better future for the last tigers of Bangladesh.

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Cat out of the Bag – Lions in a Human Landscape

Stotra Chakrabarti

STOTRA CHAKRABARTI

Cubs snuggling to their mother. The Asiatic lion population has steadily grown to over 600 individuals at present

December 2014: The chill in the air numbed my hands as I sat patiently on the bonnet of our four-wheel drive. The radium of my watch showed it was 10 past 2 in the morning, and I had lost sight of my subject – an Asiatic lioness and her two cubs – for over an hour. The radio-receiver stationed beside me ticked incessantly, to reassure us that she had not moved from the thorny *Prosopis* patch a few yards from us. But her proximity to a groundnut farm with a small hut nestled in it, with its slumbering human inhabitants, made us slightly jittery.

We were a team of four, and we were following a special carnivore, one of the last remaining Asiatic lions, to understand how this large carnivore had adapted itself so well to living alongside humans. In May 2014, under the leadership of Professor

STOTRA CHAKRABARTI

A pride of Asiatic lions feasts on an old cattle at the edge of a village. As dawn sets in, they will vanish into the adjoining patch of vegetation and rest out the day. Note the radio-collar on the lioness in the background that allows us to keep track of the pride's movements and activities

Y.V. Jhala of the Wildlife Institute of India, we had put radio-transmitters on five adult lionesses living in the human-dominated Saurashtra (Gujarat) landscape. We wanted to know about their mystical lives and their association with humans. Finally, after a while of patience and hushed whispers, we saw her coming out of the *Prosopis* bushes. The shimmering moonlight transformed her into a pale ghost as she walked through the farm. Our hearts raced with her every furtive glance at the hut, as she ambled towards the main township of Krushnagadh. We followed her, only to witness an old cattle falling prey to her mighty jaws. The sight left us enthralled at her stealth and speed. Accompanied by her cubs, she had wearily settled onto her feast at the heart of the desolate market-place that would be jostling with people in a few hours from then. Luckily, such unproductive livestock without any owners are plentiful in the Saurashtra landscape, and provides lions

Y.V. JHALA

STOTRA CHAKRABARTI

Thorny vegetation patches and crop fields near villages provide ample cover for lions to remain concealed in the day; they come out at night, patrolling village alleys and market places in search of unprotected livestock

STOTRA CHAKRABARTI

A pride of lions visits a village temple just before the inhabitants wake up and throng the area

STOTRA CHAKRABARTI

With an increasing lion population, our research affirms, predation on productive livestock is increasing all over the human-dominated Saurashtra landscape

STOTRA CHAKRABARTI

Lions act as natural predators of nilgai (seen here) and wild boar in the human-dominated landscape, bringing relief to farmers who bear considerable losses from crop damage by such herbivores

with their staple diet, hardly causing any backlash from humans.

November 2015: Carcasses of three adult cattle lay strewn in an alleyway of Amrapur village, situated about 20 km away from the boundary of the Gir forests. The lions that killed these cattle belonged to a brotherhood of four adult males, one of which carried a radio-collar that we had deployed a few months earlier. These young males regularly moved to and fro between the Gir forests and the surrounding villages. They had killed their quarries in the dead of the night, feasted partially on only one of them, and disappeared as the alleyway got busy with people starting their day. To our surprise, some of the onlookers enthusiastically described how they had actually watched the lions feed when they woke up, and none among them were apathetic to the lions.

Again, these livestock belonged to no one! As I turned on the radio-receiver, I was greeted with its characteristic beeps – the lions were not far away! We knew that they would be resting in the nearby hedgerows, biding their time till nightfall, to reclaim their kills that would be dumped at specific sites at the village boundary.

Present Day: A group of people sat in an animated discussion in Prof. Jhala's office at the Wildlife Institute of India. The topic: the Asiatic Lion. The group represented different cohorts of researchers who spanned his long-term ecological project of more than two and a half decades. As the discussion grew intense, we started putting together the pieces of a conservation chronicle. The Asiatic lion was almost hunted out of existence across its entire range from Persia (present day Iran) to Palamau in eastern India, leaving only about 50 individuals in the Gir forests of Gujarat. Under the protection and nurture of the erstwhile Nawabs of Junagadh and subsequent by the Gujarat Forest Department, the lions have grown steadily in number and range, reaching a present ~600 occupying an area more than 20,000 sq. km, of which only about a tenth is under legal protection.

About one third of the lions live outside the forests, dangerously close to peoples' backyards and farmlands. The information that we have collected from monitoring more than a hundred lions, intimately witnessing their triumphs and tragedies across the years, painted a picture of a versatile carnivore and its legendary coexistence with people. Owing to the religious sentiments and largely vegetarian diet of the people of Gujarat, there is an abundance of unproductive livestock that loiter around villages without protection and are easy prey for the lions. Also, this landscape abounds with *gaushala*s or cattle camps that provide food and shelter to such unproductive livestock. Weak and old livestock often die in these camps and are dumped outside, providing a free buffet to the lions. We often found our collared lions making regular forays to such dumpsites in search of food, to an extent that the majority of the lion's diet in this landscape came from such scavenging events. Patches of vegetation in and around the villages provide safe concealment for lions in the day, reducing the effective human-lion interface. Consequently, people hardly get to encounter lions from close quarters, other than the occasional pugmarks, similar to what the sleeping inhabitants would have seen the next morning in the groundnut farm!

Astoundingly, even when lions and humans do encounter each other, only an infinitesimal number of them result in aggressive confrontations. Our socio-economic survey across the landscape suggests that farmers are very welcoming to lions in their vicinity, as these predators act as effective deterrents to crop raiders such as nilgai and wild boar, that can cause substantial damage to farms.

The Gir Sanctuary still harbours the semi-nomadic Maldhari communities living within its boundaries. The Maldharis primarily rear livestock and sell dairy products for their subsistence. Lions prey upon their livestock occasionally, but a prompt compensation scheme from the Gujarat Forest Department has effectively ameliorated such losses and has curbed retaliation. Interestingly, our long-term data suggests that rarely are the Maldharis' prized and productive livestock killed by lions, because of good herding practices that have been perfected through a two century-old relationship of living with lions. Productive cattle are penned inside the ness (similar to the African *boma* with its thorn enclosure) to safeguard them from lions. While grazing, the livestock are usually guarded by one or two people, with unproductive individuals kept at the outer perimeter of the herd. Curiously, the Maldharis living with lions inside the Gir forests having rights of free grazing for their stock and on forest produce, made substantially more profits than their

counterparts who lived outside the forests. Their full coffers provide goodwill for the lions – the basis of this renowned coexistence.

However, as we dug deeper, looking into the recent trends in livestock predation by lions in the landscape, we were overwhelmed with the magnitude of the problem! Lions were expanding their range at an unprecedented rate, with an addition of more than a hundred villages each year, where they had started killing livestock. Good protection and subsidized food sources in terms of unproductive and/or dead livestock had resulted in a population boom among the lions outside the Gir forests (126% growth in the last five years), urging them to colonize areas where they had been absent for the last two centuries. This has created an inexplicable situation, where people lacking any prior knowledge of sharing space with a formidable carnivore are being compelled to live with one! Global history suggests that humans and carnivores do not mix well, and such a growing interface between a large carnivore and human interests is a recipe for imminent conflict and eventual disaster.

As we looked into satellite imagery of the landscape across different time scales, an issue of grave concern stared right back at us. In a progressive state like Gujarat, where the human population has risen by ~20% in the last decade, industrialization and linear infrastructure have and will continue to disrupt lion movement corridors and refuge patches. Once connected patches of *Acacia* or *Prosopis* that provided safe asylum for lions to rest, breed, and disperse in the human-dominated landscape are now facing the axe for roads, railways, settlements, and built-ups. Also, the traditional reverence for all life forms, including lions, in the people of Gujarat is fading away, as a spiking and desperate lion population increasingly threatens their lives and their prized livestock. Thus, although the future of lions inside the protected forests remains secure, their prospects in the human landscape hang on a delicate balance encompassing

STOTRA CHAKRABARTI

Courting pair of Asiatic lions

STOTRA CHAKRABARTI

Lion movement pathways between vegetation patches in the human-dominated landscape are vanishing rapidly in the face of ever increasing infrastructural development, in this case a state highway

human-tolerance and economy that might tip either way any time. Certain efforts from the Forest Department to protect lions and reduce conflict, such as intensive medical interventions for injured and diseased lions, and removal of livestock carcasses from the vicinity of villages, might be well intentioned but could be very counterproductive.

Although it was once necessary to zealously save all the lions (including through the use of rigorous medical care) to build up a small population, presently it is crucial to let nature take its own course. Such artificial interventions often result in boosting the survival and propagation of weak individuals and their genes, which would have otherwise been weeded out through natural selection. Furthermore, the removal of cattle carcasses and dumping them far away from the kill-sites often deprives lions of their food, forcing them to hunt more frequently. Instances from the landscape showed that starving lions deprived of their kills resorted to attacking and even killing humans. Recent deaths of many lions from canine distemper possibly envision the future for lions in the landscape of a Saurashtra dominated by humans and free-ranging dogs.

Thus, although the laudable conservation efforts of the Forest Department and the people of Gujarat have boosted an extraordinary species recovery, they might very well have led to a conundrum where modernization, economic development, and human resource advancement are at odds with the future persistence of the last lions of Asia.

Stotra Chakrabarti is a Project Scientist at the Wildlife Institute of India. He studied lion behaviour for his doctoral degree and has been associated with the Asiatic lion project of WII since the last six years.

The Spotted Cat's Big Troubles

Sanjay Gubbi

NARESH KADIAN

A leopard being lynched in Haryana

Late one evening in November 2013, a forest officer called to inform me of a tragedy. A leopard had killed a six-year-old boy. Could I help? I started immediately and reached late in the evening. The forest officials had placed a cage near the village to capture the leopard. The next morning, before dawn broke, we heard that a leopard was trapped in the cage. We hurried to the village near Hassan, about 190 km from Bengaluru.

A large crowd had already gathered around the cage when we arrived. As I approached, I saw that the leopard sat with its front paws stretched out of the cage. It did not appear agitated at my proximity to the cage. Something caught my eye as I sat down by the cage to get a closer look at the leopard's paws. All but one toe was missing in the animal's left paw, perhaps injured in a snare set up to catch a wild boar or some other wild animal. Was the animal incapacitated to catch wild prey and hence went after the young boy, I wondered. Or was the boy walking alone in the leopard habitat as darkness was gathering, making him vulnerable to the hungry leopard with the injured paw?

The villagers put up a strong protest as we prepared to take the cage away with the

leopard. They wanted the animal to be killed immediately and they were not willing to 'forgive' the leopard, which had killed the boy and partly eaten the body, even before the rescue team went looking for the missing boy. Forest officials tried reasoning with them, but to no avail. A couple of minutes into the heated discussion, I decided to put on my negotiator's hat and tried to persuade them to let us take the animal away from the scene. The villagers were resolute in their decision and so great was their anger that they insisted, "Sir, we will allow the animal to be taken away on the condition that you take its place in the cage so we can douse you with kerosene and set you on fire!"

There was no place for outrage here. I could understand their agony at having lost a young child in this brutal and tragic turn of events. It eventually took us a few more hours of pleading and convincing before the villagers relented and allowed the leopard to be taken away. The leopard was forced to find asylum in Bannerghatta Biological Park with numerous other leopards, some with a history similar to the leopard of this story. The scene plays itself out in the same manner in most places when conflict with wildlife comes to a head. And with good reason, when one factors in the financial loss, serious injuries, or in some situations, the tragic death of dear ones. In recent times, it appears that tolerance towards wildlife seems to be on a downward trend, even when the conflict is not so severe. Only a few wildlife species are the cause of such tragic situations, and unfortunately, leopards along with sloth bear, tiger, and elephant top the list.

The ability of this spotted cat to live in a potpourri of habitats is largely because of its smaller body size, compared to the other large cats (tigers, for example), which enables it to live in scanty cover and survive on smaller prey such as hare, porcupine, and the ubiquitous free-ranging dogs. Sadly, for the poster child of carnivore resilience and conservation success in India, this ecological trait has served as a bane, rather than a boon. The increasing conflict, or at times perceived conflict, is impacting both people and leopards.

In Karnataka, where we work, we have been documenting a steady increase in the reporting of human-leopard conflict. During an eight-year period (2009–16), a total of 573 villages that make up around 2% of the state's 27,418 villages, registered human-leopard conflict. This conflict included 88 human injuries and 14 human deaths. These villages are either situated close to forested areas and rocky outcrops, or have other habitats where leopards can survive. Sugarcane and maize fields also provide temporary shelter, enabling leopards even to give birth and raise their young. The actual instances of conflict could be higher, as many cases go unreported. More importantly, nearly 50% of all the incidents were reported from just five of the state's 30 districts, indicative of the severity of conflict in some areas. These districts are Mysore, Hassan, Udupi, Tumkur, Ramanagara, and Mandya, where focused attention would be required to de-escalate the problem to tolerable limits.

Once there is a spatial understanding of conflict, the obvious question would be, why does conflict occur and what measures can be taken to mitigate it? Although conflict increases in proportion to an increase in threats such as habitat loss and unsustainable

NATURE CONSERVATION FOUNDATION

One of the key flashpoints between people and leopards is when they feed on domestic livestock

SANJAY GUBBI

On demand from communities during instances of conflict, authorities are forced to capture leopards

hunting of the leopard's prey species, it also rises in proportion to conservation success, as a result of an increase in the species population. In response to the Wildlife (Protection) Act, 1972, leopards have been brought under strict protection, being accorded the status of Schedule I species, to safeguard them from illegal killing to feed the international illegal wildlife trade. This has helped their numbers to rebound in many parts of the country, resulting in increasing levels of conflict.

Human-wildlife conflict is a complex issue, the reasons are many, and vary with each location. Though some of the grounds for conflict could be site-specific, there are two broad causes which lead to conflict. For large carnivores like the leopard, both space and food are at risk, and are shrinking at an alarming pace in our country. Regrettably, the burgeoning human population and its ever-increasing material needs, stifles the space needed for wildlife.

Causes of conflict

Habitat destruction

Many parts of the rugged rocky outcrops that leopards call home have turned hostile and unsafe for these agile cats. Quarries and mines are peppered across their habitat. As I see it, the most threatened leopard habitats are rocky outcrops and forests outside the protected area network. These habitats are fiercely contested by the escalating demand for granite, minerals, and other natural resources. It is mostly in these areas that one witnesses high levels of human-leopard conflict.

But don't leopards thrive in man-made habitats? If so, why do they need natural habitats? Leopards certainly use man-made habitats such as maize and sugarcane fields, and plantations that provide them sufficient cover, as part of their home ranges. Female leopards even give birth in such spaces, possibly to avoid infanticide by other leopards, or other large conspecific predators that are present in the larger natural leopard habitat like scrub forests. But these crops are harvested regularly, and leopards continuously need to shift their home ranges in response to the loss of these dynamic habitats. Hence, I opine that natural habitats which provide both cover and food are very important for a large carnivore like the leopard. Even in environments where they are known to survive in sub-optimal conditions, there need to be patches of natural habitat such as rocky outcrops, hillocks, and scrub forests in the vicinity, that are vital for their survival.

Leopards are present even in the outskirts of megacities, including Mumbai and Bengaluru. Mumbai has the Sanjay Gandhi National Park spanning over 104 sq. km and Bengaluru has Bannerghatta National Park spread across 256 sq. km. In addition, Bengaluru also has extensive dry deciduous scrub forests on the outskirts of the city. All these enable leopards to survive even in the vicinity of megacities. Such habitats also occur on the outskirts of other big cities such

B. ARUN KUMAR

A leopard captured and in the process of being translocated due to conflict, was tranquilized and fitted with a radio collar to monitor its post-release movements. It survived in the site of release for nearly four years

as Nagpur, Jaipur, Dehradun, and Guwahati, among others, where leopards are known to exist. These examples underline the fact that natural habitats are the cornerstones of leopard survival. Wipe out the natural habitats that surround the dynamic habitats, and leopards could easily blink out in no time.

Depletion of prey

Unfortunately, in many parts of leopard habitats, poachers roam free with guns and jaw-traps to kill not only the leopard, but also its prey species. Loss of habitat also leads to diminished numbers or local extinction of natural prey. Our work in 19 sites in Karnataka has shown that the intensity of poaching of potential prey of the leopard was six times higher outside protected areas than within them. The leopard has endured it all, but possibly at the cost of having to shift its food base towards domestic prey.

Studies show that medium-sized wild ungulates in the 10–40 kg body weight range seem to dominate leopard diet, with an optimum prey body weight of 23 kg. They are the same size as domestic ungulates such as goat, sheep, and calves. Added to this list of ungulates is the domestic dog. Therefore, when the leopard's preferred prey goes locally extinct or becomes very scarce, the cat is left with little or no option but to hunt down domestic prey to survive. This becomes the flashpoint between people and the spotted cat, as is evident in the Pauri Garhwal district of Uttarakhand, where natural prey such as goral and barking deer have been depleted due to poaching. Here leopards throng the villages, looking for domestic prey, which leads to conflict.

Other causes

Leopards live on the outskirts of cities if there are suitable habitats, such as the Chamundi Hills adjoining Mysore or Sanjay Gandhi National Park skirting Mumbai. Some individual leopards come looking for easy prey, such as feral pigs and dogs scavenging on garbage. But this constitutes a small proportion of the larger human-leopard conflict issue. Hence garbage management, which has been propagated as a 'one-size-fits-all' solution, may require some

KARNATAKA FOREST DEPARTMENT

Leopard feeding on a cow that it had killed near Cauvery Wildlife Sanctuary, Karnataka

rethinking. There are hundreds of villages across the country where leopard conflict has no relation to garbage, and conflict mitigation solutions need to be tailored to suit the local situation in each case. Appropriate guarding while grazing livestock in leopard habitats, and suitable protection measures at night when livestock are corralled, would help decrease livestock losses, but the measures to avoid human injuries are different.

Another cause, which is more serious from the human viewpoint, is children moving from one house to another after sunset, and people entering man-eating leopard habitat near their homes at night for defecation. In the tea gardens of West Bengal, labourers plucking tea leaves are occasionally injured by leopards that have littered in the tea bushes, and these attacks happen. Otherwise, leopards do not kill humans for food. Hence, all these aspects need different approaches to mitigate the problem.

Emergency situations

What we see or read in the media are largely emergency situations – leopards entering human dwellings, found inside schools, seen inside closed buildings, and so on. This is a different aspect of conflict and needs a different set of skills to manage.

Whenever large wildlife that could cause grievous injuries to people are in areas with dense human population, we need to work on minimizing the risk to both people and wildlife through better preparedness, a coordinated approach, continuous capacity building, and shared learning among authorities and individuals. Public education and outreach play a critical role here. However, there can never be one definitive approach while handling such situations, as every location is different. The mindsets of authorities vary and several other factors have a bearing on devising a suitable approach. Two factors that remain constant and need to be addressed are large crowds and the overzealous attitude of the media. Crowds need to be managed by specially trained police squads. The media needs to self-regulate and allow for smooth and safe operations during such emergencies. It should also modify the way it projects emergency conflict situations.

Increased capacity-building activities on handling wildlife when they enter areas with dense human populations, is critical. Conducting mock drills, as is the practice in police, fire, and emergency departments, can go a long way to ensure preparedness of the Forest Department staff when managing real-life situations. These drills should also

Identifying problem individuals

Identifying problem animals is very important to reduce conflict. By sharing camera-trap data we were able to identify individual leopards that had killed livestock. Addressing the problem animal suitably could help reduce the retaliatory killing of leopards.

When forest department staff of Cauvery Wildlife Sanctuary shared a camera trap picture of a leopard feasting on a cow, we immediately compared it with our database and identified him as CU-01, an adult male of about four years. Such problem individuals should be dealt with, based on ecological and social reasoning.

Similarly, based on our camera-trap pictures we were able to identify individual leopards that had been killed in snares, electrocuted, and killed on the roads, which are unnatural mortalities.

VIJAYA KARNATAKA

A leopard that was found dead due to electrocution near Cauvery Wildlife Sanctuary, Karnataka

include police, fire, and emergency, as well as health and veterinary professionals, in addition to forest personnel.

Establishing a cadre of trained, full-time veterinarians is crucial. Currently, veterinarians are deputed from the Animal Husbandry Department, creating a void when the vets go back to their parent departments. In cases of wildlife species like tigers, leopards, and elephants straying into human dense areas on the rise, and with many of the serving veterinary staff overworked, having a dedicated team of wildlife veterinary personnel within the Forest Department merits serious thought.

Compensating losses

People are bound to suffer losses when a large carnivore like the leopard survives in their neighbourhood. Such situations necessitate a quick, sympathetic response, humane compensation schemes, and a concerted effort at improving people's tolerance towards leopards. We need to turn a new leaf at the earliest, else the future of wildlife conservation could turn combative, a situation we want to avoid at all costs. The reasons for conflict are also downplayed and often misleading. We normally tend to be naïve about difficult issues and tend to label them as "controversial" rather than view them for what they are and devise constructive, commonsensical approaches to tackle them.

While we largely blame garbage as one of the main causes for human-leopard conflict, we tend to turn a blind eye to the massive scale of destruction of the leopard's natural habitat and large-scale hunting of its prey, especially outside protected areas, which could be the primary causes of human-leopard conflict. Here we need to transition from romanticism to pragmatism.

In India, the future of wildlife conservation depends on how we manage our natural and semi-natural habitats that shelter conflict-prone species. It will also hinge on responding positively to people who bear the brunt of wildlife conflict, to extend support and understanding to them. We genuinely need to work towards reducing cases of conflict, as they affect the lives and livelihoods of people who have been patiently practising acceptance for centuries. It is also imperative that we provide pragmatic solutions to reduce conflict, without which the survival prospects of the species, especially outside protected habitats, could be bleak. In general, the phrase "All is well", does not ring true if it concerns leopards.

Sanjay Gubbi is a large cat biologist interested in leopard and tiger research and conservation. He won the Whitley Award in 2017.

Urban Leopards!

Nayan Khanolkar

City Leopards!

The leopard is the most persecuted big cat in the world. These felines are among the most adaptable and versatile large carnivores, occurring in a diversity of landscapes across India, where anti-hunting laws are enforced and cultural tolerance is high.

These images are from Mumbai – one of the busiest and most crowded cities in the world. Few would associate this bustling metropolis with forests and wildlife, let alone the presence of a large cat in its by-lanes. Yet this unexpected situation exists right here in Mumbai with 47 wild leopards (as per a 2018 survey). The highly adaptable leopard has learnt to navigate through settlements with a human density of more than 20,000 per sq. km. Mumbai is perhaps the only city in the world where big cats coexist with humans in an urban landscape, and both of them in high densities!

Aarey Milk Colony, an unofficial buffer zone for Sanjay Gandhi National Park, is an invaluable green space in the midst of the congested metropolis of Mumbai. There can be no denying that an ever expanding city like Mumbai needs better infrastructure, but to provide this at the cost of an ecologically sensitive area might prove detrimental to the health of thousands of residents as well as the city's big cats, which are coexisting in perfect peace – a unique man-animal harmony seen nowhere else in the world. If we protect such areas from encroachments and maintain them as eco-sensitive zones, they will reward us by functioning as the green lung that this highly polluted city needs desperately.

This portfolio shows some aspects of the urban leopards of Mumbai, famously referred to as "leopards with a pin code number and postal address".

Mascots of Mumbai's Wildlife – Mother and Cub

The startling harmony between man and leopard is yet another instance of how Mumbai is unlike any other city in the world. Urban leopards usually avoid interactions with humans and move silently at night, when human activity decreases. However, it is not uncommon to see a big cat on the roads between dusk and dawn. We have been following this particular leopardess for quite some time now, right from when she was a cub moving with her mother, to this day when she herself is the mother of two cubs. She has made Aarey Colony, a dairy farm, her home and is absolutely adapted to the human-dominated landscape around SGNP. Bold by nature, she crosses a high-traffic, high-speed road regularly along with her cubs and moves right up to the south-western edge of Aarey, which has both slums and residential towers. Here she is seen with her cub at a water hole created by the local residents for dogs. The light filtering through the foliage comes from a house barely 50 metres away. It is remarkable how relaxed the pair seems, despite the proximity to a human settlement.

The Megalopolitan Big Cat!

It took serendipity and eight months of camera trapping to frame together the elegance of a leopard with the moon overhead and city elements beyond. This was after the placement of multiple IR (Infra Red) camera traps for more than a year to study the movements of leopards in Aarey Colony. The study recorded nine leopards, one of which is seen in this photograph.

Humans in my Backyard/ Big Cat in my Backyard!

What is urban today was not so yesterday. The frame of civilization was put upon a patch of verdant forest. When humans came, the big cats developed what humans would call manners. They operate in time slots, which make them virtually ghosts to their not-so-new human neighbours. Most human occupants are unaware of the original citizens of this land, but thankfully, those who are aware, have learnt to quietly appreciate the cultivated intelligence of these big cats, which has enabled them to coexist. The Warli tribal to whom this house belongs is one of them. A Warli painting inside the house depicts a leopard in a quiet comfort zone, which allows the Warli owner and many tribals like him to coexist with the leopard, inspite of occasional close encounters. It took the camera-trap four months of patient vigilance to capture this unique man-leopard coexistence.

Living with Leopards - Conflict or Coexistence?

Despite sporadic leopard attacks on humans, the tolerance of the Warli tribe ensures cohabitation with leopards on the fringes of the Park, which lacks an effective buffer zone. The homes of the Warli tribals have traditional paintings of birds, animals, and plants, which demonstrate the eternal respect that this tribe has for wildlife. When I heard about a Warli man who was comfortable with leopard movement in his porch, where his son barely survived a leopard attack, while a neighbour did not, I decided to install a camera trap to capture this unique human-leopard coexistence right at the spot where the boy was attacked. While I got images of two different leopards entering this alley, it took three months to get the image that I wanted – that of a leopard walking towards the camera through the alley! High-rise dwellers living adjacent to the Park could use the empirical knowledge of the Warli tribe to learn how to coexist with leopards, which would help to greatly reduce human-animal conflict.

Nayan Khanolkar is a conservation photographer, naturalist, and educator. He has been documenting leopards outside Mumbai's Sanjay Gandhi National Park for over four years.

Shades of Grey:
Human-Wildlife Conflict in Northern Pakistan

Fathul Bari and Muhammad Ali Nawaz

OSAMA AHMAD

Snow Leopard kept in the Naltar animal facility

"I didn't kill the snow leopard, I just kept it away from my yak," says Shamayoon Khan of Hispar. "I now see the reality of what you've been saying." Shamayoon comes from one of many communities in Central Karakoram National Park, Gilgit-Baltistan. He had been demanding a cash amount equivalent to the market value of a yak he had lost to a snow leopard, one in many cases where people bear such loss with patience, rather than hounding snow leopards or wolves across the Park's snowy pastures. Shamayoon does not even keep a gun in the pasture, although herders in these valleys have a tradition of bearing guns for personal safety and livestock protection.

The Snow Leopard Foundation's 10-year advocacy effort has begun changing hearts and minds. We could not pay for his yak, but

we did institute an insurance scheme to share snow leopard caused losses in future. More importantly, his village has been included in the ibex trophy hunt since 2017, which provides an avenue of direct wildlife-based income for the community.

Top predators such as wolf, lynx, brown bear, black bear, and snow leopard are concentrated across the entire snow leopard range in Pakistan. Maybe as a result of climate change, even the common leopard has made its way into the area. Wolves and snow leopards commonly prey on livestock, and the two bear species aggravate the situation of human-wildlife conflict in Neelum Valley by raiding crops. An average of four heads of livestock per year per household are killed, according to recent findings, but the figures can go as high as 11 in areas of intense conflict. High figures were obtained from areas where multiple predators exist together, Chitral Gol National Park, for example, which hosts snow leopard, wolves, lynx, and the common leopard.

Human-wildlife conflict is not so much about predators and livestock owners as it is a conflict of people's views and ways to use wildlife as a natural resource. The conflict is due partly to local people's deeply entrenched traditions, and partly a poor understanding of biodiversity and deriving economic benefit from it. Unfortunately, the nature of conflict with wildlife varies from valley to valley, demanding different approaches. These stories are well worth sharing.

Bagashai the hunter

Bagashai had bagged two snow leopard, three black bear, and five wolves during his hunting career. When he died, Lamsan, a Kalasha man from the extreme west of the snow leopard range praised him, speaking of his bravery and hunting prowess. It is tradition to keep a dead person's body for three days, all the while eulogizing the ability of the deceased to end the lives of wild animals. The culture is beautiful in its own way, though such gatherings and stories do not usually go well with conservationists. But the problem is that these traditional cultural values are hundreds of years old, and cannot be reversed overnight – an inability to kill wild animals is considered

EJAZ UR REHMAN

Altaf Ali Shah, Range officer Wildlife with the Markhor Trophy Hunt in Tooshi-Shasha Community Controlled Hunting Area (CCHA)

SNOW LEOPARD FOUNDATION, PAKISTAN

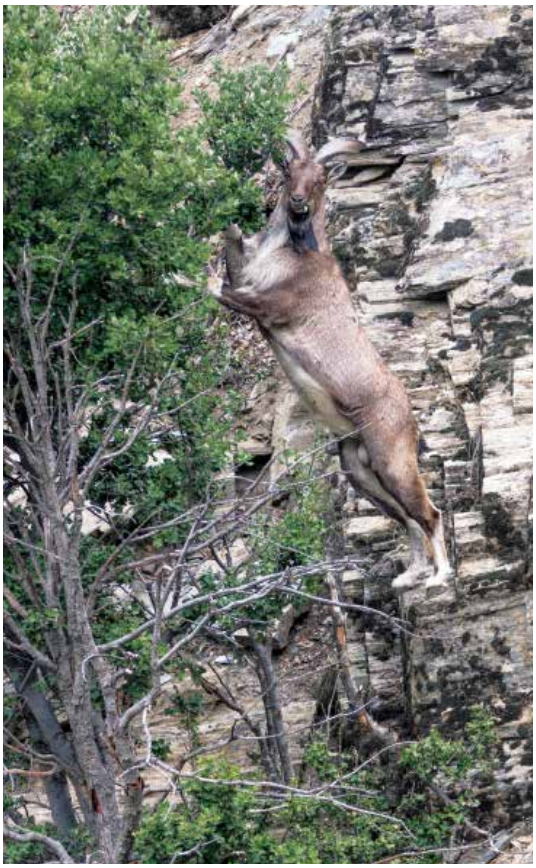
Camera trap photo of wolf in Shigar Baltistan

to be a sign of cowardice. Change in these age old concepts can be effected only with long-term dedicated efforts and sensitivity. A recent proposal is to include messages of conservation in the majority of local wildlife published material and children's literature. The time is opportune too, as the Kalasha language has recently developed a written script.

Silent death

Piyang dong are traps frequently encountered during treks to the high pastures of Gilgit-Baltistan. These earth-and-rock traps are instruments of a silent death. Baited with meat, they attract carnivores into a pit. As the animal enters the pit, a heavy rock drops onto it like a lid, imprisoning the animal with fatal consequences. This age old cruel practice has killed hundreds of wolves and other predators over decades.

By contrast, the herders of Torkhow valley practice *shapir vali*, or guarding against wolves. Yak owners take turns spending the night with the herd in the high pastures to



ABDULLAH KHAN

Male markhor foraging on oak leaves in Chitral Gol National Park

SNOW LEOPARD FOUNDATION PAKISTAN

Snow leopard caught in a camera trap in Hisper Valley, Gilgit Baltistan

ABDULLAH KHAN

A view of Shigar Valley, Baltistan

protect them. This practice is peaceful. There are no traps and no guns, just a watchful eye. People must be encouraged to abandon *piyang dong* in favour of *shapir vali* through a system of incentives.

A different kind of shooting

Imtiaz Ahmad hails from Hunza Valley. A snow leopard attacked his livestock one night. He took careful aim, and fired off – with his camera. His story was published by BBC in 2012, earning him fame and a career as a wildlife photographer. This just goes to show that it is not impossible to change people, from shooting with guns to shooting with cameras.

Trophy hunting programmes

Trophy hunting programmes are operational in many areas of the snow leopard's range. More than US$ 1.7 million was generated in income from hunting of ungulates such as ibex, markhor, and blue sheep for trophies during 2000–2014 in the Gilgit-Baltistan region alone. Khyber Pakhtunkhwa saw payments of US$ 3.3 million during 1999–2015 from the same source. Recently, an American hunter paid US$ 110,000 to shoot a Markhor in Gilgit-Baltistan; 80% of such money goes to the local people who now see an immense value in species such as markhor and ibex and protect them (https://www.kpbs.org/news/2019/feb/14/a-us-hunter-paid-110000-to-shoot-a-pakistani-goat/).

Local authorities and NGOs use the hunting initiative as a snow leopard conservation tool, but it is possible for the conservation viewpoint to be lost. Some people in Hunza Valley began considering trophy hunting programmes for snow leopard. Some feel this would actually help

conserve snow leopards. Others just think snow leopards are better dead, using the words "your snow leopard" and "our ibex and blue sheep": claiming ownership of the ungulates and declining stewardship towards the predators. It takes a great deal of time and patience to make people understand the concept of ecological integrity, to explain to them that snow leopard, ibex, and blue sheep are all "yours", and why trophy hunting is not meant to target rare and top predators.

The Snow Leopard Foundation is working with various stakeholders in the Gilgit-Baltistan region. Wildlife staff are being trained, ecosystem health workers are being deployed in communities to offset disease-incurred losses, and postgraduate students are involved in research on snow leopard, its prey species, and the ecosystem. Efforts to decrease conflict and make co-existence possible include livestock vaccination and insurance, and creating alternative livelihoods through handicrafts programmes.

Ashraf, the living memory

"When I was a young boy, I spotted snow leopards several times in the pasture. But they never attacked our animals," said Ashraf, an 87-year-old from Terich Valley, interrupting a heated debate on snow leopard conservation in the valley. His interjection was opportune, as it gave us a chance to talk about our conservation ideas. "What do you suppose snow leopards ate then?" we asked. "Ibex, what else?" he replied.

That meant there were more ibex when Ashraf was a child. It dawned on the villagers that more ibex meant abundant food for snow leopards and, therefore, fewer livestock kills. Further questioning revealed that ibex hunting was rarer in those days, ensuring a solid natural prey base for wild carnivores. It also came to light that there were fewer households, and, therefore, fewer livestock to challenge the ibex's food supply. The problem today is larger herds of livestock — more than natural pastures can sustain; and more ibex hunting, leaving large carnivores

ZAHARAN CR

Markhor (male) in Chitral Gol National Park

MUHAMMAD YOUNIS

Team Snow Leopard Foundation, Pakistan in consultation with the communities

no choice but to attack livestock. Essentially, people are the problem, not the ibex, and certainly not the snow leopard.

We used this opportunity to echo Ashraf's words, mix in some science and try to make the new generation understand the real problem. Back at camp, our team leader Mr Hussain Ali summarized the evening. "Science is convincing when presented in local settings. They have experiences and lessons, and we must use those experiences to present our arguments logically."

Local knowledge

People in some of these remote mountainous areas have been living there for thousands of years. Their history is one of dependence on natural resources. They had a system of self-governance and customary laws, which are still found in some areas, which dealt with natural resource usage sustainably. This included rotational grazing and limited firewood collection based on certain prescriptions.

Newer knowledge and changing governance systems chipped away at indigenous knowledge and systems of resource utilization. They did not consider landscape suitability or applicability, and essentially ignored the wisdom of elders. This has led to a dangerous attitude towards natural resources, where profit reigns supreme without any consideration for the ecological well-being of the landscape. It is, therefore, essential to rediscover old sustainable ways and support them with scientific logic. This will ensure the integrity of these fragile mountain ecosystems, allowing peaceful coexistence with wildlife. Fortunately, there are signs of it happening in the high mountains of Pakistan.

Fathul Bari is based at the University of Chitral and works on wildlife resources of the mountainous areas, focusing on human interactions with wildlife.

Muhammad Ali Nawaz is based at Quaid-i-Azam University, Islamabad, and focuses on understanding ecology, coexistence, and conservation issues of the carnivore community in northern Pakistan.

The Other Side of the Coin

Kulbhushansingh Suryawanshi

PRASENJEET YADAV

A snow leopard resting in a ravine after killing and eating a domestic goat in Spiti Valley, Himachal Pradesh

"Are you married?" asked the elderly lady sitting next to me in a cable car suspended a hundred metres above a swift flowing mountain stream in the Spiti Valley in Himachal Pradesh. Surrounded by snow-clad mountains, deep gorges, and the crisp cold air of the Himalaya, this was quite the setting for matrimonial conversation. It would be another 15 minutes before we reached the other side of the river, so there was no way of evading this situation. The four foot by three foot basket suspended under a metal cable was the best transport connecting the two remote villages in the mountains. Before I could think of an evasive reply, she continued, "Why don't you marry one of your snow leopards?" Her words betrayed a sense of resentment towards the snow leopard, which was now directed at me. Everyone in the region knew that I had been

MUNMUN DHALARIA

Participants in the Shen project from Kibber village, with their handicraft products

studying snow leopards in Spiti for several years now. Her tone was light, so it was up to me to brush it aside as a snide remark or to engage her in a serious conversation.

This was a watershed moment in my interaction with the people of Spiti. Until now, I had reserved all serious talk about wildlife and conservation for respected elderly men in the village. Here, in the most unusual of places, I had been called out of my shell to engage with a section of the society that I had never engaged with. To give myself the benefit of the doubt, it had never been a conscious thought; it is just the way our society is organized.

"Why, do you dislike me or the snow leopards?" I chose to engage her in a serious conversation. She quickly apologized and said that she did not mean it. This helped clear the air, to have a discussion as equals. She mentioned how she was tired from not being able to sleep for the past few days, because a snow leopard had been frequenting their livestock pen for three nights and she and her children were staying up to scare it away. She told me how, when her eldest son was little, a snow leopard had killed their only cow and there was no milk for the little child for several months, until her husband could buy another cow. She had known about and even benefited from the government compensation and the livestock insurance that our organization, Nature Conservation Foundation (NCF), had helped set up. She was grateful for this support, but added that it did not help her get a night of peaceful sleep! Her husband kept the money that they received as compensation for the livestock that they lost to snow leopards and wolves. Sometimes he used it to buy replacement livestock, but at other times he just spent the money. Looking after the livestock during winters was anyway a woman's job. The stress of caring for them during the harsh winter, only to see them taken by the carnivores, was a harsh burden.

As we alighted from the cable car, it was my turn to apologize and rethink some important assumptions in my PhD work. Market economics was only one dimension of the impact of wild carnivores on pastoralists. There is also the complex dimension of the social and psychological cost of living with large carnivores, which I had not considered so far. Men controlled the finances of the household and the community, and they had been very articulate in explaining their woes of living with large carnivores. But the hidden costs of wildlife conservation are being borne by women, and are rarely measured, let alone

addressed. This is the other side of the coin in human interactions with wildlife.

The problem became even more apparent to us when we conducted a study of human attitudes toward carnivores in 25 villages across Spiti. In this study, we ensured that 50% of the participants were women. My colleague Saloni Bhatia led the fieldwork. The results provided a new insight for our entire team. Women across the study region had consistently poorer attitudes than men toward wild carnivores like the snow leopard and wolf. This was true even for villages that had very successful conservation programmes to mitigate the economic cost of living with carnivores. To me, the only explanation for this pattern was that a hidden cost that the women were bearing had remained unmeasured.

Through this study, we learnt that women had poorer attitudes toward carnivores, but we also learnt that attitudes improved with formal education and income, and worsened with age and dependence of the village on livestock-based income sources. We knew that girl children had poorer access to education and that the women do not have access to the household cash income. So the issue of women having poorer attitudes was multifaceted. Women received less formal education, they did not have access to cash income and they bore the hidden cost of livestock predation by snow leopards and wolves in terms of increased hours

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A young snow leopard walking along a rocky overhang, photographed by a camera trap

PRASENJEET YADAV

An adult male Himalayan ibex in Spiti Valley

of work and poorer nutrition. The study revealed several attitudinal factors, not only about how the local pastoral community perceived the snow leopard and the wolf, and what affected their attitudes toward these carnivores, but also about myself as a scientist and conservationist. The outcome of our good effort is often subject to our biases, which are reflected in whom we interact with in the society. While I identified myself as an egalitarian scientist and conservationist, my actions revealed that I had been shaped by a complex interaction with the local society.

The findings of this study came around at a time when our team was already getting ready to mainstream women into our conservation initiatives in Spiti. One of our senior colleagues in Mongolia, Bayarjargal Agvaantseren, had pioneered a women-led enterprise called Snow Leopard Enterprises, to engage women in snow leopard conservation and help them raise cash income for themselves. This initiative had been running successfully for over 10 years. In India, our colleagues Radhika Timbadia, Ranjini Murali, and Saloni Bhatia initiated discussions with the women in Spiti about the possibility of a similar women-led enterprise that could produce and sell local handicrafts to raise awareness about snow leopard conservation and to generate cash income for the women. The overarching goal of such a project was to involve women in the local conservation discourse. Such an enterprise could be an avenue for women to express their concerns during our discussions about conservation. These conversations led to the formation of Shen – an initiative of the Snow Leopard Enterprises. Shen means snow leopard in the local Spitian dialect of Tibetan.

Shen serves as a platform for women to organize themselves. One of the first women's groups formed under Shen is proudly

called 'Golden Eagles' by its members. Shen hopes to provide women with exposure to the outside world that will help them gain the experiences that their education could not give them. Every year for the past five years, 10 women from Spiti travel to Delhi to display and sell their products at *Dastakar Haat*, one of India's largest handicrafts fairs. They spend about two weeks interacting with a market society independently and on their own terms. Shen hopes to provide the women with a small but independent cash income. In 2016 alone, the participating women from two villages generated revenue of two lakh rupees from their handicrafts. All the participants have their own bank accounts, an important milestone in their path towards financial liberty.

Most importantly, Shen hopes to provide an opportunity for women to directly engage with on-ground conservation activities within and around their village. I still get goose-bumps reading about the incident when five women from the Ama Chokspa group in Kibber village of Spiti went to stop

PRASENJEET YADAV

A young blue sheep in Spiti Valley. Ibex and blue sheep are the primary wild prey of the snow leopard

PRASENJEET YADAV

Snow leopard leaving its daytime resting place in search of prey in the evening

KALZANG GURMET

Spiti women of the Shen programme on a field trip

20 odd men, who had come from outside Spiti to work on a road project, from chasing and catching a blue sheep, which they were certain to kill and eat. The five women stood their ground in the altercation that ensued and threatened the men with jail if they ever thought of doing something like that again. Over the past five years, Shen has grown to include 80 women from six different villages. Each village group organizes itself independently and focuses on the unique set of challenges and opportunities available to them with the support provided by NCF.

After we saw the results of our first study on the attitudes of local people in Spiti, and learnt about the women's poorer attitudes toward snow leopards and wolves, we started looking around. We conducted similar studies in other snow leopard range countries like Mongolia, Kyrgyzstan, Pakistan, and China. To our surprise, this pattern is consistent across all these countries. We looked at other published studies and realized that this pattern may even be global. To me, it suggests that conservation efforts globally need to be more egalitarian and that there is a need for initiatives like Shen that directly engages women in conservation, if conservation has to meet its goals fully.

Shen has received financial support from the Conservation Leadership Program and is currently being supported by ICICI–P rudential Life Insurance Company Ltd., Snow Leopard Trust, and Dastakar. More information here: http://ncf-india.org/projects/sle

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Human-Wildlife Conflict in Nepal Himalaya

Naresh Kusi

NARESH KUSI

Wild yak in its serene natural habitat

Human communities in the Nepalese Himalaya are mostly agro-pastoralists whose livelihood base rests on agriculture, livestock husbandry, and collection of non-timber forest produce. High-altitude pastures in the mountain landscapes act as a natural capital to sustain the traditional lifestyle of agro-pastoralists. Unsurprisingly, these pristine areas, nestled in the lap of the majestic Himalaya, are home to different species of wild animals. In a situation like this, where wild animals and humans share the same resources, human-wildlife conflict is inevitable.

Livestock herders graze domestic yak *Bos grunniens*, cattle *Bos taurus*, dzos/jhoppas (yak-cattle hybrids) *Bos* sp., horses *Equus ferus coballus*, sheep *Ovis aries*, and goats *Capra*

NARESH KUSI

Himalayan tahr in an agricultural field, Phortse, Sagarmatha National Park, Nepal

aegagrus hircus in the pastures during the late spring and summer every year. These herding periods usually coincide with the breeding season of large carnivores like Himalayan wolf *Canis* sp. (taxonomic classification pending), snow leopard *Panthera uncia* and Eurasian lynx *Lynx lynx*. Often, the livestock density is very high, which competes with and outdoes wild prey like blue sheep *Pseudois nayaur*, Himalayan tahr *Hemitragus jemlahicus*, Himalayan marmot *Marmota himalayana*, and woolly hare *Lepus oiostolus*.

A reduction in wild prey forces carnivores to take the more abundant and less wary domestic livestock. It is equally true that with high livestock density, herders lose more livestock to carnivores even in places with high-density of wild prey populations. During the herding seasons, the locals are also busy with lambing (February), sowing (April to May), sheep shearing (June), and collecting caterpillar fungus *Ophiocordyceps sinensis* (May to June), consequently paying less attention to the protection of livestock. This makes free-ranging and little-herded livestock (usually true for yaks and horses) highly vulnerable to depredation by carnivores.

Livestock depredation is undoubtedly an important factor influencing the herder's hostility towards carnivores, because the socio-economic consequences of livestock depredation by carnivores in economically marginalized pastoral communities are usually severe. Frequent loss of livestock to carnivores instigates the herders to kill the carnivores to prevent future livestock loss, and in response to past attacks on livestock. People resort to killing the predators using various methods including

NARESH KUSI

A tunnel trap targeted at snow leopards and Eurasian lynx

NARESH KUSI

A pit-trap targeted at wolves

snare traps, pit traps, tunnel traps, carcass poisoning, firearms, and by smoking out dens (usually for wolves). Carcass poisoning had a substantial role in causing the local extirpation of wolves from various regions in the Nepalese Himalaya. It should have affected other scavenging carnivores also. However, as a positive consequence of establishing protected areas, wolves and other carnivores are making a comeback in most of their historic ranges.

Conservation organizations (both governmental and non-governmental) have come up with incentives like livestock insurance schemes, and mitigation measures like predator-proof livestock corrals and installation of fox-lights to encourage community support towards protecting the large carnivores. Currently, livestock insurance schemes are spatially limited in Nepal, and only snow leopard kills are compensated. Furthermore, the monetary compensation offered is very low. For instance, in 2016, herders in Kanchenjunga Conservation Area (KCA) in eastern Nepal received merely US$ 70 as compensation for losing an insured yak (to a snow leopard), which would be worth US$ 923 in the local market. During our recent visits to the area, many herders showed unwillingness to participate in the scheme, referring to this low amount of compensation. At the same time, most herders who had participated in the scheme suggested that the compensation amount should at least be equivalent to the market cost of a young of the livestock species predated.

NARESH KUSI

A snare trap set up for snow leopards and wolves

Herders lose their valuable livestock to snow leopard, wolves and Eurasian lynx, but the livestock insurance scheme pays compensation only if the depredation is caused by the snow leopard, as mentioned earlier. Such conservation interventions, focused on a single species, may lead to

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A predator-proof livestock corral, in Upper Mustang, Annapurna Conservation Area, Nepal

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A herder with predator-deterring fox-light, Upper Mustang, Annapurna Conservation Area, Nepal

unintended negative consequences, because they are likely to neglect the need to educate people about the interrelatedness of different species of carnivores and the importance of biodiversity as a whole. It is high time that carnivore conservation interventions move towards targeting the entire predator guild, rather than focusing on a single species. Conservation of the entire carnivore guild will help maintain important species interactions, while ensuring that the population of wild herbivores is balanced and the ecosystem is well regulated. As such, the recently amended wildlife damage relief guidelines of Nepal confer compensation to herders in events of livestock depredation by wolves also, but practical implementation is lacking.

The problem of livestock depredation can also be reduced by improving herding practices. For this, herders should be encouraged to keep their livestock in larger

NARESH KUSI

A snow leopard pelt on display during a local festival, Upper Humla, north-west Nepal

herds, attended by an adequate number of herders, and avoid known predator hotspots. They can be trained in the construction of robust, predator-proof, livestock corrals to protect herds at night. To ensure that the corrals remain usable for a sustainable period of time, locally available stones can be used as construction material to build high walls, in combination with chain-link to cover the open top. Such improvements may help to prevent carnivores from jumping easily into the corrals. Arrangements can be made to add livestock protection measures, such as the installation of lights and sound deterrents, predator detecting systems connected to a siren that sounds upon approach, and livestock-guard dogs.

These interventions can be coupled with other incentives like development and sale of handicrafts, promotion of self-sustaining home stays, and livestock vaccination. Studies have shown that these methods and incentives give better results when implemented in combination rather than any one in isolation. While working on these mitigation measures, it is equally important to ensure that wild prey population remains intact, and that the livestock numbers are managed below overstocking levels. Since both livestock and wild prey have to depend on the same resources, management to maintain quality habitat and promotion of traditional practices of rotational grazing of livestock can favour a better co-existence between livestock and wild prey.

Reduction in carnivore numbers has led to an increase in incidence of crop raiding by wild ungulates (for example, blue sheep in Langu valley of Shey-Phoksundo National Park, and Himalayan tahr in Sagarmatha National Park and Langtang National Park). While increasing carnivore density can be thought of as a natural remedy, appropriate mitigations are required to upgrade livelihood support to the local communities.

One form of human-wildlife conflict prevalent in the Nepalese Himalaya, that remained unnoticed for a long time, is the conflict of livestock herders with wild yak *Bos mutus* in Upper Humla, north-western

NARESH KUSI

A Himalayan wolf killed by carcass poisoning and later hung in a local monastery, Upper Humla, north-west Nepal

Nepal. Local yak herders in Upper Humla graze domestic yak (a different species from the wild yak) frequently in wild yak habitats, forcing the wild yaks to move away to remoter locations. During the herding season, old wild yak bulls make occasional visits to the herder's camp in an attempt to mate with domestic female yaks. Interestingly, female domestic yaks elope with wild yak bulls – a similar phenomenon is seen in the Kaziranga landscape, with wild buffalo bulls and domesticated cows! As a consequence, the furious herders resort to killing the wild yak in retaliation, or to prevent hybridization, because the hybrids resulting from interbreeding between the two yak species are generally shyer and more difficult to domesticate.

Wild yak is the largest wild mammal of the Tibetan Plateau. Tibetans have a tradition of hanging wild yak heads at the entrance of their houses as a status symbol. These heads fetch a good price in the nearby markets of Tibetan Autonomous Region of China, and thus, hunting is the biggest threat to them in Nepal. As a matter of fact, wild yak, which were only recently 'rediscovered' from Nepal, are critically endangered in the country.

Wild yak conservation efforts in the Nepalese trans-Himalaya should adequately address this conflict issue, and bring forth adequate and effective programmes on raising awareness in the local communities. For an effective resolution of the conflict, government-level initiatives like creating habitat refuges for wild yak, while encouraging rotational grazing of domestic yak in other available pastures, maintaining livestock numbers (usually yak), and halting wild yak poaching and trade may prove relevant.

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Human-Bear Coexistence: Conservation Challenges in India

Harendra Singh Bargali

India, with a geographical area of 32,87,263 sq. km, is the seventh largest and second most populous country in the world, with a population of over 1.3 billion. Its landmass constitutes only 2.4% of the total land area on earth, but it astonishingly supports about 17% of the world's human population! Despite such statistics, India stands among the 17 mega-diverse countries, and supports a variety of ecosystems with almost 8% of the world's biodiversity.

Out of the eight species of bears distributed worldwide, four species, namely sloth bear *Melursus ursinus*, Himalayan brown bear *Ursus arctos isabellinus*, Asiatic black bear *Ursus thibetanus*, and Malayan sun bear *Ursus malayanus* occur in India. The only other country that has four bear species is China, which is three times larger than India. China does not have sloth bear, instead there is the giant panda *Ailuropoda melanoleuca*. In India, bears inhabit a wide range of habitats and landscapes extending across 26 states. Sloth bear is reported from 19 states, Asiatic black bear from 12 states, and Himalayan brown bear from three states, while the sun bear is distributed in five of the north-eastern states.

HARENDRA SINGH BARGALI

A sloth bear cub busy eating ants and their eggs

Notwithstanding their widespread distribution, bear occurrence in these areas is largely patchy. A significant population of all bear species exists in degraded and rapidly changing heterogeneous landscapes outside the Protected Area (PA) network. Since India is also home to the more charismatic megafauna such as tiger, elephant, and rhino, there is a lack of species-specific conservation programmes for bears. As a result, in-depth information on species and updates on their status and distribution are completely lacking. However, over the years, there has been an increase in incidental information on bear species, gathered while collecting information on other priority species and from reportage of human-bear conflict.

Sloth Bear

The sloth bear is endemic to the Indian subcontinent and occurs in India, Nepal, and

Sri Lanka. In India, its distribution ranges from the southern tip of the Western Ghats to the Himalayan foothills. Though its range extends across 19 states, its distribution is patchy and a significant proportion of the population occurs in degraded areas outside PAs. One important habitat feature required for sloth bear survival outside protected areas is rocky outcrops for dens. Where this is available, sloth bears are able to manage even in heavily degraded habitats, getting some food from adjoining agricultural landscapes.

Sloth bears are rated among the most dangerous of wildlife in India. While they are digging for termites with their forequarters in the ground, woe to the human who comes too close. If it is a mother with young cubs, she is sure to attack. Usually, most of the incidents of human casualties are due to attack by a single bear, rather than a mother with cubs or a group of bears. In central India, incidents of crop damage and frequent human casualties from sloth bear attacks have been reported. In Madhya Pradesh, 735 instances of human casualties were reported from 1989 to 1994. Similarly, 395 such cases were recorded in North Bilaspur forest division in Chhattisgarh, from 1973 to 1998. In Odisha, 167 incidents of human-sloth bear conflict were reported in Balasore Wildlife Division from 2002 to 2013. Such incidents are also reported from most other parts of its distribution range.

The sloth bear is mostly active at night; however, in undisturbed areas, it has been seen as active during the day as well. Incidents of human casualties occur mostly in the morning hours, when people go out into crop fields or adjoining forests for defecation, or venture into the forest to collect non-timber forest produce such as mahua *Madhuca latifolia* flowers and honey, and to graze cattle. The majority of the attacks were reported within a one-kilometre distance from human habitations, which further indicates the capability of the species to use degraded habitats.

HARENDRA SINGH BARGALI

Hillocks of boulders in Maikal range of hills, Central India, provide safe den sites to sloth bear

HARENDRA SINGH BARGALI

Traditional way of collecting mahua flowers by burning leaves and litter under the tree, aiming at both cleaning the ground and protection from sloth bears

Habitat degradation and fragmentation have been identified among the major causes of the increasing number of human-bear conflicts. The major reason for the conflict is the growing shortage of food in the forest, such as honey, mahua flowers, and fruits of ber *Ziziphus mauritiana* and jamun *Syzygium cumini* among others, as these are also collected by humans. Outside PAs, stone quarrying

in sloth bear habitats leads to habitat loss and degradation. Such sloth bear habitats, which act as corridors between PAs, are also getting altered due to expansion of human settlements, agricultural fields, road network, and other developmental activities.

Habitat degradation is leading to patchy distribution and isolation of sloth bear populations in the Indian subcontinent. This bear was once common and even abundant throughout the Indian peninsula, but due to habitat loss and poaching for its gall bladder for the illegal wildlife trade, it is disappearing over most of its range. It has already vanished from the bulk of its range in Assam and northern West Bengal, and has recently become extirpated in Bangladesh and Bhutan.


HARENDRA SINGH BARGALI


HARENDRA SINGH BARGALI


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HARENDRA SINGH BARGALI

Cases of injuries caused by sloth bear in Chhattisgarh

Asiatic Black Bear

Coming to the Asiatic black bear, its distribution range in India extends across 12 states, throughout the Himalaya in north India in the altitudinal range of 300 to 3,500 m, the Eastern Himalayan ranges, and the hills of north-east India. In north-east India, its distribution range overlaps with that of sloth bear and Malayan sun bear. Habitat degradation, poaching for its gall bladder, fat, and even meat, as well as retaliatory killings are among the major threats to the species. The Asiatic black bear is reported to raid villages for stored fruits and honey in the Pir Panjal range of Jammu and Kashmir, where it causes both crop damage and livestock killing, as in the Dachigam landscape. These interactions also lead to attacks on humans. Incidents of livestock killing are also reported from the higher altitudes in Uttarakhand. People in the Himalaya degrade black bear habitat by lopping various species of oak, particularly banj oak *Quercus leucotrichophora* and rianj oak *Q. lanuginosa*, to feed their livestock. This prevents the trees from producing acorns, which are an extremely nutritious food for black bear. Collection of kaphal fruit *Myrica esculenta*, which is fondly eaten by both bears and humans, is another problem.

Himalayan Brown Bear

The subspecies of brown bear found in India is known as the Himalayan brown bear *Ursus arctos isabellinus*. Its distribution includes subalpine and alpine habitats in the Greater Himalayan and Trans-Himalayan regions of the states of Jammu and Kashmir, Himachal Pradesh, and Uttarakhand. Other than a detailed study on human-brown bear conflict in Kugti Wildlife Sanctuary in Himachal Pradesh, there is hardly any scientific information available on this species. Existing populations are reported to be in very low densities, and the information available on the nature of the conflict is limited.

In Himachal Pradesh, Himalayan brown bear raids agricultural fields for crops such as wheat, maize, barley, and buckwheat. Moreover, attacks on sheep and goats result in direct conflict with graziers. All through its range in the Himalaya, the brown bear may be poached or killed by nomadic graziers in retaliation to predation on sheep and goats.

Sun Bear

In India, sun bear distribution is limited to the north-eastern states, which is also the westernmost part of its global distribution range. Sun bears usually occur in low densities in the periphery of their distributional range. Unlike other bear species in India, this bear is not exposed to much conflict with humans, thus attacks on people are rare or absent. Occasional incidents of human-sun bear conflict are reported from Manipur and Mizoram. Studies based on questionnaire surveys in the north-eastern states have indicated illegal killing of sun bear for various reasons, including meat consumption and trade in body parts. Other threats are habitat loss due to illegal tree felling for trade, encroachment, shifting or jhum cultivation, construction of roads, coal mining, and construction of dams.

In India, bear distribution is patchy, and significant bear populations exist outside protected areas. Habitat loss and degradation are among the major threats to bear conservation in rapidly changing heterogeneous landscapes outside protected areas. Human-bear conflict and trade in body parts and even (sun bear) meat for consumption are the other conservation issues. Asiatic black bear is listed under Schedule II, while the other three bear species are listed under Schedule I of the Wildlife (Protection) Act, 1972. Internationally, Himalayan brown bear is categorized as Endangered whereas all other species are included in Vulnerable category of the IUCN Red List of Threatened Species. In case of CITES, the Himalayan brown bear comes under Appendix II, while the other bear species are included in Appendix I.

RAJAT BHARGAVA

Warning signboard to caution people about the presence of sloth bears within the municipal limits of a town

Though bears have the same level of legal protection as other charismatic species in India, they do not find a place among the priority species for conservation by government agencies, conservation organizations, and grant-making institutions. Availability of information on ecological and behavioural aspects of bears, together with updated information on their status and distribution, will be crucial in planning future conservation strategies. Considering the presence of bears in multiple-use landscapes outside protected areas, there is a need to apply both preservationist and coexistence approaches to ensure long-term conservation of bears in such habitats.

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Janus-faced interactions: Human-macaque conflicts in India

Sindhu Radhakrishna

SHAURABH ANAND

Rhesus macaque feeding on cooked food in Shimla, Himachal

Human-wildlife conflicts occur when interactions between human and wildlife individuals, groups, or species result in negative consequences for one or both parties. According to this perspective, most of the primate species in India are involved in conflict with humans, as anthropogenic modifications to the environment have resulted in deforestation and forest fragmentation, leading to habitat loss for many Indian primates. Primate injury and death due to hunting, poaching, and trapping by humans is also another aspect of human-primate conflict. Such hunting and trapping may serve to obtain meat for private consumption or commercial sale, for sport, to obtain individuals for the pet trade, or for utilization in scientific research, and sometimes to prevent or retaliate against crop depredations. Yet, the type of human-primate conflict that has received predominant attention in India is crop- and house-raiding by primates, primarily due to the economic losses suffered by farmers due

to crop depredation. Apart from financial losses arising from crop depredation and damage to property and kitchen provisions, primate raiding activities may also result in injury (and death on rare occasions) to humans.

Of the 22 pimate species in India, more than 50% are known to raid crop fields and kitchen gardens. These include Arunachal macaque *Macaca munzala*, Assamese macaque *M. assamensis*, bonnet macaque *M. radiata*, Rhesus macaque *M. mulatta*, crab-eating macaque *M. fascicularis*, pig-tailed macaque *M. leonina*, stump-tailed macaque *M. arctoides*, capped langur *Trachypithecus pileatus*, Dussumier's sacred langur *Semnopithecus dussumieri*, and Hanuman langur *Semnopithecus entellus*. Some species that inhabit urban areas like the bonnet and rhesus macaques, and Hanuman langur may also raid human habitations and cause damage to household materials and objects. Crop-raiding primates are typically generalist species with a broad dietary range that allows them to feed on human food sources, as well as occupy ecosystems that straddle human settlements and forest habitats. However, more recently, the lion-tailed macaque *Macaca silenus*, a primate that is endemic to the rainforests of the Western Ghats in southern India, and was understood to be a habitat specialist with a narrow dietary niche, has been observed entering houses and coming out onto highways to feed on human food.

Why do primates raid crops or houses and kitchen gardens? Findings from a number of studies suggest that more than one factor may be responsible. The nutritional efficiency of cultivars and human foods is believed to be an important reason that drives animals to crop- or kitchen-raid. Cultivated foods are easier to locate and access, easily digestible, and possibly more palatable than wild foods for primates. They also contain lower amounts of dietary fibre and are richer in carbohydrates and calories than wild foods. Hence crop-raiding is a foraging strategy that maximizes energy intake for the raider. Apart from the nutritional content of cultivars, several environmental, landscape-related,

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Rhesus macaques raiding crops in Solan, H.P.

SHAURABH ANAND

Rhesus macaque feeding in a cropfield in Solan, H.P.

SHAURABH ANAND

Rhesus macaque provisioning at a railway station

SHAURABH ANAND

Rhesus macaque tries to snatch eyeglasses from a man in Jakhu temple, Shimla

and species-specific factors are also known to influence the intensity and frequency of crop-raiding. For example, farms located near the forest edge reportedly experience more crop damage than those located some distance away; and non-availability of wild foods is believed to increase the frequency of crop-raiding events. While a study on red-tailed monkey *Cercopithecus ascanius* in Uganda showed that solitary males cause more crop damage than groups, a study on orangutans showed that females initiated significantly more crop-raids than males.

Among the primate species that are known to crop-raid in India, macaques are the more problematic taxa, and amongst them, the rhesus (much more widely distributed and seemingly more aggressive than other macaques) is undoubtedly the most serious conflict species. Human-rhesus macaque conflict has been a focal point of debates in election campaigns in northern India, in the media, and in judicial discussions, so much so that the species has been dubbed a "simian terrorist" in news reports. This is due to two main reasons. For one, being widely distributed, the extent of area exposed to rhesus macaque conflict is fairly high. Secondly, this macaque is extremely adaptable and inhabits urban and rural human settlements alongside forests and agrarian ecosystems. Hence, apart from crop- and kitchen-raiding, it is also involved in nuisance activities such as property damage, attacks on children and adults, food snatching and harassment in recreational spaces, all of which affect urban and rural human populations.

Human-rhesus macaque conflict is reported from many regions across the geographic distribution of the species – Assam, Manipur, Arunachal Pradesh, Uttar Pradesh, Himachal Pradesh, Uttarakhand, and Andhra Pradesh. Of these, the rural areas of the hill states of Himachal Pradesh and Uttarakhand are severely affected by its crop depredations, while the cities of Hyderabad, Shimla, and Delhi are enormously troubled by its house raiding and nuisance activities. Financial losses due to rhesus macaque crop damage in Himachal Pradesh have been variously estimated as ranging from 10–100% to 40–80% of all crop losses, US$ 200,000 in agriculture and US$ 150,000 in horticulture, and an estimated INR 325–375 crore per annum. Horticulture and agriculture are the mainstays of

economy in these states and economic losses due to these depredations have caused many farmers to abandon their farms and look for alternative sources of livelihood. In response to the social unrest caused by rhesus macaque crop depredations, MoEF&CC in 2016 declared it as a vermin species in certain regions of Himachal Pradesh, permitting lay citizens to kill the species at will.

Drivers of human-macaque conflict

Historical and literary accounts indicate that crop-raiding by primates is not a recent phenomenon in India. Two thousand year-old Tamil poetry describes monkeys stealing grain from people, and even in 1938, W.V. Grigson wrote: "In Hindu India the monkey is always present, being sacred and so free to devour anyone's crops." Reports regarding the intolerability of primate crop depredations or urban harassment have largely arisen over the past 25 years, and may thus reflect a very real escalation in conflict. What are the reasons for this increase?

Many studies suggest that the rapid increase in macaque population is responsible for the escalation in human-rhesus macaque conflict in urban and rural areas. Surveys in Himachal Pradesh show that their numbers have increased multifold over the years – from an estimated 19,500 in 1977 (when the first survey was conducted by the Zoological Survey of India), to 70,000 in 1980, 2,05,274 in 1990, 3,17,512 in 2004, 2,26,086 in 2013 and 2,07,614 in 2015. The low numbers recorded in 1977 have been attributed to the export of the species to laboratories in North America and Europe in the early and mid 20th century. Post the ban on export in 1978, rhesus macaque populations recovered rapidly. The increase in numbers may also be due to their dependence on human foods. Studies in Japan and elsewhere attest that artificially feeding monkeys with large amounts of nutritious food results in increased birth rates, lower infant mortality, and younger age at first birth. In India, as in many parts of South and Southeast Asia, provisioning

SHAURABH ANAND

Rhesus macaques feeding in a garbage dump in Shimla, H.P.

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Awaiting opportunity, rhesus watches woman selling food

monkeys with food is a socio-cultural practice rampant in religious and tourist locations. Monkeys are provisioned with food by humans in two ways – voluntary feeding of monkeys in temples and recreational spaces such as public parks and tourist spots, and involuntary provisioning, when monkey groups gain access to garbage or food dumps. Some macaque species (including the rhesus) may also naturally gravitate towards human habitations to gain access to food and shelter.

While access to human food may be partly responsible for the increasing number of rhesus macaque groups near human settlements, loss of forest home range due to anthropogenic encroachment is also an important reason why many primate species turn to crop-raiding. Another factor that may have contributed to the sudden increase in rhesus numbers is the human practice of translocating problem monkey troops. Hundreds of monkeys have been trapped and released elsewhere by farmers and lay citizens in order to rid their own area of the nuisance. This has resulted in artificially inflating macaque population numbers in the release sites, thereby creating new conflict areas. Unsupervised large-scale translocations of this kind also negatively impact the population dynamics of other primate species that may be the original inhabitants of the release sites. A study that examined current distributional limits of the bonnet and rhesus macaques in India concluded that introduction by humans has led to the rhesus expanding its distributional range into the southern peninsula, into areas formerly occupied by bonnet macaques, resulting in a further decline in population levels of the endemic bonnet macaque.

A holistic view of all these factors suggests that human-rhesus macaque conflict in India operates in a cyclical manner, with various factors feeding into each other. Loss of forest habitat to anthropogenic encroachment, in combination with macaque behaviour, leads to macaque movement towards human settlements. Access to human foods near human settlements through food provisioning and/or crop-raiding leads to attacks and injuries. This in turn leads to translocation of macaque troops to other areas, thus artificially inflating the population of macaques in certain locations. The fallout of this increase in macaque population is increased conflict in terms of crop- and house-raiding, and thus the cycle is perpetuated.

Conflict mitigation strategies

Human responses to primate crop- and kitchen-depredations in India typically include chasing away of monkey troops using dogs, catapults, and air guns, capture and translocation of problem troops, and shooting or poisoning of monkeys. Some of these measures only result in short-term success, while others are detrimental to the survival of monkey populations. Attempts to translocate problem troops to monkey sanctuaries have also met with limited success. More recently, there has been a focus on preventive management, such as population control through sterilization, garbage management, and strict enforcement of non-provisioning, and attempts to create fruit belts in buffer zones between farms and forest areas. While these measures promise long-term effectiveness in conflict mitigation, they currently suffer from improper management. For example, the

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Rhesus macaque shot dead in Himachal Pradesh following the vermin order

monkey sterilization programme that was launched in 2007 in Himachal Pradesh has been successful in sterilizing 96,500 monkeys; however individuals are picked haphazardly, and many have died during the procedure. A population survey of rhesus macaque conducted in 2015 in Himachal Pradesh concluded that their overall population had declined in the state, though some regions showed a sharp increase in rhesus numbers. The study recommended that continuing with systematic sterilization of adult individuals would help in rhesus population management.

Another significant problem is people's attitudes towards the conflict species and their perceptions of the intensity of conflict. It has been well-documented that people's perceptions regarding the damage caused by the conflict species, or its destructive nature, dictate reactions against the species far more strongly than do actual losses. Primate conflict studies in Himachal Pradesh show that although farmers consider rhesus macaques to be agricultural pests, they are unwilling to physically harm the species in retaliation due to their religious beliefs. Religious veneration is a predominant aspect of human perceptions regarding monkeys in India; however, studies also attest that people's tolerance for monkey conflict activities reduces over time. Additionally, different communities in India vary in their cultural reverence for primates, and people in some regions do resort to killing primates in retaliation for crop- and house-depredations. Apart from attitudes towards the conflict species, disagreements between human stakeholder groups can also challenge the success of mitigation strategies. For example, a study showed that farmers at the receiving end of macaque crop depredations in Uttarakhand were very resentful of the forest department because they felt that they were insufficiently compensated for damages that were caused by the 'forest department's wildlife species'.

The road ahead

Unlike many wildlife species, conflict macaques live in close association with humans in India; this makes conflict resolution a complex and challenging task. The predilection of many macaque species to voluntarily move towards human settlements and the tendency for humans to provision macaques may be important factors that shape the onset of conflict. However, the same association has also led to a deep religious and complex cultural relationship between macaques and people, which makes conflict mitigation simultaneously simple and complicated. As with Janus, the Roman god of beginnings and endings, human-macaque conflicts begin and end with the cultural relationship between humans and macaques. A simple conservation approach that focuses only on humans or on primates is unlikely to work well in the long-term. Instead, the need of the hour is a multidisciplinary research approach that will not only study primate ecology and behaviour, but also human attitudes towards conflict species, to achieve a holistic understanding of the issue.

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A Conflicting Life
with Nicobar Long-tailed Macaques

Ishika Ramakrishna

The word 'conflict' is an unfair one. It suggests angst, frustration, and violence, precariously balanced between its English and sociological meanings. Often, we focus on the negative interactions that we observe between people and wild animals, labelling them as 'conflict scenarios' for which we need to find quick solutions. These interactions between people and their neighbouring wildlife are, however, a little more complicated. The issue of human-wildlife conflict encompasses a diversity of situations – from man-eating large cats to grain-eating rodents. With circumstances as wide-ranging as these, it is challenging to categorize or define the true relationships between them. Human-wildlife interactions embrace the past, present, and foreseeable future of all involved, making it all the more important to understand them closely.

ISHIKA RAMAKRISHNA

Some individuals of a troop of Nicobar long-tailed macaques socializing one late afternoon. This may involve playing, grooming one another, or having a last snack before turning in for the night

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The canopy of a clump of *Pandanus* by the sea. Long-tailed macaques often spend several hours of the day foraging or resting among these trees, which provide shade, refuge, and food to these coast-loving monkeys

People's interactions with wildlife take on several added layers of complexity in the case of primates. Across the world, macaques, langurs, baboons, and even chimpanzees have been known to raid farms, gardens, and homes. In fact, in some places they have become a permanent feature of urban landscapes, making use of infrastructure, market areas, tourist hotspots, and highways to forage for human-provisioned foods. All these primate species have their high intelligence, extreme adaptability, and innate curiosity to thank for their ability to make the best of their changing habitats. It is, unfortunately, these very qualities that irk most people who live among their prolific, notorious cousins.

India is no exception to this global joust with monkeys. They have found their way into (or out of) people's lives in every corner of this country – even down to the very southern reaches of the Andaman and Nicobar Islands. For several years, the Nicobar long-tailed macaque had been tucked away in the dense rainforests and coastal reaches of three islands – Katchal, Little Nicobar, and Great Nicobar. They spent their days feeding on the sea-facing screwpine *Pandanus* fruit – a staple they have always shared with the indigenous Nicobarese community. Then, half a century ago, several families from mainland India began to migrate to the isolated, relatively uninhabited Great Nicobar Island. They trickled in over the years, steadily developing the island to accommodate themselves.

The island-bound macaques have spent the last few decades inching their way closer to human settlements. They have discovered easy-access foods like coconut and banana from plantations, fruits from orchards, vegetables from kitchen gardens and, unfortunately, garbage. Their diet now includes all these items along with the nutritious *Pandanus*, much to the dismay of several locals who lose their produce to the monkeys' opportunistic hands.

How does conflict between people and macaques begin? How did this case of conflict begin? And can we be presumptuous enough

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An adult male Nicobar long-tailed macaque processing a coconut he found along the beach

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A juvenile holds onto a piece of *Pandanus* while feeding on its starchy content. Macaques chew off bits and suck out the starch, leaving behind dry fibre that they spit out

to label it so? These were the questions that churned my mind into studying the rapidly changing relationships between people and the Nicobar long-tailed macaques on the island of Great Nicobar. As I delved into this system by talking to the people and watching the monkeys, my 'how' questions began to appear. The answers, however, were anything but straightforward.

Our understanding of interactions between people and any wild animal tends to come from an accumulation of people's perceptions of their own experiences. When people grow weary and wary of these animals, we call it conflict. In the case of the Nicobar long-tailed macaque and the people they interact with, I found myself relying heavily on the latter's experiences. While I couldn't communicate with the macaques, or pick their bright minds about how times have changed, I followed them around to make a note of all they did. Putting all these observations together, I tried to understand the true nature of these interactions.

People's perceptions of the macaques directly influence their behaviour towards these primates. The process, though, is cyclical, with changing monkey behaviour altering the way people deal with situations where they are directly faced by monkey antics. Through several detailed interviews and conversations with people from across the island, I discovered that each person's reasons for viewing the macaques positively or negatively were different. No two interviews were identical, and rightly so, for no two people are perfectly alike. Each one is a product of a unique upbringing, family history, and personal experience, combined with a unique personality. None of these should be overlooked while understanding why people are amicable or antagonistic towards the monkeys. Further, each person comes from a family of a certain religion, culture, and socioeconomic status. These, in turn, dictate how tolerant they *can* be towards an animal that causes them losses.

"The monkeys are amusing"

The novelty of having sailed into Great Nicobar from mainland India to be faced by these large, dark-coloured and long-furred

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A farmer talks to me about the devastation that monkeys cause in his coconut plantations

ISHIKA RAMAKRISHNA

A watch dog sits guard in a coconut plantation. He has been trained to alert his owner when the macaques arrive and to chase them away before they climb up the trees

monkeys was intriguing for most people. While some were and still are apprehensive of these primates, others found them captivating and amusing to watch. Many of the more recent settlers on the island were still discovering all that the macaques were capable of, keenly observing their behaviour and shenanigans whenever they came close together. In fact, some fantasized about rearing a young one to adulthood, simply for the entertainment that they believed would come from doing so. These desires, however, were not shared by the older settlers, whose tolerance for the monkeys had peaked several years ago. These apparent veterans of living with macaques had had their fair share of amusement, and now they simply wished to be absolved of the daily stress of safeguarding their farms and homes from the monkeys' destructive actions.

"They need to fill their hungry stomachs too"

People's personalities and innate affinities towards the macaques speak volumes. I found myself surprised on several occasions where there was dissonance between the losses someone faced and their perception of the monkeys. One afternoon, a woman welcomed me into her home for a chat about the monkeys, shortly after her house had been raided of its tapioca and brinjal. She described in detail the financial hardships her

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With the macaques finding more food that is easily accessible in villages, their populations have been rising on the island

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The skull of a Nicobar long-tailed macaque on display outside a house. This practice, although illegal, is believed to warn the monkeys from coming closer

household faced, and how they grew their own vegetables to save the expense of having to buy them from the pricey market. When I asked about the monkeys, she elaborated upon how they visited every second day, destroying several days' or months' worth of effort by pulling out the vegetables by their roots. She was particularly sad when the monkeys left the destroyed vegetables uneaten, rendering them useless to anyone else. When I asked her what she thought of the monkeys, she sat upright in her seat with a glint in her eye. "I think they're very lovable," she said shyly. She went on to tell me why, enacting the monkeys' behaviours, mimicking the sounds they make, and likening young macaques to her own growing children. The fact that they cost her heavy financial losses which she was not in a position to bear had not tarnished her own attitude towards the monkeys. She still found joy in their presence.

At the other end of the spectrum was a cook in the government guest house facility.

ISHIKA RAMAKRISHNA

Troops living in urban or semi-urban areas encounter several garbage dumps. Being curious about the resources they offer, they unscrew bottle caps, break open packets and empty their contents into their mouths. This can be rather dangerous, as medical waste could potentially be eaten by the monkeys, leading to poisoning or illness

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A troop rests outside the gate of a temple in Campbell Bay, the most developed strip of Great Nicobar

He earned well each month and could comfortably support his family of five without having to engage in agriculture or gardening. This being said, he despised the monkeys and believed that there wasn't enough room on the island for both people and macaques to live together. He loudly proclaimed that we should kill them all, after which people would live in uninterrupted peace.

"The monkeys in this village are utterly shameless"

People have had a wide range of experiences with the monkeys – some closely encountered and some observed from afar. I was regaled with several decades' worth of anecdotes, both from personal events and island gossip. My own fascination for these animals and their behaviour drew me to their tales as well, albeit with a cautious pinch of salt.

Narratives of these encounters ranged from the feeding of monkeys at temples and homes to the chasing away of monkeys that stole several kilograms of supplies from inside the same places; from an old monkey hitching a ride on the back of someone's bicycle to a group of agitated macaques pulling the sari off a frightened woman. Even the less dramatic tales of monkeys 'stealing' coconuts or 'slapping' domestic dogs took people through a wide range of emotions.

It is human nature to exaggerate negative incidents over positive ones. I observed how even one untoward experience with the macaques could undo years of harmony in people's perception of them. Few people retained their originally positive outlook after having heard of or gone through an unpleasant experience, perhaps irreversibly so.

"These are little Hanumans in my backyard, I cannot harm them"

India is a land of diverse mythology, cultures, and religions, where people may identify with any combination of these. The island of Great Nicobar resembles a mini-India, with representative families from

several states and cultures living in a close-knit mixed bag. The residents of the island are, for most part, staunchly religious as well, visiting at least one of the many existing temples, churches, mosques, and gurudwaras regularly.

The topic of Hanuman came up in several of my interviews, with the people talking me through their belief in and reverence of the "monkey god" from the Ramayana. While many were devotees of this long-tailed god, represented in idols small and large across the island, only a subset directly translated their devotion to the Nicobar macaques. For some people, the blind requirement to respect Lord Hanuman was sufficient to keep them from harming or wishing ill upon the macaques – be it willingly or grudgingly. For others, the distinction between the mythological character and the monkeys that stole their

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A macaque grooms herself after a downpour on this tropical island. The fur, as seen here, is thick and frizzy, allowing macaques to move about in the unpredictable rain without slowing down

ISHIKA RAMAKRISHNA

A Nicobarese woman uses a flat clamshell to extract the starch from *Pandanus* fruit, which she will then steam and cook in different ways. The leftover fibres from the fruit are mixed into pig feed later

ISHIKA RAMAKRISHNA

The people of Great Nicobar are highly religious. Here, women from across the island have just disembarked from a bus to make a procession towards church on a Sunday

coconuts was clear. Some people, however, were disputed, saying they had to chase the monkeys or pelt stones at them, but would draw the line at killing them or causing them serious harm. It was interesting to try and understand the line of reasoning that led a person to firmly stand by or question their religious and cultural ideas in the light of everyday events unfolding before their eyes.

"There's not much we can do except chase the problem away"

The island's history, the macaques' ecology, and the people's varied perspectives towards the situation at hand present a managerial challenge to the local people and the Forest Department. The monkeys, being innovative and intelligent, have been finding ways to dodge every effort to keep them away from people's homes, gardens, and farms. Both the locals and the Forest Department are now struggling to find effective means of safeguarding the people's livelihoods and peace of mind, while simultaneously keeping the monkeys out of harm's way. The solutions need to be as delicate and complicated as the interactions between people and the monkeys, if they are to be effective in the long run. These are yet to be found.

For now, the people still wake up each morning and stand guard in their fields, aided by trained dogs and armed with catapults and stones. They still live on tenterhooks, wondering whether that's a monkey they can hear rustling in the trees above. They still wearily shake their heads when they discover monkey-tampered harvest in their absence. They are still waiting on the prospect of a harmonious coexistence, for they know that the monkeys are, after all, the true owners of the island they call home.

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Human-Wildlife Conflict in Sri Lanka

Jayantha Jayewardene

SUDATH ABEYSINGHE

Elephant herd at Kalawewa National Park, Sri Lanka.
In Sri Lanka, elephants destroy crops on a much larger scale than other species

Sri Lanka is a predominantly Buddhist country with around 70% of its population nominally subscribing to a Buddhist worldview. The Buddha in his teachings has said "One must not deliberately kill any living creature either by committing the act oneself, instructing others to kill, or approving of or participating in acts of killing." In ancient times, the Sri Lankan state protected animals, birds, and other living creatures of the land, pursuant to a moving plea made by Arahath Mahinda, who brought the message of Buddhism to Sri Lanka from India. The first wildlife sanctuary in Sri Lanka was declared by King Devanampiyatissa, who reigned from 307 BCE to 267 BCE. As a result, animal protection is now a part of the traditional culture of

SAMPATH EKANAYAKE

Human-Elephant Conflict: a house damaged in an elephant raid

Sri Lankans who have always had an ethical (if not carefully rationalized) concern for the welfare of animals and who revere all forms of life. However, certain circumstances have induced a section of Sri Lankans to enter into conflict with wildlife.

Human-Wildlife Conflict

Human-wildlife conflict is generally perceived as a situation when wildlife acts in a way that is detrimental or harmful to humans. However, when humans trap, shoot, or kill wildlife, it is not considered a matter of conflict. Poaching animals for meat or certain parts of their body like skin, tusks, bones, and feathers is not seen by humans as causing conflict. However, should a leopard kill a dog, calf, or goat for food, the act is perceived as a conflict that humans have with leopards. Humans, apart from killing birds and mammals, enter forests to collect fruits, tubers, medicinal plants, honey, beeswax, and other such non-timber forest produce.

In Sri Lanka, elephants destroy crops on a much larger scale than others species such as spotted deer, sambar, Indian porcupine, and wild pigs, and create a greater perception of conflict. The average number of humans killed by elephants each year in Sri Lanka is 65. The number of humans killed annually by snakebite in Sri Lanka is around 120, and in 2018, dengue spread by mosquitoes caused the death of 202 humans. However, it is

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Coconut tree pushed down by wild elephant

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Elephants eating garbage, a sad reflection of human intrusion into their habitats

man's conflict with elephants that is always kept in the public eye and highlighted by the media. In this essay, I discuss the issue of human-wildlife conflict in Sri Lanka with regard to elephants and other fauna.

Elephant

Sri Lanka is an island country with an increasing human population demanding more and more land for various needs. The only lands that are now left for wildlife inhabiting forests are the remaining habitats of the elephants. With even these habitats on the decline, elephants are forced to venture out of their home ranges in search of food, resulting in conflict between humans and elephants.

Humans use guns and firecrackers to keep elephants away. Pumpkins are filled with poison and explosives, locally called *hakka patas*, and put out in crop fields for elephants. The pumpkins explode when bitten into and blow the elephant's mouth away. Planks with nails driven into them are left on the paths that elephants use. When trodden on, the nails penetrate the elephant's foot. In pain, the elephant stamps its feet in an effort to get rid of the plank, but this only drives the nails further into the foot, increasing the pain. Hot oil or burning polythene is also thrown onto crop-raiding elephants to deter them. Such harassment prompts elephants to attack humans, even to the extent of lying in wait to ambush them.

Leopard

The leopard occurs in all habitats throughout the island – the arid, dry, and wet zones. In hill country, leopards are found in forest patches, tea estates, grasslands, home gardens, as well as pine and eucalyptus plantations. Leopards prefer hunting at night but are also active during dawn and dusk. They are not averse to carrying away dogs, goats, and calves for food. It is then that the leopard comes into conflict with humans. When domestic animals are taken by a leopard regularly, it is shot. Some leopards also attack and kill humans. In earlier times, there were many records of

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Leopards get caught in traps laid out for wild pig, porcupine, and deer

man-eating leopards in Sri Lanka, the "Man-eater of Punani" being the most notorious.

Many leopards die due to cable-wire traps or snares. Snaring is an extremely unpleasant way to kill an animal as it results in extensive suffering and can drag on for a long time. These traps are largely laid out for wild pig, porcupine, and deer, but leopards also get caught in them since they use the same paths as their prey. The trapped leopards are left to die on their own or are killed. In the past 10 years, at least 38 leopards have been killed by snares set mostly for wild pig, with the actual toll probably far higher.

Wild pig

Wild pig is a species that is responsible for a lot of damage in agricultural fields. According to the present wildlife law, a farmer can kill a wild pig if it trespasses onto his property, but the meat cannot be transported or sold. However, they are already being killed in large numbers and are sold under cover, since there is a big demand for their flesh. Trap guns*, snares, and *hakka patas* are being used to kill wild pig, and these also kill non-target species. Electrified wires are laid

PALITH ANTHONY

Wild boar, with a clearly visible left tusk

* Trap guns are loaded and set on jungle paths, at a height that will kill smaller mammals like deer, porcupine, wild pig, etc. A trip wire activates the gun.

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Injured rusty spotted cat

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The endemic toque macaque of Sri Lanka

on jungle paths used by these animals, and humans also get killed sometimes when they unwittingly come into contact with these wires.

Sloth Bear

Sloth bear attacks on humans are reported in Sri Lanka. A bear will move away on hearing the approach of a human; it does not attack humans intentionally. However, a bear that is suddenly surprised and encountered in the jungle (especially a female with cubs) will stand up on its hind legs and attempt to claw and bite the human. Most of the time, the victim does not die, unless he/she bleeds to death. Most victims of bear attacks are maimed and disfigured for life, with gashes on the face and arms, eyes gouged out, bites on the nose, and ears being torn off.

Crocodile

Of the two species of crocodiles that occur in Sri Lanka, the saltwater crocodile *Crocodylus porosus* is known to attack, kill, and eat humans. The saltwater crocodile is found in rivers and estuaries in the southern part of Sri Lanka. The Nilwala Ganga in Matara has a high concentration of saltwater crocodiles,

RUWAN BANDARA

Reasons for conflict can arise when porcupine populations close to cultivated areas surge

SUDATH ABEYSINGHE

Rose-ringed parakeets feeding on harvested paddy

and thus the intensity of human-crocodile conflict there is high. Humans are attacked when they enter the water to wash clothes, bathe, or fish. Victims are dragged under water and held till they drown. Some may escape or lose an arm or leg while fighting to break away from the grip of the crocodile's strong jaws.

To address the threat from crocodiles, people lay out poisoned meat or shoot the animal. Building an iron netted cage in the water, so that the people could bathe safely, is a safety measure. However, as the part of the cage facing the land is not fenced, there have been instances of crocodiles coming ashore at night and getting caught in the cage on trying to leave the land before daybreak. And people venturing into the cage in the morning get attacked by the trapped crocodile.

Primates

The population of the endemic toque macaque *Macaca sinica* has increased significantly in Sri Lanka. As a result, many have been forced to come out of their jungle habitats in search of food. They initially came to raid the garbage that was strewn all over the streets. Troops of monkeys are now found in urban and semi-urban areas throughout the country. These monkeys are very bold and aggressive, and attempt to bite people who try to drive them away from their houses. They remove the tiles on roofs, raid kitchens, and cause damage and destruction to households in many other ways. The tufted grey langur *Semnopithecus priam* and the purple-faced langur *Semnopithecus vetulus* are agricultural pests, but are not aggressive, do not raid houses, and generally do not get into conflict with humans.

Other animals

Giant Squirrels raid all types of fruit trees and even coconut palms. Indian Peafowl, parakeets and other seed-eating birds destroy crops, some even eating up seeds as they are sown in the field. Porcupines root out plants for their food. Rodents are well known for their depredations on grains. All these species are agricultural pests that adversely impact the village economy.

Wildlife habitats are being reduced rapidly and fragmented due to human intrusions. This has a negative effect on wildlife populations and the predicted scenario will soon become a reality, unless humans take cognizance of this overarching problem with positive and effective action to arrest the trend.

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Human-Wildlife Conflict in Nepal

Kanchan Thapa

AKASH SHRESTHA / WWF NEPAL

Solar powered electric fences are becoming increasingly popular in Nepal. Community members inspect the fences for regular maintenance

Thaba Sarki, a farmer by profession, hails from Rapti Sonari village which is situated along the outskirts of Banke National Park in Nepal. While she continues to battle most of life's issues with ease, losing her crops to elephants and recently wild pig has been a particularly problematic area in her life. Tired and helpless in the face of crop raid incidents in her small rice field along the forest corridor in Banke National Park, Sarki is usually fretting and complaining about the ordeal. In recent years, elephant related conflict cases have been on the rise, posing challenges for conservation fraternities to effectively manage the situation.

Fence Dilemma

As a person from the conservation fraternity myself, I wonder and question, where exactly are we going wrong when it comes to dealing with this situation? I have seen hundreds of kilometres of solar-powered electric fencing being installed to stop elephants from entering fields in different parts of the country, especially around settlements near the fringes of national parks. Although the mechanism seemed to work for some time, the entire operation has failed in many places in the absence of timely maintenance. In many instances, communities failed to remove the

undergrowth along the fences that caused leakage of the current flow, making the system ineffective. I pause. Maybe we had forgotten to explain simple maintenance tricks to people. This reminds me of a paper by Garrett Hardin, "The Tragedy of Commons", that talks about how one of the things that leads to failure in managing conflict is inconsistency in maintaining fences.

I visited the state of Assam in north-east India in 2015 to observe some practices to mitigate human-elephant conflict. In the process, I happened to visit Thapa Gaon, a small village located on the outskirts of Guwahati, comprising around 25 households that had been constantly attacked by herds of elephants a few years ago. However, the village wore a different look during my visit. The local people had installed single-line solar-powered fences that they found to be very effective in preventing elephants from entering their village. The fences were wired on poles bent at a certain angle to avoid breakage. What could be better? The collective effort of the communities in Thapa Gaon to maintain the fence has kept the hedge intact!

From my observations, I gathered that norms which compel communities to regularly maintain such measures are a must. Nepal is regarded as a frontier in community-based conservation. Communities living in the vicinity of Bardia National Park have come up with fencing guidelines, which are expected to compel the people to maintain the fences installed in the area. The replication of simple yet innovative fencing in Assam's Thapa Gaon and fencing guidelines to enforce their upkeep, like the one in Bardia, will certainly help people like Thaba Sarki in Banke avoid human-elephant interface.

AKASH SHRESTHA / WWF NEPAL

Community members inspecting the solar powered fence in Khata Corridor, Nepal

SIMRIKA SHARMA / WWF NEPAL

An SMS-based early warning system is an effective way to avoid conflict with elephants. Communities receive a message alerting them on the presence of approaching elephants near Bardia National Park

Models of ex gratia

According to the statistics of the local administration and park authorities in Nepal, elephants are the highest on the list of conflict creating animals. The data from 2010–14 shows fatalities as high as 66% caused by elephants alone. Given the severity of the problem, the Government of Nepal and conservation fraternities came up with curative measures such as the provision of ex gratia, which is compensation given to communities victimized by human-wildlife conflict. From the government managed fund at the central treasury, ex gratia is provided to the affected communities after the victim's family furnishes an application at the nearby national park office. Though time-consuming, providing ex gratia has proved beneficial in cases related to human casualties.

In order to shorten the time period of pay out of ex gratia, conservation fraternities such

SHAYASTA TULADHAR / WWF NEPAL

Communities guard their fields against crop raiding in Banke National Park

as WWF Nepal put into place a local fund mechanism that is managed by the Buffer Zone Council, to provide immediate relief to the affected communities that are later reimbursed from the national-level fund. Buffer Zone Council is a local institution that administers buffer zone communities surrounding national parks in Nepal. This mechanism seems more effective, as the victims receive money on a timely basis.

Furthermore, community forestry, a devolution of state forest functions to community forest groups, has been a highly successful programme implemented by the Government. In the mid-hills of Nepal, a relief fund has been established with initial seed money and all the community user groups located within a certain geographical area, demarcated by a sub river basin, can replenish the relief fund from their membership fees. Each community user group annually deposits around nine dollars (IRs 636) in the bank account, which is used to alleviate conflict incidents. Ex gratia is provided to the victim's family if the case is registered within that area. This funding model is innovative and efficient; there are more than 20,000 registered community forest user groups in the country, and these groups function as catalysts in managing cases of human-wildlife conflict in Nepal.

Lastly, the conservation fraternity has also come up with ex gratia that has been designed to secure livelihood activities such

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An early warning system has been installed in a village near Chitwan National Park

SHEREN SHRESTHA / WWF NEPAL

A wild bull elephant attempting to enter a village to raid homes and crops near Bardia National Park

as tailoring, vegetable farming, and livestock rearing, among others. The family of Bimala Pariyar, who lost her life during an elephant attack in Bardia National Park recently, received a cash amount as ex gratia and used the money to start a tailoring business, to cite one example. All the above models designed for the procurement of compensation could help communities avoid possible backlash against conservation and perceive it in a more positive light.

Strategic approach in dealing with conflict

Given the severity of human-elephant conflict in the lowlands of the Terai, there was an urgent need to develop a national level strategy to cope with the situation. In this context, the Government recently drafted

SHAYASTA TULADHAR / WWF NEPAL

This lady was attacked by a leopard while returning home from the forest. She survived the attack and maintains that she has no grudges against the carnivores, and enthusiastically shows her healed wound

SHAYASTA TULADHAR / WWF NEPAL

Livestock depredation by leopard is common in the Terai. Communities have built predator-proof corrals as a possible preventive measure

WWF NEPAL

Machan constructed along the boundary of the forest to keep watch and guard the village against incoming wildlife from Bardia National Park

AKASH SHRESTHA / WWF NEPAL

Traditional barbed wire fence used for deterring wildlife from entering into villages and farmland

a mitigation measure strategy specific to elephants, along with associated action plans. This is a first-of-its-kind policy document in the country that has been designed with the objective of managing conflict issues based on the geography in a holistic manner. Nepal's first elephant biologist, Dr Narendra Man Babu Pradhan states, "Analysis of human-elephant conflict cases shows individual negligence as a primary reason for such incidents. Raising awareness among the masses can help prevent conflict to a great extent."

Interaction with other wildlife

Beside elephants, a published study on the pattern of human-wildlife conflict shows that leopards, rhinos, bears, and tigers caused most of the human fatalities and injuries in the mid-hills and Terai region. With the rhinos, given their distribution pattern, conflict is confined along the areas surrounding national parks in the Terai. Mirkakunga Buffer Zone User Committee in Chitwan National Park has built a concrete wall along the interface between the forest and communities to avoid interactions with rhinos. We are yet to see its effectiveness.

Conflict with leopard is widespread in Nepal, given this cat's wide distribution. In Baitadi district, located in the north-west part of the country, more than 33 people lost their lives in the recent past. It has been argued that the success of the community forestry programme (management of forest is handed over to the community) has led to increase in leopard population, especially in mid-hills. Many conflict cases have been reported in urban-centric places, including Kathmandu valley. The Government of Nepal has set up an immediate strategic measure for rescuing animals and releasing them in safe places, far from settlement areas. As a long-term strategic solution is pending, the Government is now devising a long-term strategic document for mitigating human-leopard conflict. Success of the mitigation measures applied to human-leopard conflict in Sanjay Gandhi National Park in India could be worth exploring.

Three species of bears, Asiatic black bear, sloth bear, and brown bear are found in Nepal. Sloth bear are exclusively found in the Terai and Churia foothills. Asiatic black bear

SABINA KOIRALLA

Human-monkey conflict is on the rise, especially in the mid-hills in recent times. A monkey raiding maize crop in a typical agricultural field, close to the forest

is primarily recorded along mid-hills habitat and high mountain protected areas. Records show that the majority of bear attacks on humans happened inside national parks.

Conflict with tiger is another pressing issue among the buffer zone communities surrounding national parks in Terai. Records show that most human fatalities from tigers have occurred inside the forest. This can be avoided with proper awareness among the communities. Conflict with tigers has decreased in the recent past.

Monkey Mania

Attacks by monkeys, especially macaques, are a problem in the mid-hills of Nepal. The situation recalls events from Pierre Boulle's *La Planete des Singes*, a novel adapted into the hit movie Planet of the Apes. Conflict between humans and monkeys is a huge problem, especially with regard to crop raiding. Given the social and religious sentiments attached to the species, active population management such as culling of the conflict animal is not practiced. As an immediate solution, monkeys are being captured by hiring professional catchers and releasing the problem animals elsewhere. This is just an unwise strategy of shifting the problem to another place. A few mitigation measures are being piloted, but we are yet to see the results. Nepal welcomes a pragmatic solution to human-monkey conflict.

All said and done, human-wildlife conflict is an emerging issue and only a holistic and strategic plan and its implementation will ensure the coexistence of humans and wildlife.

Kanchan Thapa is a wildlife biologist at WWF Nepal. His research focuses on population and landscape ecology.

Human-Wildlife Conflict in Rajasthan

Dharmendra Khandal, Divya Khandal, and Ishan Dhar

DHARMENDRA KHANDAL

Radio-collared rescued tiger makes a leap for freedom

In a remote corner of Rajasthan, we went to explore places and facts forgotten by history. We worked our way down into a deep gorge of the Vindhyan plateau, and on the escarpment saw a prehistoric human shelter, which had a pictograph of a tiger. The blood-red hematite ore rock art panel not only depicted the tiger, but also the context of that period. The tiger was surrounded and attacked by a band of humans with bows and arrows, who were perhaps trying to protect their livestock or even themselves, for that matter. The scene depicted in this prehistoric cave remains the same in the present era, but now human-wildlife conflict (HWC) is no longer just a battle for survival between humans and wildlife. It is, many a time, man-made, and most of the time, perceived incorrectly. The new defining concern is that we have to save the very same species with

which we have been in conflict. It is better that we quickly realize that these species are essential for our own long-term survival. They are essential to maintain our precious ecosystems, and it is on the services of these ecosystems that our existence is dependent.

Rajasthan is the largest state in India, and covers 10.5% of the total area of the country. Most of its protected areas (PAs), totalling 3.2% of the extent of the state, are located in the hilly areas of the Aravalli and Vindhyan ranges, while just two sites are situated in the desert areas of the state. Rajasthan's economy is primarily reliant on agriculture and the rearing of livestock. About 50% of the state's area comes under cultivation. The state stands second in the rearing of livestock and first in rearing goats. Human-wildlife conflict in Rajasthan has two aspects – one where there is a direct threat to human or animal life, and the other adversely impacting human economy or animal habitats.

Besides Ranthambhore and Sariska Tiger Reserves, Rajasthan has established its 200 sq. km third tiger reserve known as Mukundara Hills Tiger Reserve in 2013.

DHARMENDRA KHANDAL

A rescue operation that went wrong. Range Officer Daulat Singh (indicated with an arrow) was seriously injured when the tiger was cornered by a crowd in a village just outside Ranthambhore Tiger Reserve around noon

Mukundara

The State Government of Rajasthan's decision to create and re-populate the Mukundara Hills Tiger Reserve in the district of Kota is a direct consequence of the exponential population growth of tigers in Ranthambhore; more than 20% of the reserve's tigers roam outside its boundaries, making conflict inevitable. The decision to establish and re-populate Mukundara attempts to address the slow rise of conflict in Ranthambhore; and it was surprisingly welcomed by the local communities in Mukundara.

Mukundara is an experiment in its infancy. There are currently four tigers in the reserve. Three (2 females and a male) of these were relocated there from Ranthambhore by the Forest Department, while a fourth (a male) naturally migrated 150 km south to Mukundara from Ranthambhore, affirming the presence of a natural corridor between the two habitats. The project has seen both popular support and criticism, especially when it comes to how repopulation could influence the dynamics of human wildlife

DHARMENDRA KHANDAL

A daring rescue of a tigress from an open village well. Wild animals frequently fall into uncovered wells in the peripheral villages of Ranthambhore Tiger Reserve

DHARMENDRA KHANDAL

Tranquilized and unconscious, the tigress and her rescuers are precariously lifted out of the well together on a suspended platform

DHARMENDRA KHANDAL

Being loaded into a vehicle post darting by the rescue squad. Such operations demand diligence and flawless coordination

conflict in Mukundara. Steps have been taken to mitigate potential conflict, such as the fact that repopulation is being carried out in an incremental manner and an 80 sq. km holding enclosure with predator proof fencing has been erected to release tigers in phases. However, far more has to be done to prepare the ground for a viable population of tigers living in minimal conflict with their human neighbours. This dry habitat has multiple villages that will simply have to be relocated to increase habitat space and also reduce the risk of human-wildlife conflict. Although the frequency has been relatively low, Mukundara does have a history of human-wildlife conflict when it comes to

sloth bears and leopards. The repopulation project is still in its early stages and only time will tell what the projected human-wildlife conflict scenario will look like.

Crop raiding

Rajasthan is a challenging agronomical landscape for farmers as most of its agriculture (75%) is rain-fed and based on erratic monsoons. Crop-raiding animals only aggravate an already bleak situation. The state has the maximum number of potential crop-raiding species existing outside PAs in the country, comprising antelopes (nilgai, chinkara, and blackbuck), wild pig, primates (langurs), canids (golden jackal, desert fox), and Indian peafowl. Near protected areas, the situation is slightly different, since most PAs are near the Aravalli or Vindhya hill ranges, where groundwater is available for irrigation. In such areas, monsoon crops, such as *jowar* (sorghum) or *bajra* (pearl millet), have become secondary, as the market demand for these crops has decreased, so people grow them mainly as fodder for livestock. The primary crops nowadays are wheat and mustard. When the dry deciduous forests start to dry up after the monsoon, wheat fields entice the ungulates to raid them. This was not the case three decades ago, when both the facilities, electricity and bore wells, were not easily accessible for farmers.

Recent Forest Department wildlife estimates show that while only 29,200 antelopes occur within protected areas, triple the number exist outside them. Similarly, jackals and langurs also have the same ratio in numbers within and outside PAs. This could be because 74% of the local communities in the state are vegetarian, which is far higher than the average (31% for all communities) in India, besides the fact that killing animals is also a cultural taboo in the state. There are few predators (primarily wolves and leopards) outside PAs in proportion to the high number of herbivores, which only worsens the situation as crop depredation continues. Free-ranging dogs are the only predators in such landscapes, but they do not bring about a natural balance in the population of herbivores.

There is no crop compensation scheme in the state at present, so it is a difficult task to calculate tangible damage from crop-raiding by wildlife. A very big step was taken to prevent crop-raiding through the construction of walls around protected areas, but as wildlife also exists outside these PAs, this initiative did not work. On the peripheries of Rajasthan's PAs, about 500 km stretch of up to 2-metre tall walls was

DHARMENDRA KHANDAL

Coexistence of humans and wildlife is the key to conservation. A local community member stands before folk art depicting a tiger

DHARMENDRA KHANDAL

Human-tiger conflict dates back to prehistory. This cave painting from Rajasthan is perhaps one of the earliest human acknowledgments of such conflict

constructed by CAMPA and World Bank funds, and MNREGA schemes. The cost of construction of these barriers might be in the millions, but the result is that while the barriers may have helped address the crop-raiding problem, locals keep breaking the walls to illegally to graze their animals – the same breaches are then also used by wildlife. A study shows that in the 100 km wall around Ranthambhore, goatherds broke the wall at about 250 places to enter the forest for grazing. The wall may not be working as a physical barrier to stop illegal grazing or crop raiding, but it is working as a psychological barrier to stop encroachment on the protected area, so a large group of forest officials are supporting this idea.

Fencing individual fields is quite possibly the only option, and inclination towards fencing is rapidly increasing, but ultimately it will badly harm many species of wildlife outside PAs. Natural fencing with thorny plants such as *Ziziphus*, *Euphorbia*, and *Opuntia* occupies a lot of space and takes time to grow, so people are losing interest in such fences, and so conflict continues.

Livestock killing

The livelihoods of the local communities of Rajasthan are primarily based on the rearing of livestock. In India, the state stands second in the number of heads of livestock – 577.32 lakhs, while it stands seventh with a human population of 744.88 lakhs. Most sanctuaries in the state face enormous biotic pressure due to livestock grazing.

Livestock killing by big cats is considered to be a major issue relevant to rural livelihoods and conservation, because many carnivore species have been heavily persecuted as a direct result of elevated conflict levels with communities. In most places, the Forest Department provides compensation to the community when a predator kills their livestock; however, there are several problems in the process and its implementation. In 2015, more than 400 livestock kills were compensated by the Ranthambhore Forest Department. Most livestock are killed by leopards.

Tiger Watch Ranthambhore conducted a study in Ranthambhore, which revealed a shocking difference in compensation cases

DHARMENDRA KHANDAL

Cloth fencing in the bed of the Banas river to protect the cucurbit crop from jackals

DHARMENDRA KHANDAL

A leopard relaxes on the wall of a ruin overlooking a town.
Leopards frequently find themselves hedged into human dominated landscapes

and actual kills made by predators. Out of 10 different ranges, we collected data on kills from three ranges, which revealed that the majority of livestock killing incidents go unreported in these ranges. Only five out of 119 livestock predation incidents actually received livestock compensation from the Forest Department! There are three major reasons to not report such cases: the livestock was taken into prohibited areas for grazing; the process of reporting is complicated; and the process is time consuming, so that many a time, the villagers feel it is easier to eliminate the predator themselves.

Conflict with tiger, leopard, and sloth bear

Leopard: According to the Forest Department, around 600 leopards exist in the state. There are 25 wildlife sanctuaries and three national parks in the state, and most have populations of leopard, except those in the desert, e.g., Tal Chhapar and Desert National Park.

Efficient rescue teams based out of five cities (Udaipur, Jaipur, Jodhpur, Kota, and Sawai Madhopur) in Rajasthan cover almost the entire state for rescuing various problem animals. These five teams have rescued 200 leopards in the last 10 years (incidentally, 400–500 leopards are being rescued in the neighbouring Gujarat each year). These 200 leopards were rescued from human habitations, agricultural fields, deep open wells into which they fell, or from the clutches of snares or jaw traps laid by poachers. Two interesting patterns have become apparent, the first is that leopards have been dispersing from the Aravallis, and some are moving towards the desert areas, as some were rescued from places as far as Chauhtan in Barmer, Nagaur, Hanumangarh, Churu, and Jodhpur. Historically, the desert areas did not have leopards. Second, most of the rescued animals were males and they were likely exploring new ranges. Jaipur-based veterinarian Dr Arvind Mathur rescued 46 leopards,

out of which 43 were males. There are four districts in which quite a few human beings have been killed by leopards: Pratapgarh, Dungarpur, Rajsamand, and Alwar. In the last 15 years, as many as 30–35 humans were killed by leopards in these four sites.

The Forest Department took a proactive step this year by launching Project Leopard, Rajasthan being the first state in India to launch this project. Project Leopard may sound like it is meant to increase the population of leopards in the state (as was the objective of Project Tiger), but this is more like a project to conserve leopards by improving their prey base, mitigating conflicts with humans, and eliminating poaching.

Sloth Bear: Forest Department records state that a total of 900–1,000 sloth bears exist in the state. Around 70% of the wildlife sanctuaries of Rajasthan have sloth bear populations. There are several forested areas in the state outside of the protected areas where they are also found. Even though they are present in various parts of the state, bear conflict is disproportionately concentrated around Mt Abu. Every year, 6–7 people are badly mauled by bears and most of the victims are among the locals. Mt Abu is a hill station with hundreds of tourism facilities, and thousands of tourists who irresponsibly throw garbage around, which attracts bears to venture near human habitations. Mt Abu earns a large amount of money from tourism, and in order to reduce the conflict with bears, priority should be given to address the problem of garbage dumping in this hill resort.

Tiger: Rajasthan has lost 96% of its historical range of tiger distribution, and tigers are now confined to the Ranthambhore

DHARMENDRA KHANDAL

A farmer chases a leopardess off his field in broad daylight on the periphery of Ranthambhore. Conflict often results in more injury to animals than to humans

DHARMENDRA KHANDAL

A tigress wanders into the bustling town of Khandar outside of Ranthambhore in broad daylight. Tiger Watch's Village Wildlife Volunteers maintained calm and kept the growing crowd of spectators away from the tigress

and Sariska tiger reserves. Since the declaration of Project Tiger in 1973, 10 humans have been killed by tigers in Ranthambhore. Of these, nine were killed inside the reserve, and one a kilometre away from the periphery. A large and vibrant economy generated through tiger tourism has resulted in strong local community groups actively supporting tiger conservation, and along with timely compensation for livestock kills, public anger towards tigers is reducing.

A Point to Ponder

Relations between humans and wildlife changed when humans stepped up their trophic level in the food chain due to their intelligence, use of fire, development of lethal tools and weapons, and formulated social bonds for mutual support. They then took over as intelligent super predators and created a landscape of fear for other species. After attaining super status in the food chain, we need to take the responsibility to manage our ecosystem rationally, and we have to learn to live with animals, as our irresponsible actions on the planet are threatening not just wild animals but our very own existence.

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Human-Wildlife Conflict and Coexistence in Kerala

P.O. Nameer and M. Shaji

WAHIBA IRSHAD HUMAM

Ill-maintained trench cum electric fence in Wayanad Wildlife Sanctuary in Kerala. Trail indicates that people as well as animals go below the fence

In Kerala, there are some families/communities, particularly in the districts of Wayanad, Palakkad, and Kannur, who live close to forests and are an aggrieved lot, as they suffer from frequent interactions with wildlife. This problem is also reported from other districts of Kerala, but on a smaller scale. Wild animals such as elephants, wild pigs, and monkeys (bonnet macaques) dominate the list of 'trouble makers' in human-wildlife conflict situations. Occasionally, also carnivores such as leopards, and very rarely tigers. Over the years, some other taxa, particularly the porcupine, have been alleged to raid crops.

Why is the incidence of human-wildlife conflict on the rise these days? What could be the probable reasons? And what are the plausible solutions to mitigate or reduce

conflict? Here we attempt to find answers to these questions.

Conflict emerges when the requirements of wildlife and humans overlap, with consequential costs to both people and wild animals. Wildlife negatively impacts upon food security, homes, and livelihoods of the affected people, and as a result, people become hostile towards the wildlife in their area. Kerala has a human population of 33.39 million (2011 census) with a population density of 859 per sq. km, as against the national average of 382 per sq. km. Though the total forest area in the state is 29.01%, slightly above the country's average of about 22%, the higher human population density could be a factor that needs to be considered when discussing human-wildlife conflict (HWC).

Moreover, though the extent of forest area in the official records is 29.01%, this includes monocultures of teak, eucalyptus, wattle, and areas under other plantation species. There has also been a qualitative deterioration of the natural forest, with the lack of regeneration of forage plants and proliferation of inedible plants owing to various reasons. This could be a compelling reason for animals straying out of the forests in search of food. Additionally, in forest areas where water is scarce, water in the adjacent cultivated areas draw animals into agricultural landscapes and human settlements. The increase in human population has led to encroachment on forest areas, with cultivation of nutritious and palatable crops like pineapple, tapioca, banana, arecanut, and coconut attracting animals such as wild pigs and elephants to

WAHIBA IRSHAD HUMAM

Electric fence being used for drying clothes in Wayanad, Kerala

human-dominated areas. Our inefficient solid waste management practices have resulted in the easy availability of food waste, which in turn has resulted in a population explosion of free-ranging dogs. This is one of the reasons for leopards straying into human-dominated landscapes, as dogs are easy prey for leopards. Garbage dumps with significant amounts of chicken waste, if they are close enough to forest areas, it also attracts wild pigs and leopards. Added to this, inefficient waste disposal in many 'ecotourism' destinations located close to the forest area attracts monkeys, and with time, these monkeys learn to *beg* for food from tourists or steal and aggressively snatch food and other items from people.

The Department of Wildlife Sciences, Kerala Agricultural University undertook a detailed assessment on HWC in Kerala, with an aim to find out the spatial and temporal patterns of occurrence of HWC in the state. All 36 forest divisions of Kerala were visited, including 25 territorial divisions and 11 wildlife divisions. At each forest division, we perused the compensation registers/files about instances of HWC, and data were extracted from these documents. The data recorded includes the name and address of the applicant, village and forest range where the incident occurred, date of the conflict incident, the wild animal involved, amount of compensation claimed and the compensation paid, details of crops damaged, and injury/death of humans.

The Pattern of HWC in Kerala

During the 10-year study period (2006 to 2015), there were 523 human deaths and 1,627 injuries to humans due to wildlife attacks in Kerala (including deaths due to snake bite). The number of livestock killed during this period was 1,645. Regarding injuries to humans, there has been a fivefold increase during the past five years in Kerala, while livestock depredation has increased four times. These figures suggest that the general trend of HWC in Kerala is on the rise. A total of 33,473 cases related to HWC were booked by the State Forest Department during the 10 years.

The issue of HWC compensation

While the number of instances of human-wildlife conflict has been on the rise in the state, there is a sharp disparity in the compensation that is being paid to the affected people. From 2006 to 2015, the total compensation claim towards HWC was Rs 111.66 crores. However, the amount paid out was only Rs 22.22 crores, which is only 19% of the amount claimed.

The lower amount paid out by the Government to settle compensation claims needs to be addressed urgently. Also the time lag between the conflict incident and

P.O. NAMEER

the settlement of compensation must be minimized, and the efficiency achieved in this regard by states such as Maharashtra and Madhya Pradesh should be emulated. The compensation paid should also be realistic, and recompense the claimants sufficiently. Presently, the average claim settlement is less than 20% of the amount claimed, this disparity should be examined pragmatically, and more farmer-friendly criteria need to be evolved for the compensation settling process. Having said this, it should be noted that the Government of Kerala has recently (in 2018) increased the compensation amount from Rs 5 lakhs to Rs 10 lakhs upon human death due to wild animal attack. The government has also increased the compensation amount from one lakh to two lakhs upon human death due to a snake bite, which can even occur in towns or in cities.

The most conflict-prone areas in Kerala

The most conflict-ridden forest divisions (FD) in the state are South Wayanad FD, North Wayanad FD, Wayanad WLS, Kannur FD, Kasaragod FD, Mannarkkad FD, and Thrissur FD. This indicates where the priority of the state government and forest department should be focused on.

Land-use change and rise in HWC

One of the major reasons for HWC in Wayanad is the change in land use that has happened over 28 years between 1952 and 1980. During this period, the forest area was reduced to 60% (1,087 sq. km). This erstwhile forest land, ideal habitat for large mammals including elephant has been converted into plantations and cropland. The vegetation cover, which was intact and once continuous, has been fragmented in Wayanad and this could have a bearing on the ranging of large mammals, leading to an increasing incidence of conflict.

Cropping pattern and its impact on HWC

Analysis of the cropping pattern in Wayanad district reveals that paddy, banana, coconut, and arecanut account for 38.51% of all the crops cultivated. It is interesting to note that these are the very species that are highly preferred by elephants and some other herbivores. This could be another reason for the increased incidence of HWC in Wayanad. Added to this, there are large numbers of human settlements sandwiched among the forests, which could also be the cause of the increase in HWC.

Forest Management interventions and their impact on HWC

Key habitat management activities being carried out in the protected areas of Kerala is weeding (removal of lantana and eupatorium), vista clearance to facilitate sightings of animals by wildlife tourists,

A forest in Wayanad with little regeneration and at the same time excessive weed growth

and construction of waterholes. With a view to control weeds in protected areas, annual weeding operations are a regular exercise in most of the protected areas in the country. However, very little data is available in the public domain on the usefulness of such an exercise, as weeds keep coming back even after the control measures are taken. On the contrary, since weeding is implemented without a rigorous monitoring mechanism, the labourers engaged in the weeding operations remove not only the weeds but also other regenerating plants, even valuable forage species. The undergrowth fails to regenerate not only in the vista cleared, but also deep inside the forest, see the images above.

Low regeneration of trees in the forests

To ascertain the regeneration status of the trees in Wayanad, a regeneration survey was carried out by Department of Wildlife Sciences, Kerala Agricultural University. The results clearly demonstrate that regeneration of most of the tree species has been negligible. Regeneration of dominant tree species at Wayanad, such as *Terminalia elliptica*, *Anogeissus latifolia*, *Dalbergia latifolia*, *Lagerstroemia microcarpa*, *Grewia tiliifolia*, *Cassia fistula*, *Pterocarpus marsupium*, and *Olea dioica* has been extremely low to negligible. In most cases, there were no plants in the girth category of up to 50 cm gbh (girth at breast height). Regeneration was even lower in *Grewia tiliifolia* and *Pterocarpus marsupium*, wherein there were no plants up to a gbh category of 90 cm, clearly indicating extremely low regeneration, which must negatively impact the availability of forage in these forests. Poor regeneration of the forests could also affect their long-term existence. This needs to be addressed urgently. An urgent restoration programme should be undertaken to address this issue, not only to mitigate human-wildlife conflict, but to ensure the very existence and future of our forests. Data is not available at present on *Garuga pinnata*, *Terminalia bellirica*, *Bridelia retusa*, and *Careya arborea*, but these are exceedingly important forage species that need to be monitored as well.

Construction of waterholes

Another major management intervention that is being carried out in our protected areas is the construction of waterholes to ensure availability of water for wildlife. While this may be a good wildlife management practice, it should be implemented after careful evaluation of the shortage of water at the landscape level, realizing the fact that large mammals have the capability to range considerable distances. Moreover, the construction of the waterholes is carried out without much thought to the hydrology of the region. Furthermore, almost always, waterholes are dug keeping primarily the mega-vertebrates in mind, completely ignoring the ecological necessities of other taxa. This could be jeopardizing the long-term survival of several other taxa, such as small mammals, some species of birds, herpetofauna, and several species of invertebrates. For instance, at many sites, waterholes are dug either very close to natural swamps, locally known as *vayal*s, or very close to perennial water sources such as streams and rivers. In some extreme cases, they are dug even within the *vayal*s. When a waterhole is dug within or very close to the *vayal*s, it leads to draining out the *vayal*, thus negatively affecting many other animals and plants that depend on the *vayal*s, which are crucial grazing grounds for large ungulates in summer. Thus, waterhole construction within the forests must be done very carefully and judiciously, after making a detailed evaluation of the site at the landscape level.

Major wild animals involved in HWC in Kerala

The top 10 wild animals that are involved in human-wildlife conflict in Kerala are Asian elephant *Elephas maximus*, wild pig *Sus scrofa*,

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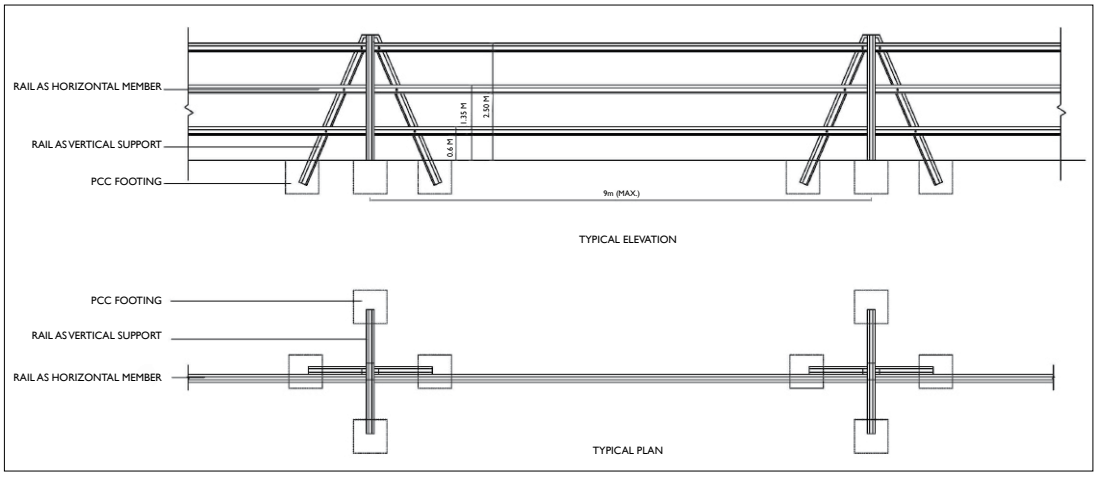
Rail fence at Nagarhole NP, (note the height of fence is only about 2 m)

bonnet macaque *Macaca radiata*, deer species (sambar *Rusa unicolor* and spotted deer *Axis axis*), leopard *Panthera pardus*, tiger *Panthera tigris*, gaur *Bos gaurus*, porcupine *Hystrix indica*, wild dog *Cuon alpinus*, and various species of snakes. Almost 70% of the conflict is due to Asian elephant and wild pigs, and another 21% by bonnet macaque and snakes. Other species such as deer, leopard, tiger, gaur, porcupine, and wild dog account for the remaining 9%.

Evaluation of HWC mitigation strategies adopted in Kerala

The major conflict mitigation strategies adopted by the state forest department focus on the creation of physical barriers of various kinds. The two most widely



PRAVEEN P. MOHANDAS / P.O. NAMEER

The conceptual design of the elephant proof rail fence (EPRF)

used are elephant proof trenches (EPT) and electric fences. Both are efficient methods of checking the intrusion of large mammals into agricultural fields and human-dominated landscapes. Nonetheless, these two methods do have some inherent problems. Firstly, they demand high maintenance. If not maintained regularly, they become ineffective; plus their maintenance is dependent on the involvement of the local people. Another, more serious problem with such physical barriers is that they should be installed with utmost care while selecting the site of installation. What often happens is that the barriers are built without undertaking any landscape-level evaluation to determine the movement corridors of the animals, which further exacerbates the problems caused by wildlife. It also could result in shifting the conflict from one site to another. So, before installing these physical barriers, extreme care should be taken and the ecology and behaviour of the wildlife should be considered.

Yet another physical barrier being used these days to prevent the intrusion of wildlife is the granite wall! Not only is this highly cost-demanding, it is ecologically unviable, as it completely restricts the movements of several non-target species too. Apart from this, the disadvantages of the physical barriers listed above apply to granite walls too.

Another HWC mitigation option presently under consideration is the elephant proof rail fences (EPRF). The advantages of EPRF are that they do not hinder non-target species; moreover, recurrent expenditure is almost zero, as it does not involve any maintenance cost. However, before installing EPRF, detailed evaluation at the landscape level must be done. More importantly, the EPRF design must be carefully selected before implementation. A modified version of the EPRF designed at the Department of Wildlife Sciences, Kerala Agricultural University, with the help of structural engineers and architects, is given above, but is yet to be tried in the field to check its effectiveness.

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Signs indicate that the field had been raided

Endnote

Over the past 10 years, 86% of HWC in Kerala has been caused by three species, Asian elephant, wild pig, and bonnet macaque, with elephants contributing 48% of the conflict reported. About 50% of the conflict was reported from Wayanad district alone.

HWC has been in existence since time immemorial. When humans and wildlife are competing for common resources, conflict is bound to happen. To address this, various management prescriptions and conflict mitigation strategies need to be implemented more effectively and judiciously. There is also need for an attitudinal change on the part of humans, as there seems to be a drastic fall of tolerance level among people, who react adversely as soon as they see or suspect any signs of wildlife near their habitations.

HWC mitigation cannot be tackled by the Forest Department alone; it requires multidisciplinary collaborations between the departments of Agriculture, Revenue, Animal Husbandry, Tribal Welfare, insurance companies, land-use planners, and conservation biologists. Since habitat loss, degradation, and fragmentation are the

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A broken elephant proof wall in Wayanad, Kerala

root causes of the problem, they have to be addressed to provide long-term solutions. Wildlife corridors that connect patchy and isolated habitats between fragmented forest patches must be acquired and given protected area status.

An important consideration in the choice of a particular mitigation measure is a cost-benefit analysis for a region and situation. Before this, a landscape-level evaluation of the population and habitat needs to be undertaken. In the absence of definite policy guidelines, there is an inordinate focus on the symptoms rather than the causes of the problem. No single solution is effective and different approaches need to be integrated to address human-wildlife conflict.

The use of the term and concept of "coexistence over conflict" needs to be encouraged. In an age where interactions with wildlife are an inevitable part of our lives, we should work towards coexisting peacefully with wildlife rather than devising ways to deal with what we perceive to be a conflict with wildlife. To achieve this, large-scale awareness and sensitization programmes need to be conducted using various means, including social media.

The low rate of settlement of compensation claim is an aspect that needs to be addressed immediately, and settlement should be done more efficiently. The time lag between the conflict incident and the settlement of compensation needs to be minimized; in any case it should not go beyond a reasonable time. The amount of compensation paid should be realistic and should actually be able to recompense the farmers for their loss.

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Beyond Conflict vs Coexistence:
Human-Tiger Relations in Idu Mishmi Land

Sahil Nijhawan

SAHIL NIJHAWAN

The breathtaking landscape of Dibang Valley

As you drive into Dibang Valley in Arunachal Pradesh, you can't help but be consumed by the scale and depth of its greenness. It stretches relentlessly – from its summit of rock and ice to the glistening depths of the Dibang river beneath. The landscape is at once ominous and hopeful. This formidable greenness hides many secrets. Here, tigers, clouded leopards, and Asiatic wild dogs prowl the mountains, preying on both flesh and spirit. Semi-domesticated gaur (mithun) and Mishmi takin, furrier renditions of the African wildebeest, stand proud atop

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Mithun, the semi-domesticated gaur, is a precious animal for the Idu Mishmi of Dibang Valley

mountain precipices, staring down the clouds. This is the traditional homeland of the Idu Mishmi people. Here, Idu shamans (priests) fly treacherously over sky-high peaks to journey into the land of the spirits. Dibang Valley also guards a beautiful, complex, and fragile story. This is the story of the Idu-wildlife relationship that challenges the simple binaries and assumptions that underlie our understanding of the natural world. Notice the use of "relationship" as opposed to "conflict" to describe human-wildlife interactions? It is intentional as it encapsulates the true scope of interactions between the Idu and wildlife. It is intentional as it tries to course-correct decades of misguided preconceptions.

I was first introduced to Dibang Valley in 2011, when I was sent there to verify unconfirmed reports of tigers. We succeeded in uncovering direct evidence of tiger presence in the foothills. But what really had me hooked were the many more tigers that the Idu told me about – those that lived high up in the mountains, those that could mimic human and animal sounds, those that sought revenge when people killed them, and those that could think like us. I returned a year later to begin my doctoral fieldwork, studying Dibang Valley's 'many' tigers and the reasons why they were there. Over the next two years (2013–15), I deployed camera traps in more than 220 locations from lowland tropical forests all the way to alpine meadows. I collected faecal samples to find out what tigers and other predators fed on. I lived with Idu families and shamans to learn Idu mythology, customs, and belief system. Over time, as I became conversant in the Idu language, I conducted hundreds of interviews to understand the local socio-economic dynamics, patterns of forest use, and ideas around tigers.

The Idu Mishmi are predominantly animists, who believe that non-humans such as animals and spirits have the same capacities of conscious decision-making as humans. They too live in families and societies. And just like us, they can tell right from wrong. The world of animists is inhabited by good

SAHIL NIJHAWAN

Idu elders at a local ceremony

and bad spirits. To survive and prosper, one must ensure that these spirits are appeased with the help of a shaman, who is the only one able to communicate with the spirit and animal worlds. In Arunachal Pradesh, including Dibang Valley, land and forests are under the *de facto* ownership of the local people, unlike in the rest of the country. The Forest Department controls a meagre percentage of land. In the very north of Dibang Valley, along the Tibetan border, lies the Dibang Wildlife Sanctuary (DWLS, 4,149 sq. km): eight times as big as Corbett National Park but staffed with fewer than 10 Forest Department employees.

My cameras captured an astounding diversity of animal life – 30 different species of mammals! We photocaptured 12 individual tigers, including cubs and breeding females. Eight of these tigers were found living in Idu-owned forests. I had only begun to scratch the surface, as my cameras covered less than 10% of Dibang Valley's forested mountains. Advanced statistical analyses indicated that there could be as many as 50 adult tigers in Dibang, up to 90% of which would live in Idu-owned forests. Unlike in the rest of their range, these tigers relied on a unique prey assemblage with two species of muntjac, the Indian *Muntiacus muntjak* and Gongshan *M. gongshanensis* making up most of their diet, followed by mithun, Himalayan serow *Capricornis thar* and the Mishmi takin *Budorcas taxicolor*. In the absence of formal protection mechanisms, tigers and their prey and habitat had been protected in Dibang Valley in large part due to the Idu culture, which in turn had been safeguarded by Arunachal's Inner Line Permit, a legal instrument that prohibits settlement by non-locals.

Conflict, you call it?

"Ohh, so you study human-tiger conflict in Dibang Valley," is the standard response when I introduce my research topic at gatherings of ecologists and conservationists. I protest without fail, "No, I study all types of relationships between people and tigers." Why is it that conflict is how we in the conservation community frame almost all human-wildlife interactions? Since the dawn of humanity, people have cohabited with wild animals. To us, wild animals have been foes, food, predators, companions, and spirit guides. They have been both feared and revered, detested yet tolerated. Through history till the present day, even against the backdrop of the global environmental crisis, human-wildlife relationship has never been singularly that of conflict. Then why is it that conservationists deem conflict the only relationship worthy of study? Let me describe the myriad ways in which the Idu interact with and relate to the tiger. Perhaps then we can decide whether conflict is the suitable frame for this relationship.

The existence of such rich biodiversity and a population of the endangered tiger without formal government/NGO protection was a surprise to me. To the Idu, however, it was

nothing but a mundane fact of life, for they have always shared their mountain home with these wild animals. Idu children are raised on the story of ancestral brothers born to the same mother: the first, an Idu from whom all Idus descend; the second, the tiger. A disagreement resulted in man conspiring to kill his brother tiger. The creator re-birthed the tiger and sent it to the high mountains away from his brother's villages, where it lives to this day. But the willful killing of the tiger by his own brother, an act of murder that spilled the blood of one's own kin, unleashed a series of misfortunes that still plague the Idu to this day. Killing a tiger is the greatest sin. The two live separate lives, however, the tiger does occasionally descend into his human brother's villages in the lower mountains to steal his prized cattle, mithun, creating tense confrontations. Tiger killing by mithun is not mere livestock depredation; it is a re-enactment of the ancestral myth that intertwines man and tiger. It is this myth that enrages man, but despite financial, emotional, spiritual, and psychological stress, it is the same myth that prohibits immediate and violent retaliation. Livestock depredation, a definitive predictor of conflict everywhere else in India, is for the Idu a complicated matter, a symbol of continued mythological enactment.

For a common Idu, the tiger is a physical, psychological, and spiritual danger. "The threat from the tiger is so great that we don't talk about it flippantly," said an Idu elder. "If you kill it, it doesn't just seek revenge once. It keeps attacking the killer's entire family for generations. It'll make a family member commit suicide, cause epilepsy, drown you in the river, or burn down your house," he added. Most Idus wouldn't even say its name, referring to the tiger as "it" or "khinu" (the Idu word for powerful spirits). Idu shamans are believed to be born with a tiger spirit whose powers they need in order to heal and protect people. It is the shaman (through his spirit-tiger) who brings children into the world, hence making them 'Idu', and lays the dead to rest. Even though the Idu are modernizing rapidly, shamans still hold a key position in their society. The Idu need the shaman, the shaman in turn depends on the tiger.

Those who have had close physical encounters with tigers often speak of the animal's great powers. They speak of its guile and how it thinks like us. Many of these same people for whom the tiger is a grave spiritual danger, also argue that it should live in Dibang Valley since "that's how the world has always been". For the Idu, the tiger is many things. It is a wild animal that kills mithun, the mythical brother who must not be killed (yet again), a spiritual danger, and the shaman. These different 'tigers' exist together, neither in perpetual peace nor in conflict. Often, they are indistinguishable. Like any other, the Idu-tiger relationship is speckled with episodes of conflict amidst fear, indifference, and dependence. This relationship cannot be described adequately

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Traditional Idu house

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Clouded leopard

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Gongshan muntjac

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Himalayan serow

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Himalayan monal

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Mishmi takin

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Tiger

through the easy binary of conflict vs coexistence. It is neither, yet it is both.

Conflicting ideologies, conflicting interests

This is not just the story of Dibang Valley. Across the world, both indigenous and otherwise, human relationship with wild animals is multidimensional, layered, and temporally variable. Recent research has found thriving leopard populations outside protected areas across India, some of these exist without any natural prey. Here, the conflict-like situation between people and leopards is but one of the many ways in which the two interact. The Maasai community of the Kenyan Serengeti largely views lions as integral to their lives and wants them around, despite episodes of cattle depredation and an age-old tradition of lion spearing as a rite of passage for young men. This multi-layered relationship is now the foundation of a novel Maasai-led lion conservation model.

Yes, there are antagonistic episodes, but describing a wide spectrum of human-animal relations only in terms of conflict calls for this 'conflict' to be resolved urgently. Often, it is resolved by creating new and permanent separations between people and wildlife. This separation makes the case for demarcation of spaces within which we believe animals 'should' live, and where they shouldn't. Once these artificial boundaries are drawn, they cement and make permanent what were transient spaces of negative interactions. It is these stark divisions between animal and human spaces that justify radical restructuring, such as the plans to build 17 mega hydropower dams in Dibang Valley. The same divisions are being used to force the 'Idu tiger' to become the 'Indian tiger' through the proposed conversion of DWLS into a tiger reserve. If and when DWLS is declared a tiger reserve, it will surely exclude Idus from their ancestral land, but it is unlikely to keep the tigers in or from occasionally preying upon mithun. However, instead of Idu culture and shamans mediating temporary episodes of conflict between people and tigers, the Forest Department will be held responsible. This will, at best, convert the Idu-tiger relationship into a monetary transaction via ill-designed compensation programmes. At worst, it will create perpetual enmity, conflict between Idu and tigers which the culture is no longer able to encompass and explain.

Generations of wildlife researchers and practitioners have been trained in flawed assumptions whereby most would immediately and indiscriminately term the mere existence of wildlife, particularly large predators, outside protected areas as conflict. Yes, there are situations where interactions between people and wildlife are predominantly negative for both. In such situations, separating the two may be the only option. However, in most cases, what is typically labelled human-wildlife conflict, which in essence makes people and animals conscious combatants against each other, is in reality 'human-human' conflict. That is, when two or more parties – those holding pro-wildlife positions and those defending other positions favouring people and/or developmental interests – attempt to assert their interests at the expense of the other. It is an ideological conflict over how wildlife and the relationship with it is conceptualized; over who protects it and where.

Until we are open to understanding both the human and the animal story, we will continue to simplify and misunderstand their relationship. We will continue to let 'conflict' obfuscate a spectrum of interactions. And we will continue to believe in the myth of either permanent conflict or romanticized coexistence.

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Reminiscenses of Human-Wildlife Conflict in Rollapadu

Ranjit Manakadan

One fine morning in 1992, I boarded a rickety bus from Nandikotkur, packed to near capacity with the usual beedi-puffing men, chattering women with their baskets or kids, and the conductor who would shout "Hold it!" (this amusing me no end) at each village stop on the journey to Rollapadu. As the bus passed the Cherkucherla-Sunkesula crossroads, gone were the cropfields and the black cotton soil, and instead the captivating scenery of the undulating *barka* with its weathered, stone-strewn soil and expansive grasslands greeted me. And in less than five minutes after that, I was back once again in Rollapadu (after a stint in Point Calimere Wildlife Sanctuary) to work under the BNHS's Grassland Ecology Project. I had worked in Rollapadu Wildlife Sanctuary (RWS) earlier, from 1984 to 1988, under the decade-long BNHS project on the great Indian bustard (GIB), so it was a sort of happy homecoming for me.

RWS had its genesis in 1982 with the 'discovery' of the great Indian bustard in the grassland habitat to the north and west of Rollapadu in Kurnool district, Andhra

RANJIT MANAKADAN

RANJIT MANAKADAN

Till the problem of human-blackbuck conflict arose, the GIB was a matter of pride for the villagers of Rollapadu. The buses of the Nandikotkur depot had the GIB as the mascot (see right and left top corner of the two buses)

SUJIT NARWADE

A great Indian bustard with blackbuck at Nannaj, Solapur

Pradesh. Following the discovery, the Forest Department, on the recommendations of BNHS, undertook measures to protect the habitat by establishing three grazing- and disturbance-free grassland enclosures. In 1989, an area of 6.14 sq. km was notified as a wildlife sanctuary. With all the positive changes, Rollapadu became a great place for the GIB, and where we had the fortune of witnessing a breathtaking sight of a 'marching' drove of 24 adult cock GIBs – a congregation "out of this world" since the 1980s for this species that is now near-extinct.

Besides the GIB, Rollapadu has another endangered bustard species, the Lesser Florican, which breeds in the area. RWS also supported one of the largest congregations (about 500 birds, predominantly Montagu's harrier) of wintering harriers in India in the 1980s. Among the larger fauna, RWS is home to blackbuck, wolf, golden jackal, Indian fox, jungle cat, Indian grey mongoose, and monitor lizard. The demoiselle crane and bar-headed goose are winter visitors to the landscape. Among these species, human-wildlife conflict was an issue in the case of blackbuck, wolf, and demoiselle crane.

Blackbuck

The blackbuck has considerably benefited from the creation of Rollapadu Wildlife Sanctuary. Known locally as *Krishna Jinka*, the species was known to roam over the grasslands and croplands of the area, then in very small numbers, these being the more wary/lucky ones that escaped poaching by villagers or outsiders with guns, or the local hunting community, known as Shikaris (same stock as the Pardhis of Maharashtra), who caught them with noose traps. Once the enclosures were created, most of the animals took refuge in the largest enclosure due to protection, lack of disturbances, and the lush grass growing in the enclosures. The animals could jump across or walk over the demarcating trench cum mound (TCM) walls to enter the enclosures from outside without difficulty at many places.

RANJIT MANAKADAN

Monitor Lizards are caught for the pot in Rollapadu Wildlife Sanctuary

When I started my studies in Rollapadu in 1984, the population of blackbuck comprised 17 individuals, and by the time I left in 1988, it had increased to 38. The blackbuck, besides the GIB, was a source of delight for the locals to watch (despite their occasional nibbling in cropfields), and also for tourists (besides being a 'consolation prize' for those disappointed at not sighting GIB during the visit).

However, attitudes changed with the years as their numbers grew, and the population was around 250–300 animals by the time I returned to Rollapadu in 1992. The blackbuck had become a major irritant for the farmers of Rollapadu due to crop depredations. To make matters worse, this led into an anti-sanctuary and anti-GIB issue, as the sanctuary had come into being due to the GIB. Complaints from the farmers of Rollapadu were frequent, and all spoke of not wanting the sanctuary, which was earlier a matter of pride for the villagers of Rollapadu.

During the Grassland Ecology Project, we carried out a study to assess the problem of crop damage by blackbuck in the Rollapadu area. Among the 20 crops grown in the area, damage was recorded in eight, namely foxtail millet, maize, jowar, groundnut, sesamum, green gram, black gram, and cotton. Damage was especially severe in foxtail millet and maize, and in the well-irrigated summer crops of green gram and black gram. It was not clear whether the damage recorded in cotton was caused by blackbuck or by livestock. Of the eight crops, seven were eaten, and in sesamum, damage was caused by male blackbuck trampling the plants to the ground. That blackbuck did not eat/prefer paddy, sunflower, and mulberry was certain, as these cropfields were in close proximity to the enclosure, and the animals were not hindered by barriers to raid these fields. Though damage was not recorded in two cultivated species of Cucurbitaceae, seedlings of Cucurbitaceae were recorded growing in blackbuck middens.

The recommendations provided to the Forest Department from the BNHS study ranged from instituting a crop damage

RANJIT MANAKADAN

RANJIT MANAKADAN

Other than the issue of HWC in Rollapadu WLS, the villagers of Rollapadu had to deal with the menace of bonnet macaque, till they were caught and translocated to a nearby forest

compensation scheme for farmers; cultivation of non-palatable crop species close to the sanctuary area; laying fences, especially at crop-predation-prone areas; and reducing the population of blackbuck to about 100 individuals by culling (as crop damage is expected to be small with these numbers, judging from the history of crop damage in RWS in relation to blackbuck populations).

Wolf

Wolves were recorded during both the research projects, and more frequently during the second study. Wolves benefited from the creation of the grassland enclosures due to the lack of disturbance, and since they offered a safe place to dig dens to raise their pups. And, with the increase in blackbuck numbers, an alternative food source (other than sheep and goats) was made available.

A pack of two males and a female were frequently recorded during the second study, and a den with pups was sighted, and later, the sub-adult wolves were seen roaming with the pack. Disease (probably canine distemper) killed off two of the wolves in 1994 – which also almost wiped out most of the Indian fox population – and no wolves were seen that year. However, in April 1995, a pair moved into the enclosure with seven pups.

Wolf kills of blackbuck were not recorded in the enclosure during the first study (when the blackbuck population was in the range of 17–38 animals), and the wolves till then apparently subsisted largely on sheep and goats. During the second study, a total of six

NARENRDA PANDIT

Besides preying on blackbuck, the wolves of Rollapadu supplemented their diet with sheep and goats

kills by wolves were recorded in the enclosure: three blackbuck, two sheep, and one goat. The villagers claimed that kills of sheep and goats by wolves had increased over the years, and the worst case reported was of a pack that ran amok and killed 26 sheep one night (a classic example of surplus killing). Increased vigilance and use of trained dogs can stop or reduce sheep and goat depredations by wolves. In many cases, the entire carcass or a major portion of the sheep was retrieved after a chase and taken for the pot, or ended up in a butcher shop. Incidentally, the shikaris used to trap wolves with noose traps in the past. Besides the meat of the wolf that was eaten by this hunting community, the stuffed animal was paraded in villages to obtain rewards from the shepherd community.

Demoiselle Crane

Demoiselle cranes were regular winter visitors to the Rollapadu area during the two studies. The cranes arrived in thousands, ranging from 5,000 to 15,000 during my study. Birds would play truant if the rains were in excess in Gujarat and Rajasthan. The arrival of the cranes was looked upon with grave foreboding by the farmers due to their depredations on the jowar crop. Other than the cranes, the bar-headed goose also visited Rollapadu in a few hundreds, but largely fed on the leftovers of the groundnut harvest, hence they posed no issues for the farming community.

Summing up

Rollapadu Wildlife Sanctuary presents a classic example of conflict between humans and wildlife, pertaining to species still surviving in a heavily human-dominated landscape. According to the villagers of Rollapadu, the landscape of the area and surrounds were largely uninhabited by humans decades ago, till people of the

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The arrival of the cranes in winter was looked upon with grave foreboding by the farmers of the Rollapadu area due to their depredations on the jowar crop

More than two decades have passed since the BNHS study in RWS, and sadly, the GIB is more or less extinct now – ironically, for the very species for which the sanctuary was created. Fortunately, the lesser florican is still around, and breeding too.

Now, large tracts of the former grassland expanses to the southwest of the sanctuary are covered by solar panels! Along with this, power lines criss-cross the landscape. With irrigation and increase in water table made possible through the Telugu Ganga Canal and the impounding Alaganuru Balancing Reservoir, agriculture has become more extensive and intensive, and there has been a change in the cropping pattern and crop species.

Blackbuck are said to now number around 800 heads. There were some attempts to reduce their numbers by translocation to other areas, but these raised more issues and problems for the Forest Department. A crop damage compensation scheme is in place now, which has helped to compensate farmers for their losses. There are plans to undertake fencing in problematic areas.

Wolves are rarely seen now, much to the relief of pastoralists. Similarly, the demoiselle crane has been giving a miss to the area in winter for the past five years or so (for whatever reasons), hence farmers are relieved. The bar-headed goose still winters in the area, but, as said earlier, they were not an issue for farmers as they only pick up the leftovers of groundnut and jowar, post-harvest.

Reddy community moved into the area, along with other communities in tow, to set up villages and bring the land under the plough. Initially, this may have favoured wildlife species that inhabit open scrub and grassland country, such as GIB, blackbuck, and wolf, as humans started to clear the scrub, carried out subsistence agriculture, and brought in sheep and goats. According to the shikaris, the cheetah used to roam the plains of this landscape, and a pair would frequent Rollapadu grasslands in the distant past. They even claim that the 'hunting leopard' was kept by one of their forefathers to hunt blackbuck till the early part of the 20th century. However, with the increasing human influx and related developments over the decades, the arrival of humans turned out to be detrimental for wildlife. A sort of resurrection happened for some species with the creation of RWS, helping them to increase in numbers, but this unfortunately also led to conflict with humans, as discussed earlier in this essay.

RANJIT MANAKADAN

A just hatched Lesser Florican chick in Rollapadu, the other eggs waiting for their turn

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Human-Bird Conflict in India

Ranjit Manakadan

In India, human-wildlife conflict tends to be associated with large animals like the Asian elephant, wild pig, blackbuck, and nilgai that raid crops. In case of injury or death, the 'culprit' has to be a big cat (leopard or tiger) or elephant, and rarely bears or the wolf. Birds are seldom in the 'conflict' picture; if anything, they are 'pests' that can be taken care of. Given their size and flight capability, they can be easily shooed away or shot for the pot, so there is never or much less of a reason to complain. Nonetheless, quite a few bird species are a source of problems to humans. They take a toll on agriculture; compete with fishermen or impact the earnings of fish farmers; soil buildings and surroundings

RANJIT MANAKADAN

Rock pigeon – a menace to buildings and a hazard for aircraft

RAJAT BHARGAVA

In India, parakeets, especially the rose-ringed parakeet, are highly destructive to agriculture

in urban set-ups; or pose a serious threat to aircraft. Other than direct conflict, some are carriers of diseases that can be transmitted to domesticated animals, pets, and humans.

'Pest' birds-farmers conflict

Grain- and fruit-eating birds have always been a problem to agriculture and horticulture. Farms provide a concentrated, easily accessible, and highly predictable source of food, making them extremely attractive to birds. Bird raids on crops are spread throughout the cultivation period, from sown seeds, seedlings, shoots, flowers, to grain or fruit.

To protect cropfields and orchards from birds, farmers resort to various methods, such as guarding, scaring, exclusion, and even lethal means. One of the most infamous exercises to eradicate granivorous birds was in China during the reign of Mao Zhedong. To improve agricultural production, Mao, under his Great Sparrow Campaign (under the umbrella of the Four Pests Campaign), sought to exterminate sparrows (specifically, the Eurasian tree sparrow) on the grounds that "they ate too much grain". The campaign that started in 1958 resulted in the killing of millions of sparrows. However, with time came the realization that this exercise was counterproductive, as rice yields declined with a boom in insect pests (including locusts), which the sparrows also eat. So, the exercise was wrapped up in 1960.

In India, the rose-ringed parakeet takes the title of the most destructive bird to agriculture. Sálim Ali and S. Dillon Ripley's HANDBOOK states that they are "one of the most destructive bird pests of agriculture and horticulture … wasting far more than they actually eat". Other common 'pest species' include pigeons, doves, sparrows, weaverbirds, and Indian peafowl, besides the ubiquitous crows. Some of these also raid harvested grain in threshing sheds, drying yards, and granaries. There are many other

DHANANJAY GUTTE

The migratory black-headed bunting, though a small bird, is a major pest to cereals as it occurs in large flocks

species that visit crop fields and orchards, but they are not regarded as crop pests, since the damage is small or insignificant. For example, the great Indian bustard (which prefers animal matter) takes occasional nibbles at Bengal gram, groundnut, and *Eruca sativa*.

Among the migratory problem-birds for agriculture in India are greylag goose, bar-headed goose, demoiselle crane, common crane, red-headed bunting, black-headed bunting, rosy starling, and common starling. Since some of these species occur in large

SUJIT NARWADE

A flock of rosy starlings raiding jowar

flocks and/or are large-bodied, the losses to farmers can be substantial. The HANDBOOK says about the bar-headed goose: "often causes considerable local damage to winter crops such as wheat and gram".

Since killing of all wildlife (except those declared by the Forest Department as vermin, or when posing a danger to humans) is now banned in India, agriculturists have to spend their time, effort, and money in protecting their crops from birds. Despite the ban, crop raiders are often killed surreptitiously, even the Indian peafowl (listed under Schedule I of the Indian Wildlife (Protection) Act, 1972, and the National Bird of India). The peafowl has traditionally benefited from protection by humans on religious grounds in some areas, but with a significant rise in its populations in recent years (with stricter wildlife law enforcement) and increased levels of crop raiding, tolerance for the species is on the decline. Unlike for mammals, there is no compensation scheme for crop depredations by birds in India – implementation of such a scheme would be complex, considering the vast area under cultivation and the intricacies involved in estimating crop damage by birds.

Piscivorous birds-fishermen/aquaculture conflict

Fish-eating birds, especially the larger and flock-forming species like pelicans, cormorants, storks, herons, and egrets, have been a threat to fisheries, and in more recent decades, to aquaculture. Kingfishers pose a threat to fish farms, but the depredations are low due to their small size and occurrence either as solitary birds, in pairs, or a party of a few birds. However, there is a note in the BNHS's *Journal* (1988, 85: 425–426) of kingfisher depredations in a fish nursery pond in Ludhiana, Punjab. I also recollect reading many years back about boys being hired by an aquarium fish farm in Chennai to get rid of visiting kingfishers using catapults.

An early example of piscivorous birds-fishermen conflict in the Indian subcontinent is from Pakistan, concerning pelicans [Neelankantan *Tiger Paper* 1980, 7(2): 21–24), quoting Guy Mountfort]: "… once numerous over the rivers and jheels of Pakistan, but by 1969, they had been almost exterminated on the grounds that they ate too much fish. Plans for a factory to extract oil from carcasses had to be abandoned after it became clear that

V. KANNAN

V. KANNAN

The traditional support for village heronries is on the decline due to various factors
(L): Kokkare-Bellur Heronry, Karnataka; (R): Telineelapuram Heronry, Andhra Pradesh

V. KANNAN

Piscivorous birds and fishermen tend to come into conflict

there were no birds left to kill." In contrast, a BNHS study on the spot-billed pelican in southern India during 2000–2003 revealed that fishermen in the Andhra Pradesh part of Pulicat Lake surveyed did not look at pelicans (and other piscivorous birds) as competitors for fish resources. A few even said they welcomed pelican sightings to select sites for laying fishing gear. However, this attitude can be expected to change in the future with decline in rainfall (as a result of climate change), reduction in fish catches, the corresponding increase in fish prices, and the general decline in tolerance by people to depredations of wildlife in recent decades, besides the increase in the populations of some piscivorous bird species (discussed further on).

Avian piscivore-human conflict is more likely to be an issue in the smaller wetlands (especially those leased out for fisheries) and in fish/prawn farms, than in large wetlands like Pulicat Lake, Great Vedaranayam Swamp (Tamil Nadu), Chilika Lake (Odisha), and in large reservoirs, and more so if there is the tag to the wetland as a bird/wildlife sanctuary. During our surveys under the Spot-billed Pelican Project, conflict was recorded to be an issue in the fish farms at the edges of Kolleru Lake (Andhra Pradesh), but not in Kolleru Lake as such. We recorded carcasses of a few waterbirds entangled in nets placed over fish ponds. According to the locals, mainly cormorants and pelicans attempt to forage in the fish ponds. Similarly, in the Pulicat Lake area, conflict between piscivorous birds and humans was restricted to prawn farms. Measures adopted by prawn farmers to deter birds include guarding and scaring, but we suspect that lethal methods were also used, since the workers were hesitant to talk on the subject.

The great cormorant has a long history of conflict with fishermen, and more recently with fish farmers and recreational anglers, in Europe, and conflict has increased with

a dramatic increase and expansion of populations since the 1960s. One major reason attributed to the increase in their populations is overfishing by humans, which has led to the decline of larger predatory fish, thus favouring an increase in smaller size classes of fish, which suits cormorant foraging strategies. Around 2% of aquaculturists, 13% of commercial freshwater fishermen, and 31% of commercial coastal fishermen recorded losses greater than 50% of the annual financial turnover in their fishery. Recreational anglers recorded considerably higher financial losses due to cormorants, averaging 57% of the annual turnover. (See http://www.intercafeproject.net/pdf/REDCAFEsummary.pdf for a comprehensive account of the cormorant conflict problem in Europe.)

Increase in cormorant species populations is reported in Kerala, and is also evident in Tamil Nadu to the birding community. Besides the plausible reason of loss of large predatory fish that benefits smaller fish species and correspondingly cormorants (as hypothesized in Europe), other contributory factors for the increase in India include stricter protection to wildlife in recent years, creation of reservoirs and other water bodies, and probably also since cormorants are not preferred waterbird species for the pot– its local names translate to "water crow". A questionnaire survey undertaken in Kannur district in Kerala found that 30% of the prawn farms of the district were subject to raids by piscivorous birds, with cormorants being the major threat species.

PATRICK DAVID

Great cormorant has a long history of conflict with fishermen, and more recently with fish farmers and recreational anglers in Europe

'Urban' birds-people conflict

Some of the heronries in India, and especially those in southern India, owe their existence to the protection afforded by people on sentimental or religious grounds. In some cases, the relationship was mutually beneficial, as the locals made use of bird droppings (or the water enriched with droppings) as fertilizer for cropfields. Sadly, the traditional support to heronries in human habitation areas is on the decline. Over recent decades, trees that supported heronries at some sites have been felled to prevent birds from nesting or for other reasons, e.g., the lost pelicanries of Kolleru (Andhra Pradesh) and Moondradaippu (Tamil Nadu).

Reasons for the loss of community support for heronries include the noise created, foul smell, litter, or faecal matter and other wastes, fouling of water (where the same water source is also used by the locals), advent of chemical fertilizers (making the use of bird droppings obsolete), the need to lop or cut trees for timber, fuel, fodder, or for sale, and loss of revenue from fruiting trees due to nesting activities of the birds. In towns and cities, the sharp appreciation in the price of land adds to the anti-sentiment for heronries in public places.

Other than heronry birds, the well-known Indian 'urban nuisance birds' are the house crow, rock pigeon, and common myna. In winter, these are joined by common starling and rosy starling, which roost in enormous flocks in trees in residential or office compounds. The cattle egret has also taken to roosting in trees in urban surroundings.

These species perch, rest, roost, and nest on buildings and/or trees, soiling the buildings or the ground below with their droppings. The wily house crow has its own nuisance value which Indians are well acquainted with!

Birds-aviation sector conflict

Bird strikes have been a matter of concern for the aviation industry since the first aircraft flew. Not many may know that the first reported bird strike occurred when Orville Wright's aircraft was struck by a bird two years after the first powered flight in aviation history in December 1903. One of the worst bird strike disasters was in October 1960, when an Eastern Air Lines plane crashed shortly after takeoff into Boston harbour, with 62 human deaths, after hitting a flock of starlings.

From 1912 to 2002, worldwide, bird collisions with civilian aircraft have resulted in 55 fatal accidents, 295 deaths, and destruction of 109 aircraft. The lowest estimate of annual financial loss to the civil aviation industry, globally, is US$ 1.2 billion (www.birdstrike.org/news-info/press-kit; www.wikipedia, accessed on 20.04.2015). Research and funds are being directed to tackle the problem of bird hazard to aircraft, through habitat management/modification, deterrence products, and other bird control techniques in airfields. Despite all these measures, birds continue to be a problem for aviation worldwide, and the trend is increasing with the intensification of air traffic, increase in the number of aerodromes, and the development of larger, faster, and quieter aircraft.

RAJDEO SINGH

Black kite is the top bird hazard species in most Indian airfields

Studies on bird hazard to aircraft in India and finding ways to mitigate this problem was pioneered by BNHS in the 1980s, with surveys of 22 aerodromes across India. The studies generated baseline information on the potential bird-strike species in and around aerodromes and recommended measures that could be taken to control the populations of birds in and around airfields, or deter them from visiting airfields. The recommendations significantly helped to mitigate the problem, but bird strikes continue to be a problem due to a variety of reasons. After a long hiatus, BNHS has recently (since 2015) taken up studies on bird hazards to aircraft, and work is presently being carried out in a defence airfield of the Indian Navy and in Mumbai airport.

A review of bird strike data sent by military and civilian airports in India revealed a total of 158 bird hits from 1997 to 1999, involving about 20 odd species. Of these, the most frequent hits were by nine species, namely black kite, brahminy kite, white-rumped vulture, red-wattled lapwing, rock pigeon, Eurasian collared-dove, spotted dove, common barn-owl, and little swift. A significant change noticed in this review was the decline in hits by vultures in northern India (compared to BNHS data in the 1980s), primarily since there had been an alarming decline in the populations of *Gyps* vultures since the 1990s, due to the drug diclofenac. The reported financial loss by domestic (Indian) airlines due to bird and animal hits was Rs 7.5 crores in 2010, Rs 12.27 crores in 2013, and Rs 25.72 crores in 2014. Defence

RAJDEO SINGH

RAJDEO SINGH

Birds have been a threat to aviation since the first planes flew

planes face a higher risk from bird strikes as they fly sorties at low altitudes – unlike civilian aircraft which cruise at high altitudes and face risk mainly during take-off and landing. A total of 574 and 357 bird strikes of IAF planes were reported for the period 1991–97 and 2010–13, respectively.

Endnote

The subject of bird-human conflict – except for the issue of bird hazard to aircraft – is hardly a matter of discussion in conservation circles and the government in India, nor does it find press coverage. This is not surprising, since it gets overshadowed by the bigger issue of human conflict with large mammals, particularly elephants which kill about 500 people every year and cause enormous damage to crops and property. The major problem with bird-human conflict in India (and in many parts of the world) is that birds now inhabit a landscape or waterscape that is dominated by humans. India is developing rapidly, with a burgeoning human population, and wildlife and their habitats are facing the brunt of its impacts. Earth is facing its sixth extinction event, which is expected to wipe out over half of the 1.7 million known species of plants and animals by the middle of the 21st century. According to BirdLife International, one in eight bird species – more than 1,300 species – now face extinction. With all these happenings, it is difficult to predict how the avifauna-human conflict will pan out in the future, and as they say, "Only time will tell."

Lastly, I have, on occasions, pondered on the appropriateness of the term human-wildlife conflict, specifically human-elephant conflict, human-tiger conflict, human-bird conflict, and so on. It is us humans who have proliferated and continue to do so shamelessly, linger pitiably into old age, live in a culture of gluttony and greed, and without thought or compassion usurp the homes and lives of other beings of planet earth. So is there any justification to hint that this so-called conflict is two-sided?

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Wildlife Poaching and Trade *vis-à-vis* Human-Wildlife Conflict

Rajat Bhargava

RAJAT BHARGAVA

In the bygone era when there was no widespread use of insecticides or pesticides by farmers, bird flocks benefited farmers by eating harmful crop insects and weed seeds. Humans today are striving for organic produce!

The moment I got to know that a *Hornbill* special was being planned on human-wildlife conflict, I thought of the current issue, a special on wildlife trade in India, and realized that one had not covered one of the major aspects of the cause of wildlife poaching for wildlife trade – the one that stems from human-wildlife conflict. India is one of the primary sources for wildlife trade products in the world. Why is this so? Do we have abundant wildlife, or is there rampant poaching despite the ban on all wildlife related trade and poaching under the Wildlife (Protection) Act, 1972, with all its amendments in 1991? Could some of the ongoing poaching and trade in wildlife arise

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In a remote village in Uttar Pradesh, a farmer women guards her ripening jowar cropfield from parakeets and other wildlife

RAJAT BHARGAVA

A dera of a Ghayara – a nomadic hunting community also known as Kanjar with their temporary settlement at a village outskirt

from human-wildlife conflict? Here I share some of my experiences, especially from northern India.

We all know that humans were hunter-gatherers in bygone ages, but gradually we became dependent on agriculture, although hunting is still practiced by many. The aim of every farmer is to protect his crops from threats, including crop raiding by animals. When the human population was small and agricultural lands were sufficient, crop depredations were acceptable to some extent. As families grew and farmlands got divided, depredation by wildlife became a source of worry to farmers, most of whom struggle to make both ends meet. The same is applicable to livestock, and so livestock killing by wild animals has become less acceptable to people, despite the compensation schemes given by the Government and NGOs. And as a result, retaliatory killing of carnivores takes place.

It may be useful here to first write about the tribes involved in wildlife poaching and trade. Some of these tribes do not have their own permanent settlements. They move from place to place, temporarily camping near cropfields and at the periphery of forests, giving them opportunities to poach for food and trade. Some also gain employment from

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A flock of rose-ringed parakeet raiding a mustard field.
This habit of the parakeets makes them a victim of trade

RAJAT BHARGAVA

Once a common scene in winter in some rice mills, such 'raids' by birds are now an uncommon sight

the land owners by guarding crops from wild animals. Although Indian farmers tend to generally tolerate the presence of birds in cropfields, except for some of the more troublesome species (discussed further on), they are completely at odds with species like rhesus macaque and wild pig due to their heavy crop depredations. And because of wildlife depredations, farmers are forced to grow crops inedible or less preferred by wildlife, such as sugarcane and plantation species. Although porcupine and wild pig do inflict damage on sugarcane, farmers risk growing it as the profit from it is high.

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A herd of nilgai foraging in a freshly sown cropfield.
This species is one of the top conflict species for Indian farmers

Cases of human-bird conflict leading to bird trade from north India

I have lived with parakeets and parakeet trappers and have wondered how, despite the ban on trapping parakeets for the last three decades, this nefarious activity still persists. One of the primary reason (according to me) stems from the high dependence of parakeets on crop plants. To protect their crops, farmers bank on Baheliya (bird trapper), for whom parakeets are the main quarry for sale as pets, or Chidimar (bird killer) tribals. The non-nomadic Baheliya tribe has, for generations, caught birds in the *terai* belt for their livelihood, operating more openly around village farms and fields, than in forests due to the fear of being apprehended by forest department personnel. These tribes have historically projected themselves as friends of the farmer, as they make a living by snaring and selling crop marauding birds. The farmers are not hostile to the trappers; on the contrary, they are only too happy to give the hunters free access to their fields so as to get rid of these bird pests.

The Alexandrine parakeet, a favourite bird trade species, is caught in sunflower fields in the states of Punjab, Haryana, and Uttar Pradesh, when juveniles born in March descend on ripening sunflower seeds in June-July during the rainy season. Rose-ringed and plum-headed parakeets are caught throughout the year in millet, sorghum, maize, and mustard fields, using claptraps and hanging nets. Juveniles and adults are also caught with latex and bamboo traps when they raid orchards of peach, mango, star fruit, Indian plum, mulberry, loquat, chickoo, apple, and wood apple. Weaverbirds and munias are also looked upon as pests by

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A group of village trappers in the outskirts of
a protected area sharing human-bird conflict stories

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A breeding colony of egrets in a small settlement in Sitapur district was in danger until a simple suggestion by the BNHS of tying old oil bins on trees near the human habitation (inset) saved these birds from being smoked out

some farmers, though these birds do feed on crop pests, and the seeds of grasses and other weeds. Wintering and passage migrants, especially red-headed and black-headed buntings are caught from pigeon pea and wheat fields. The resident and over-abundant rock pigeon is caught along with doves from various cropfields, especially in freshly sown plots. Red-vented bulbul is trapped from vineyards and strawberry farms – these birds actually feed more on crop pests than on fruit. Mynas are caught near various plantations as they come to roost there. Galliform birds, especially grey francolin and Indian peafowl, are caught around sugarcane plantations where they run for cover. Ducks, especially ruddy shelduck and bar-headed goose, are snared in chickpea fields. Migratory cranes are ensnared in groundnut fields in western India. A variety of waterbirds in eastern India are caught in and around water chestnut (*singhara* in Hindi) *Elaeocharis dulcis* and fox nut (*makhana* in Hindi) *Euryale ferox* cultivation ponds. All these, like those discussed further on, are examples of human-bird conflict leading to poaching and the bird trade.

Raptors, especially peregrine falcon, are threats to flight pigeons, and wintering falcons find domesticated pigeons easy prey during the pigeons' flying practice regimes and during racing. They are shot with air guns, though traditionally they were caught live by Baheliyas using *do-gazza* traps to be sold for falconry. Similarly, large eagles around forest edges are killed by villagers; these eagles are called "*murghi chor*", as they tend to lift domestic chicks and ducklings. In eastern India and in some small villages in Assam on the Indo-Bangladesh border, large storks such as the black-necked stork, herons, and cormorants, all of these native fish-eating birds, are killed by poisoning with Furadon, or snared with leg-nooses as 'punishment' for fish-eating in large fish ponds.

Indian peafowl is tolerated in most villages because of its religious associations, though it feeds heavily on crops. Besides, farmers collect its shed tail feathers which have good market value, and this income possibly compensates for the loss incurred from crop depredations. Hence, the Government of India has not banned the domestic trade in shed peacock feathers. Otherwise farmers collecting feathers would become culprits and would not tolerate crop-raiding by India's national bird. Being unaware of these facts,

most activists unwisely advocate a complete ban on the trade in peacock feathers.

Owls, nightjars, and vultures are believed to be in conflict with humans due to various beliefs, associated folklore, and for black magic and sorcery in India, and hence become victims of misbeliefs. An owl sitting on one's house is considered a bad omen, so it is chased away or killed. Their body parts are used in black magic and sorcery as talismans prescribed by tantriks. Nightjars are butchered by shepherds who consider them to be 'goatsuckers' due to the folk belief that they suck milk from goats. The blood of freshly killed nightjars is applied on the tongue of cattle and domestic livestock as treatment for various mouth diseases. Also, the reflection from the red eyes of nightjars due to a vehicle's headlights gives these birds the name of "*bidi* (cigarette) *wali chiriya*" and dancing *churail* or *dayan* (witch) in some villages. All this spells doom for these birds, which are killed by catapults whenever village boys get a chance. The once super abundant vultures were previously chased away or shot in the widespread belief that the tree that they sat on would die.

Lesser known wildlife species and tribes in man-wildlife conflict situations

The Bawari, Kanjar (also called Ghayara), Dey, and Badhiya tribes of north India, the Pardhis of central India, Pase-pardhi of peninsular India, Narikurruva and Hakki Pakki of south India, Mirshikars and Santhals from eastern India, Kalbeliyas and Joginaths (or Nath Jogis) from western India, are all known for poaching wild animals for trade in wildlife products. A common belief created by these communities among the farmers and villagers is that they help mitigate human-animal conflict through their traditional vocation of capturing animals. These tribes are not flourishing because of such illegal activities – they just make a bare living.

Unlike the Baheliyas, who are more or less sedentary in their lifestyle, most of the other mentioned tribals travel from place to place on the lookout for sprouting cropfields which attract wildlife species such as black-naped hare, nilgai, wild pig, chital, chinkara, and blackbuck. Nowadays, even the nilgai, revered by Hindus for its resemblance to the cow, is frequently shot by these tribals with the help of some villagers to prevent crop damage and for meat. The wild pig is hunted by these tribes in a number of ways. In Maharashtra, the sutli bomb or dukar bomb, blended with dough or strewn with chicken waste, is placed near cropfields to kill them. Once a pig bites the bait along with the bomb, the explosion seriously injures or kills it outright.

Other animals such as leopards are often victims of these crude bombs. The accidentally killed leopards fetch a good amount of money, since the claws and teeth, apart from the skin can get a fair price in local sales, or in sales to village sub-dealers or jewellers as these items are worn in talismans in the superstitious belief that they bring good luck to the wearer. The villagers who maintain flocks of sheep and goats are aware of these practices and often turn a blind eye to the tribes operating in their area, as they suffer from leopard predation on their flocks and dogs. The villagers even go to the extent of informing the tribals where and when

RAJAT BHARGAVA

A leopard that entered a village cluster in Rajasthan caught by the forest team

RAJAT BHARGAVA

A mongoose that was killed when it raided a chicken house

a leopard is sighted. Iron leg traps and jaw traps (*karakha* in Hindi) are used for snaring a variety of animals including tiger, which is poached for its skin, bones, and other body parts. Wire snares or simple electrocution are often used to kill deer for crop protection. The skin and antlers are then sold as souvenirs or for use in religious rituals. The meat is a coveted commodity in the marketplace.

The list of animals poached in the name of crop protection, with some of then ending in the wildlife trade, is long. In eastern India, flying fox is caught by the Santhals using hanging nets between fruiting trees, as it feeds on cultivated and wild fruits. The trapped bats are eaten by certain tribes and the oil extracted from the fat is considered a remedy for rheumatism. For decades, various species of mongoose were poached to meet the demand from the paintbrush industry, a practice now quite under control. Even so, trapping of mongooses, squirrels, martens, jungle cat, and civets by several tribes continues in many places. Species such as jungle cat and mongooses prey on poultry. Porcupines are pests on vegetables such as potato and carrot, so they are captured in ring traps made of mulberry stems, and then stoned to death. The quills are sold for black magic, while the flesh is eaten. Field rats are harvested by Irulas, Musahars, and several north-eastern tribes, as they do a lot of damage to crops. Killing of snakes and monitor lizards by the Badiyas of Doon Valley, Nath-sapera, Joginath, and Qalandar tribals is tolerated or encouraged by the villagers as they fear snakes and also wrongly believe that monitor lizards can bite. Hunting dogs of these tribals also help to locate pangolins,

RAJAT BHARGAVA

Blue rock pigeon flocks roosting on an office building; buildings soiled with bird faeces is an increasing problem in Indian cities

one of the most heavily poached and traded mammals in Asia.

The problems caused by the rhesus macaque all across its distribution range are on the rise. Prior to 1978 and the ban on export of monkeys, the Kanjars of north India and Makariyas of eastern India, who are excellent at trapping monkeys, were employed to capture them. These tribes, as well as the Qalandars and Madaris, can minimize human-rhesus conflict by chasing problematic monkeys away from human habitations using Hanuman langur, but the use of Hanuman langur has also been banned by government on the plea of some animal activists. Translocation of city monkeys to wildlife areas should not even be thought about, as the urban monkeys could transmit diseases to the forest dwelling monkeys and add to competition with them.

End note: Some human-bird conflict situations

In April 2019, I was shocked to see a farmer's son running relentlessly after egrets in a freshly ploughed and watered field near Dhampur in Uttar Pradesh. On being asked why he was chasing the egrets, he gave me the reason – the egrets were eating their organic-farming friends, the earthworms, from their nursery. So, a case of conflict with a totally new dimension!

I wish to share another case that I handled in a village in Sitapur district, Uttar Pradesh, in 2015. I was called by the district administration to talk to the farmers about possible stringent punishments for killing birds and measures to mitigate the problems caused by egrets and herons nesting in and around households. The farmers had requested the authorities to remove the nesting birds from their settlements, or else, they threatened to take drastic measures. When these egrets breed in April and May, using trees and bamboo groves for nesting, the life of the villagers becomes hell. With hardly any regular electricity and the heat

RAJAT BHARGAVA

In certain areas near forests, animals that were feared to cause damage to life or crops or were useful to humans were worshipped as gods on the belief of preventing life/crop losses

inside their houses, the villagers are forced to sleep in open areas on their rooftops or in verandahs. In the morning, they need to milk their cows in open areas. The droppings of the birds roosting above soil their clothes, contaminate the milk, and litter their beds. The villagers had thought of cutting down all the trees to prevent the birds from coming back to the village to nest. But the fear of wildlife laws, and a partial remedy by tying empty tins, legs of old charpoys, and cattle bells hung with ropes near the nesting trees, helped prevent this drastic action.

Feeding of birds in large cities, especially blue rock pigeons, on religious and ethical grounds, with these birds nesting and roosting on overhead wires and in balconies and windows, soiling homes with their droppings, is unacceptable in cities, large factories, and airports. Pigeon-proofing windows and other entry points into house or other buildings with nets is one solution to mitigate this urban human-bird conflict.

Rajat Bhargava is a Senior Scientist working with the BNHS. He is one of India's most widely travelled and experienced ornithologists.

Spotlight on Sikkim

Usha Lachungpa

NCBS MSC STUDENTS

Himalayan black bear at garbage dump in high altitude area of East Sikkim

Seven years ago, I wrote a small article for our local newspaper on the occasion of Animal Welfare Fortnight, in which I quoted Meghna Krishnadas, an NCBS student on a study excursion to Kyongnosla Alpine Sanctuary in East Sikkim.

We waited for them in the fading twilight of an autumn sky in Sikkim. "They will come" said one of the men doing his routine work. "They are here unfailingly by 5:00 p.m. everyday," added another. Fidgety in the creeping cold of the approaching night, we were almost giving up the wait when we saw them. They emerged silently from the mist, dark shadows of shaggy mystery in the hazy evening; a pair of Himalayan Black Bears. Mother and cub ambled up to the garbage dump above which we stood waiting, sniffing for what this evening might have in store for their hungry bellies. Our excitement knew no bounds as we watched the pair forage at the garbage dump. A few minutes after the mother and cub moved away, a large solitary male came along for his share of the 'fast food', shuffling through the pile of waste while the men clicked pictures, shouted in excitement or just went about their business, all less than a few meters from the wild animal. This incident left us wondering about the potential impacts of this strange incident on both wildlife and humans.

Kyongnosla is not too far from Gangtok and sure enough, in less than a week after Meghna's course in-charge Dr Ajith Kumar handed over a CD of the pictures and videos to our Chief Wildlife Warden, we had an incident of a bear mauling people in Gangtok, the state capital. Public pandemonium followed, and in the ensuing melee, with field staff having little experience in tranquilizing and trapping, the traumatized bear attacked our foresters and the veterinary compounder. This was around a decade ago. And this was not the first time either. In January 1998, there was the locally famous incident where

workers coming in the morning encountered a sleeping black bear at the Sikkim Time Corporation complex in Deorali, Gangtok, and the ensuing chaos caused the panic-stricken bear to maul a girl badly.

In 2009 alone, the Forest Department confirmed at least 29 incidents of bear sightings of which six were attacks on humans causing grievous injuries, seven on livestock (ox, goats, pigs, and even poultry) killed mostly outside forest areas, and standing crops like maize raided. These are also fruiting months for the much in demand pomsi *Machilus edulis* which floods the markets in Gangtok and other areas. So much so, people commented that bears followed the harvested fruits to the Gangtok bazaar, or were raiding habitations looking for their forest fruits!

Almost all successive years saw local media highlighting this issue: "Bear mauls youth in North Sikkim," said *The Economic Times* in August 2010; "Bear mauls city cop in Sikkim," said the *Telegraph* in April 2014; "Wild bear attack in West Sikkim: One seriously injured," said *The Voice of Sikkim* in December 2015; "Man grievously injured in bear attack," said *Sikkim Express* in November 2017. There have also been fatal attacks.

An important point to note is the dates. Almost all encounters were pre-winter, when bears would have been stocking up on food reserves prior to hibernation. There have been numerous instances where bears had been regularly raiding ration godowns in army settlements above Gangtok and getting 'high' on sugar. Our famous forester, the late Mr Chezung Lachungpa, then Area DFO, lamented how he was in tears when they had to put down a magnificent large male bear when it broke free in the crowded campus of the military settlement. Another dead black bear brought down from the same area some years later, still covered in snow, had severely burnt paws. Post-mortem examination showed an empty stomach, leading to speculation that the hungry bear got electrocuted while

wandering around the settlement in search of food. Mr Lachungpa commented that perhaps bears had stopped hibernating due to year round availability of food. Or maybe, it was a sign of changing climate.

Sikkim is high in the Himalaya, the youngest and most fragile mountain in the world. Pushed up from the bed of the Tethys Sea, like an island in the sky, and an identity so unique in many ways, its steep slopes are clad with evergreen forests, through which rivers rush down in their valleys, from icy glaciers up north. Its high altitudes are dotted with lakes and wetlands against a backdrop of snowy mountains, most of which are sacred spaces providing poetic fodder for many. Known as a *beyul* or a (once) hidden valley, presently over 80% of Sikkim is under

USHA LACHUNGPA / FEWMD

Demand for wild fruits in the markets may be one of the causes of HWC

the Wildlife Protected Area network, leading all other Indian states.

High up in the reserve forest of Sevo, in Lachung Valley, North Sikkim, at an altitude of over 3,500 metres, 23 km deep inside the forest, stands a juniper tree with a girth of around 13.65 m. Locally called Lha-Shukpa, this grand old giant which is around 22 metres tall, though partially hollow with age, is presumed to be over 700 years old. Such trees are the real homes for our wild denizens. Like mothers of the forest, they provide sanctuary, safety, food and shelter, hiding and denning sites, where wild creatures can live in peace, away from the threat (or temptation) of human presence or habitation. It is the sanctity of these rare old giants and their habitats that need continued conservation to prevent wild denizens from needing to leave these areas.

Not surprisingly, some of the most threatened landscapes are the rapidly expanding villages surrounding lowland forests. Here the National Bird, Indian peafowl, invades crop fields; in the mid-altitudes, Himalayan porcupine, wild boar, and barking deer destroy grains, potatoes, and vegetables; Assamese macaques raid fruit trees and cardamom plantations. Both humans and wild bears vie for the coveted pomsi, as well as bhadrasey *Elaeocarpus* spp. or wild olive and katus or chestnut *Castanopsis* sp. Confrontation leads to severe casualties on both sides, making one wonder whether our national constitutional duty of conservation of wildlife and compassion for all living creatures is worth all the losses and hardships faced by marginal farmers on their meagre land holdings.

USHA LACHUNGPA

Post mortem of electrocuted Himalayan black bear

Looking at the larger picture, perhaps there aren't enough predators in our forests. The leopard, lesser cats like leopard cat, and Burmese python, these predators unwittingly serve as our honorary forest wardens, needing no wages and hunting their legitimate prey. Apex predators mostly, they prey on the very species that are farmer-unfriendly: the Indian peafowl, wild boar, barking deer, Himalayan porcupine, and Assamese macaque. And then there are other predators like clouded leopard, red fox, golden jackal, dhole, even the small yet fierce yellow-throated marten, all hunt these 'conflict species'. On the other hand, in some parts of Sikkim where domesticated goats stray on forest fringes, we saw fatal casualties in wild ungulates such as brown goral, Himalayan serow, and even

USHA LACHUNGPA

Pushing the boundaries – habitations close to the forest edge

Himalayan tahr, all of which were found to have severe scabies infections.

Of the larger and more glamorous animals in the protected areas, the elusive snow leopard is a ghostly presence in high altitude areas like Khangchendzonga National Park. The snow leopard is well known to the Dokpas or Tibetan nomads in Sikkim's cold desert, who are more plagued by the stray and free-ranging dogs feeding off kitchen waste around defence settlements. These free-ranging dogs have mongrelized the pure strain of the invaluable livestock guardian breed, the Dokhyi or Tibetan Mastiff (an ancient breed of dog). Today, these free-ranging dogs have become the dominant predator, replacing the already threatened wild predators like snow leopard, Pallas's cat, Tibetan wolf, Tibetan fox, and red fox. Being neither wild nor really domesticated, the dogs present a difficult issue, with the Chief Wildlife Warden having no say in controlling this menace in the wilderness areas they range. Since they also prey upon domesticated livestock like yak and highland sheep, in addition to rare wild ungulates like Tibetan argali, Tibetan gazelle, and Tibetan wild ass (or kiang as they are locally known), it is evident that urgent measures need to be taken to control this human-induced conflict.

USHA LACHUNGPA

Veterinarian Dr C.P. Rai with crop-invading peafowl captured by Mirshikars for translocation in South Sikkim

PEMA THINLEY

Pack of free-ranging dogs at Tso Lhamo in Sikkim's cold desert

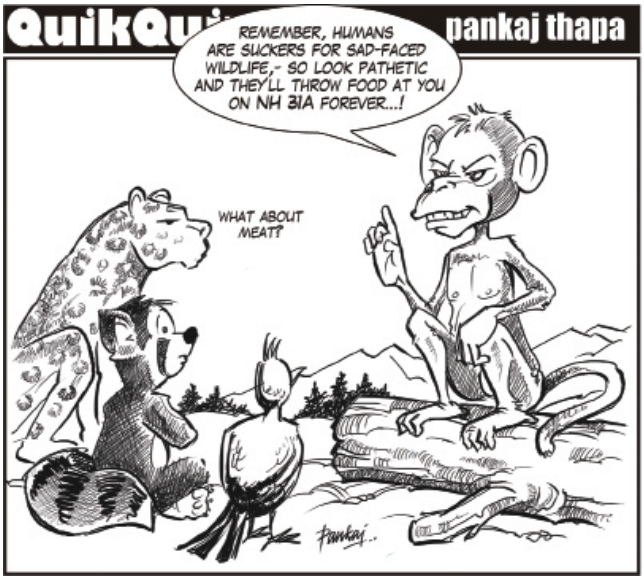
PEMA THINLEY

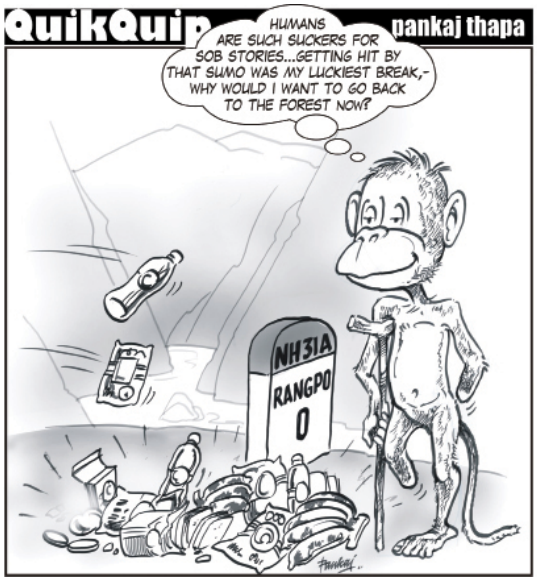
Tibetan argali killed by free-ranging dogs at Tso Lhamo

Sikkim's SARAH (Sikkim Anti Rabies and Animal Health) initiative by the Animal Husbandry Livestock Fisheries and Veterinary Services Department, aided by international organizations like VetsBeyondBorders and Brigitte Bardot Foundation, has made a great beginning with regular ABC-AR (Animal Birth Control and Anti Rabies) programmes for urban free-ranging dogs. Forest Environment and Wildlife Management Department has also taken help from SARAH in a couple of trap-sterilize-immunize-and-release programmes in higher altitudes of North and East districts. In this sacred landscape, most people are loathe to taking more drastic measures. Unless these are institutionalized as annual and uninterrupted long-term programmes with both state and central government funding, and woven into conservation programmes for flagship species such as snow leopard and red panda, they will remain flashes in the proverbial pan.

Coming to the less glamorous wildlife species, such as the case of the unfortunate Assamese macaque begging beside highways, or rummaging on garbage or left-overs and food thrown out of moving vehicles, having lost their innate fear of humans – there are increasing cases of attacks, some on children and even morning joggers in Gangtok: the latter has led to a court case recently. In all cases, the media usually projects the wild animal as the villain. We read about 'monkey menace', 'bear menace', but we do not penalize litterbugs or those who intentionally drop left-over food for these animals, and expect the fund-strapped government agencies to solve the problem. It is time to realize that in trying to uphold some archaic sentiments, we as a race are pushing an unsuspecting wild animal to the brink for no fault of its own.

Surprisingly enough, not many are aware of the valuable role of foresters in mitigating human-wildlife conflict. The Government of Sikkim, having noted the increasing severity of human-wildlife conflict over the years – given the fast expanding villages and extensive road networks and development of large infrastructures – has passed orders for swift compensation to those affected. However, given the frugal budget allotted, the officials are hard-pressed to distribute it as





SUNITA KHATIWARA

HWC researcher Sunita Khatiwara interviews a village elder for her study

fairly as possible, while tackling the ire of the enraged public and the threats posed to their own lives in tackling the problem animals.

The forest department usually reaches out to Wildlife Institute of India for advice and assistance, but recently some local researchers have also taken up studies on human-wildlife conflict. Rakesh Basnett is studying conflicts with black bear in West Sikkim for his PhD. Sunita Khatiwara's work mostly focuses on social surveys for people's perspective on conflict, actual economic loss due to crop raiding, livestock depredation by black bear and Assamese macaque, as well as human casualties; also on the approaches and measures taken by the forest department to manage and mitigate conflict and action taken on post-conflict situations.

There really are no straightforward solutions, as people have always been living with such conflicts. We are all aware of our responsibilities as good citizens for safe disposal of our garbage, caring for our domestic pets, not feeding wildlife or harvesting wild fruits from protected areas, and many other life lessons. The burden of our own population, with its careless habits inculcated over the last few decades of decadent existence, leads us to the realization that a few rules for ourselves need to be enforced with military severity to see any results. The guardians of our international borders also need strong policy decisions to mitigate the outcome of the present ways of disposing of excess food, control of camp dog populations, and threat posed by livestock brought into the state as 'meat-on-hoof'. It is time we took a few ethical decisions in our own long-term interest. Dr George Schaller once said to me at an international conference to ask my government and people to make a choice: to have free-ranging dogs or snow leopards. Are we ready to take that call?

Usha Lachungpa is a Life Member and past Scientist of BNHS, involved with biodiversity conservation issues in Sikkim for over three decades.

Huzzah for the Termites!

Kumaran Sathasivam

There was much shooting of tigers in 19th century India
(reproduced from: Records of Sport in Southern India by General Douglas Hamilton)

You could speculate that human-wildlife conflict, by definition, is something old, that it has been around since the beginning of the earliest civilizations. I sought evidence for human-wildlife conflict in late 19th century India in the *Journal of the Bombay Natural History Society*. Published continuously since 1886, the *Journal* is the foremost source of scientific information on Indian natural history. You can also gather all kinds of fascinating historical information from this journal. This article is based on a 'walk' I took through the first 10 volumes or so. As I set out on my ramble, I tried to imagine what a different place I was entering – India at the end of the 19th century. What were humans and wildlife doing to each other in that age? I found out that there were occasional attacks by wild animals on humans then, just as there are now. A short note in Volume 8 of the journal describes how a villager was tending her cattle one evening in the jungle. A tiger appeared on the scene with the intention of seizing one of the bullocks. The woman moved between the tiger and the cattle to prevent this. The tiger promptly seized her by the shoulder and 'crunched the upper part of

the arm bone into bits'. The doughty woman dealt the animal several blows with a bamboo stick she had in her hand. The tiger let go and retired into the forest. The incident took place at the foot of Amboli Ghat, Maharashtra. One wonders when a tiger was last found in Amboli. How widespread wildlife must have been a century or more ago! The woman had to undergo amputation at the shoulder joint. However, she recovered and was well after two months.

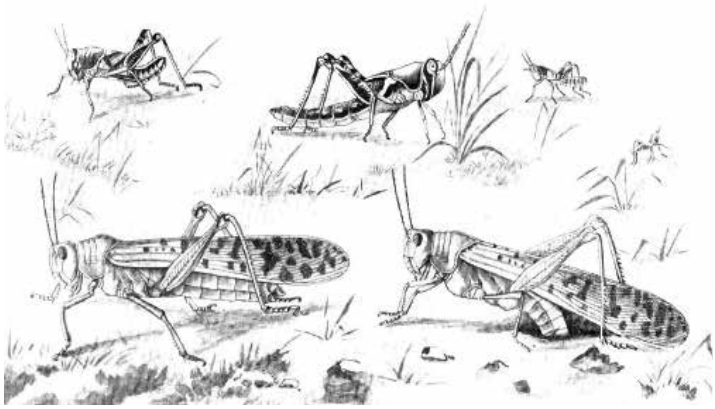
But a man who was attacked by a mother bear two years earlier was not so fortunate. This man and a little boy were resting on the ground near a path leading to a village in the "State of Dharampore, near the Nassick Frontier", when a bear came behind the man and attacked him. After mauling his face and back severely, the bear left him. The man died of his injuries two days later. The bear died too, for the little boy ran off for assistance, and a group of men found where the bear was lying up for the day. She had two cubs with her. A beat was arranged, and all the bears were shot dead.

Sometimes small animals caused serious damage to crops in large parts of the country. Locusts were said to appear from time to time over wide areas in north-western, western, and southern India. The general notion was that the locust that invaded India belonged to the species *Acridium peregrinum*, though the identity of Indian locusts had not been ascertained. We know from an article by E.C. Cotes that the best known locust invasions were those of 1869 in Rajputana and the Punjab, of 1878 in the Madras Presidency, and of 1882–83 in the Deccan.

But much more frequently, there was conflict simply in the form of people going out and hunting animals. There seem to have been a great many people doing this, for various reasons. Some of the sportsmen ate the animals they killed. Wildfowl were being shot all over the country. And other species were also thrown into the pot. One hunter mentions two such birds in a note. "This hornbill [the great Black and White Hornbill]", he says, "though not an appetizing bird to look at, is as good as bustard for the table."

The sloth bear was once very common across the Indian Peninsula
(reproduced from: *JBNHS* Vol. 10(4), 1897, facing p. 688)

Other people were hunting animals to obtain products that were traded commercially. A review of the book FUR-BEARING ANIMALS IN NATURE AND IN COMMERCE appeared in the *Journal*. This review informed the reader that a good tiger skin was worth £4 to £6, and the claws were worth 9d to 5s each. The spotted deer was also mentioned in the book. A few skins were bought by the United States and a few by English furriers for foot-muffs and the like, but the majority of the skins were purchased for leather. A large skin in good condition was worth 6s. to 7s. The antlers were also an article of commerce.



Acridium peregrinum now called *Schistocerca gregaria* is one of the four locust species found in India
(reproduced from: *JBNHS* Vol. 15(2), 1903, facing p. 163)

A wounded bear will fight for its life often with great ferocity

The sambar was the specific quarry of some sportsmen

(reproduced from: Records of Sport in Southern India by General Douglas Hamilton)

There was a great deal of shooting of the larger animals – gaur, tigers, leopards, sambar – for sport. One sportsman wrote that he had killed 56 leopards and 46 tigers. I wondered how many more sportsmen might have had similar records. Some hunters specialized in shooting animals that attacked humans and livestock. These animals were not always tigers or panthers. They included the wolf, which, like everything else, seems to have been far more widespread and numerous then. When it attacked humans and their animals, it paid with its life. An article on wolf hunting in 'the southern Mahratta country' (Jath district) that appeared in the *Times of India* was reproduced in the *Journal*.

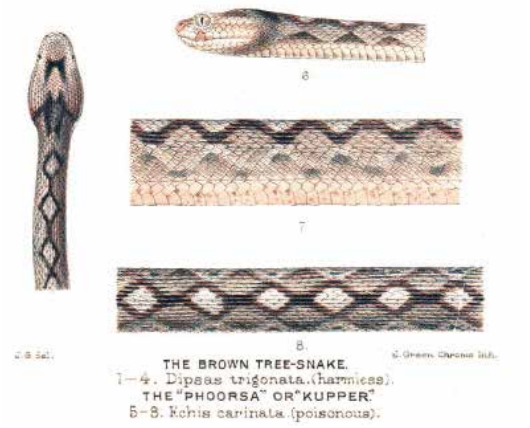
Another animal at the receiving end, one I did not expect, was the crocodile. Captain Sutton-Jones of the Deoli Irregular Force submitted to the *Journal* an account of the method adopted by him of destroying crocodiles in village tanks. This method involved the use of a harpoon with a moveable head. The editors wrote this: "The presence of these loathsome reptiles in village tanks and reservoirs is, as far as we know, productive of nothing but evil, as they are most destructive to the fish and wild fowl, and not infrequently drag goats and even children into the water."

It appears that naturalists too were contributing to the decimation of animals. They commonly killed animals to make collections of specimens. E.H. Aitken touched on this activity in a description of a ship journey from Liverpool to Bombay. Sometimes there was killing, or attempts to kill, for no particular reason. In the article I referred to in the foregoing, Aitken wrote of a steamer, coming from Kurrachee [Karachi] to Bombay, that was accompanied for a whole day by a whale. The whale came very near, almost rubbing against the vessel. "Some of the passengers or officers", said Aitken, "following the true Englishman's instinct of killing, fired rifle balls into it."

The Government of Bombay paid rewards then for destruction of venomous snakes in Satara and Ratnagiri districts. Rumours reached the government at one point that snakes were frequently bred in confinement by people in these districts for the sake of the rewards. The government asked the BNHS whether there was any truth in them. The BNHS was of the opinion that the rumours were probably founded on the fact that snakes' eggs were frequently picked up by jungle dwellers, who naturally kept them until they hatched so as to claim the government reward. It was also quite possible, reported the Society, that gravid

females of the *phoorsa* or saw-scaled viper had occasionally been kept for a short time after capture, to claim a reward for the young ones as soon as they were born.

Watching all this conflict from my vantage point in the 21st century, I knew where all this was leading, of course. The conflict was so one-sided. The question that kept recurring to me was, Wasn't there some recognition that the massacre could not be sustained? As a matter of fact, there was. Some laws had just been passed in the 1880s to protect at least some animals. And other laws were being planned. We know from Volume 3 of the *Journal* that the Ahmedabad Municipality had passed an act in 1887 to protect game birds and animals. The President of the Municipality asked the BNHS for an opinion as to which birds needed to be protected. The Committee provided a list of game birds and animals but said that, as naturalists, they would be glad to see all birds protected during the rains. In Volume 6, L.K. Laurie wrote "The question of doing something to protect the insectivorous birds and birds of plumage, and to stop

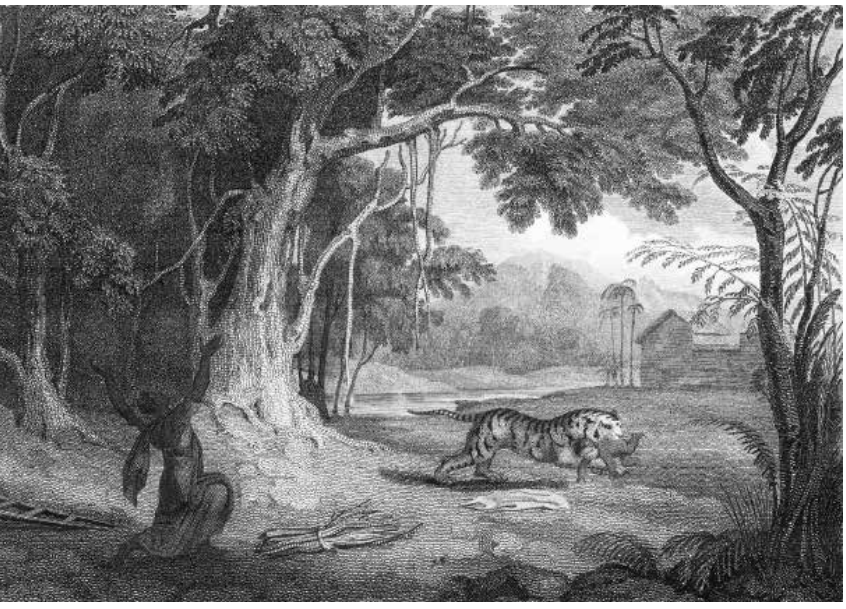


Rewards were offered for the destruction of venomous snakes such as the saw-scaled viper
(reproduced from: *JBNHS* Vol. 18(3), 1908, facing p. 542)

the indiscriminate slaughter of game at all seasons of the year, has been for some time past under the consideration of the Chief Commissioner [Central Provinces]". Volume 7 carried correspondence between the Government of Bombay and the BNHS on the preservation of "birds and harmless wild animals" in Malcolmpeth (Mahabaleshwar).

There were those who spoke against the killing of animals by naturalists for

A tiger seizing a bullock in a pass
(reproduced from: Oriental Field Sports, Vol. 1, 1808)



Scene of a melancholy event on the island of Salsette
(reproduced from: Oriental Memoirs by James Forbes)

specimens. Aitken talked of spending much of his boyhood "prowling about stealthily, with a catapult in [his] hand, plotting against the lives of little birds". He added that the birds were rarely any the worse, and he learned their habits, voices, and distinguishing characteristics. "Every day I live I become more confirmed," he wrote, in the conviction that no naturalist can adopt a wholesomer motto than the saying of a very wise man, of whom it is recorded that "he spoke also of beasts and fowls, and of creeping things and of fishes." The saying I refer to is this, "A living dog is better than a dead lion."

Well, we know how the story went. Protective laws were passed, but human-wildlife conflict has continued all through the 20th century and continues in the new millennium. Wildlife has become far less abundant, and many species are restricted to relatively small protected areas. The conflict continues around these areas, squeezing the animals in them. It looks as though it is only a matter of time before we wipe out all wildlife most effectively with all this conflict, doesn't it? It is all so disheartening.

But I would like to leave you with an extract from an 1886 article by Aitken titled 'White Ants' and with the note that the editor added to this article, because they give me hope:

One of the windows of the travellers' bungalow at Panvel had been attacked by white-ants, when it was opened and left open for two days, thus cutting them off from their base of operations.

A scrimmage with a tiger
(reproduced from: Letters on Sport in Eastern Bengal, 1886)

An encounter with a gaur
(reproduced from: Records of Sport in Southern India by General Douglas Hamilton)

Instead of working along to the side of the window and going down by the frame, they had made an earthen pipe, three inches long, to connect the window with the sill below. The pipe was perfectly straight, like a mill chimney, and very thin, just wide enough to allow passage for one ant at a time; so they must have had some arrangement for obtaining "line clear" before entering at either end. White-ants being blind, it is an interesting question by what sense they assured themselves when they commenced their pipe that they were not working out into space.

This was the note that the editor, R.A. Sterndale, added:

A chest of drawers was removed about 4 or 5 inches away from a wall. The feet of the chest were inserted in saucers of turmeric powder, and the contents were considered safe. But on opening one drawer after a time, it was found full of white-ants. On looking behind the chest, there was discovered a track leading up the wall to a level with the drawer, and then a bridge consisting of a single pipe was thrown across and the drawer entered.

When I read this, I gave a huzzah for the termites. Maybe there is hope for the animals yet.

E.H. Aitken 'on the prowl' for specimens
(reproduced from: *Hornbill* 1983[3&4])

Kumaran Sathasivam a naturalist and writer involved in coordinating the Marine Mammal Conservation Network of India (www.marinemammals.in)

Diseases: A Source of Human-Wildlife Conflict

Naveen Pandey and Andy Hopker

The death of a few monkeys, followed by the death of human beings, around Kyasanur forests in the Shivamogga district of Karnataka in 1957, opened a new frontier in human-wildlife conflict in India. The cause was identified as a tick-transmitted virus that mostly killed primates. Based on its first isolation in Kyasanur forest, the disease was named Kyasanur Forest Disease (KFD). Six decades later, between 400 and 500 people die from KFD annually. Yet our understanding of the KFD virus is far from ideal. Therefore, treatment for KFD is not in sight. The disease has been reported from the forests of Kerala, Tamil Nadu, Maharashtra, Goa, and even Gujarat. The good news is that a vaccine is now available to contain the disease.

Another disease that caught the attention of wildlife biologists surfaced in Serengeti National Park in 1994, when a virus often ascribed to dogs suddenly wiped out around 30% of the African lion *Panthera leo* population. It was Canine Distemper Virus (CDV), which killed 23 Asiatic lion *Panthera l. leo* in Gir National Park, Gujarat, in October 2018. The virus is suspected to have originated among dogs around the Park. Two common observations connect these events. The first is that the pathogens have jumped over to newer hosts; and the second is that our understanding of disease transmission and control between wild and non-wild populations is still in its infancy. Conflict is bi-directional, isn't it?

NAVEEN PANDEY

Cattle washed in streams (this one feeds Kanha NP) contaminate the waters with urine, faeces, and parasites

NAVEEN PANDEY

Non-immunized livestock in weekly cattle markets pose a challenge to disease control

NAVEEN PANDEY

Meat of livestock and wild animals, when traded together, creates a pathway for disease transmission (photographed in Cambodia)

The ever-increasing global population of human and livestock that we bring with us introduces ever more complex dimensions into how we interact with wildlife, with whom we compete increasingly for resources and habitat. Human-Wildlife Conflict (HWC) has emerged as one of the most formidable challenges facing wildlife managers in all continents.

The survival of many species is threatened globally, with HWC as one of the primary drivers of species extinction. As our understanding of the complexity of HWC increases, more and more issues demand our immediate attention. Disease transmission between sylvatic and domestic animals not only threatens the coexistence of wildlife and human beings, it also carries the risk of species extinction catastrophes.

Driven by the demands of the rising human population, land use changes have severely compromised wildlife habitats. At the same time, livestock production practices have intensified in recent times. As density of livestock increases, so does competition for forage with wild herbivores, leading to a change in wildlife population demographics. Wild carnivores prey on domestic livestock and domestic carnivores scavenge carcasses of wild species. Biting insects can readily spread disease between species. So can birds, which feed, roost, and defaecate where they please.

These factors have been creating dynamic interfaces between wildlife species, and consequently, between wildlife and human beings. Increased potential for contact, pathogen transmission, and emergence of livestock and human diseases, are the outcome of such interfaces globally in recent decades. Infectious agents originating from the wild are now regarded of significant economic value as they have substantial impacts on human health, animal health, and agricultural productivity.

Rabies is a classic example of a disease spreading between species. Caused by a virus, rabies is spread through saliva, typically though not exclusively via a bite from an infected animal. All mammalian species are susceptible to rabies, and the disease is universally fatal, affecting the central nervous system in a complex manner, often compelling the sufferer to bite others, allowing the onward transmission of the virus. However, though rabies is a terrifying and emotive disease responsible for approximately 60,000 human fatalities worldwide annually, and an uncounted number of animal fatalities, transmission by bite is relatively slow compared with transmission by aerosol vectors (droplets in coughs and sneezes). WHO suggests that a wild (sylvatic) cycle of rabies exists with wild animals like bats, raccoons, and foxes serving as the maintenance host of the virus.

ANDY HOPKER

Round and swollen hind quarters of a bullock indicate a fatal clostridial infection, blackquarter disease, which is shared by wild animals

NAVEEN PANDEY

Scarcity of water brings many species together, facilitating disease spread at waterholes (Sariska TR)

Foot and mouth disease (FMD) is endemic in India, and the virus affects all domestic cloven-hooved animals, including cattle, buffalo, sheep, goats, and pigs. It also affects an unknown number of their wild counterparts. The disease spreads rapidly over large distances with airborne droplets, as well as through direct contact between animals, or from contaminated objects, environments, and infected carcasses and meat. It can persist in the environment for months under suitable conditions. While not normally fatal to domestic livestock in endemically infected regions, unexposed populations can be hit very hard by the disease, and even mild cases can be quite debilitating, reducing the fitness of wild animals. There is great concern about the effect of this highly infectious disease on the fringes of India's national parks, and domestic cattle are frequently vaccinated both for their own protection and to create a buffer to slow down the rate of spread to wild species within the national parks. An active interface around protected areas, where livestock and wild ungulates share space and fodder, is a cause for concern throughout India. A direct annual loss of around US$ five billion has been reported from India alone due to FMD virus. Sadly, most of the loss is borne by farmers.

Canine Distemper Virus (CDV) in dogs causes a highly fatal disease spread through all bodily secretions. It not only affects wild canids but was found to have spread to the lions of Serengeti and also mutated to affect seals in Europe. Tigers have also been affected. However, populations of social species of wild carnivores like the Asiatic lion are at greater risk as the virus spreads through packs and prides by close contact during the relatively extended course of the disease. Tigers infected with CDV have been reported to behave strangely and often visit villages. This escalates conflict situations. CDV needs a reservoir like dogs to remain effective as a pathogen. The vaccination of free-ranging dogs with live distemper vaccine is debatable, as the vaccinated dogs would shed the virus. Mass vaccination of

lions in the Gir landscape is not practical or feasible either. The currently available Ferret Distemper Vaccine has not been adequately tested for safety and efficacy in lions.

Canine Parvo Virus (CPV) Virologists working in the USA believe that CPV appears to readily cross back and forth between domestic dogs and wild carnivores, mutating as it does so. It is likely that a similar situation exists in India. The disease is highly infectious, spreading through faeces and droplets, as well as through direct contact. In dogs, it is highly fatal, and its spread can be of epidemic proportions in unvaccinated dog populations.

The very soil we are on can pose a risk to animals, as some bacterial diseases can lie dormant within it for many years.

Blackquarter disease, caused by an anaerobic, motile, Gram-positive bacterium *Clostridium chauvoei*, and other clostridial diseases remain in the soil for extended periods. When the bacterial spores are consumed by grazing domestic animals and possibly also by wild ruminants, they localize in the tissue. Following an inciting cause, the spores get active and cause rapidly fatal diseases. Exudates / fluids from the dying animal further contaminate the soil and endanger other animals. Anthrax *Bacillus anthracis* spores can remain within the ground for many decades, undergoing complex cycles within the soil, until they are unearthed by human earthworks or natural events. They cause a rapidly fatal disease, potentially affecting all mammals. Carnivores, being less affected than herbivores, can act as vectors, dragging carcasses from place to place.

Newcastle (Ranikhet) disease is a highly fatal viral disease of domestic poultry. While large flocks are routinely vaccinated, the disease is a great burden on small scale farmers. Poultry keepers around Kaziranga National Park in Assam relate the seasonal

NAVEEN PANDEY

Crows now outnumber vultures on carcasses in Sariska Tiger Reserve

NAVEEN PANDEY

A rhino and cattle seen sharing space and fodder in Kaziranga NP where disease sharing is also possible

occurrence of the disease among their flocks to the migratory and feeding patterns of wild birds, which act as a reservoir of disease, affecting susceptible domestic fowl. The impact of the disease on wild birds is unknown.

All species are affected by parasitic diseases. While many parasites are highly adapted to specific hosts, others such as liver flukes *Fasciola gigantica* and *Fasciola hepatica* which prosper in wet conditions where their intermediate hosts – mud snails – are found, are known to be promiscuous in their choice of passive co-hosts. Animals grazing in wet areas or frequenting the same waterholes and rivers are at particular risk; and these locations are often frequented by both wild and domestic animals. The true situation for parasitic worms (both roundworms and tapeworms) is generally considered species-specific. However, the cross-over of parasites between similar species of domestic and wild animals is not well understood yet.

NAVEEN PANDEY

This gaur and its calf near Kanha NP are vulnerable to FMD infection if they come into contact with infected livestock

How diseases get transmitted

Disease transmission at the wildlife-livestock interface may occur through many pathways, altered by spatial and temporal variations. These variations would depend on virulence, host range and affinity of the infectious agent and/or the presence of a biological or mechanical vector.

Direct or indirect contact of infected populations with susceptible populations is a crucial factor for disease transmission and the wildlife-livestock interface often provides the platform for such contact. A disturbing number of livestock has been routinely observed grazing around protected areas, and sometimes well inside the PA's core zone. Body discharges like urine, faeces,

NAVEEN PANDEY

A civet in flood affected Kaziranga takes shelter in a house

NAVEEN PANDEY

Spotted deer being fed along with a cat near Kali Tiger Reserve

and saliva are constantly released along the interface. Many potent transmission mechanisms become functional, aiding in disease transmission. Diseases like foot-and-mouth disease (FMD), bovine tuberculosis, canine distemper, and anthrax spread either through aerosols or contaminated feed and range at the interface. Diseases like babesiosis are transmitted through a flightless vector, i.e. ticks. Winged vectors may act as biological vectors spreading diseases like trypanosomiasis, or as mechanical vectors spreading illnesses like anthrax.

The availability of a susceptible host would be an important factor in the spread of disease. Villages where livestock has been covered by an immunization programme would experience less frequent outbreaks of the disease, as fewer susceptible animals would be available for the pathogens. Climatic factors which affect animal number, distribution, and vector abundance would also affect disease outbreaks and transmission. Dry periods or droughts bring most of the animals, both wild and livestock, to common water-sources, which enhances transmission of diseases like FMD and anthrax that spread through contact. Vector-borne diseases like blood protozoan infections (babesiosis) would be more prevalent in the rainy season, as multiplication of the vector population around wet months would facilitate disease transmission.

Defining the risks of diseases at the interface

Movement of animals, wild or domestic, has been regarded as one of the most frequently recorded risks. The transmission of FMD through cattle markets is a classic example. The weekly cattle market in Mohgaon at the edge of Kanha Tiger Reserve allows thousands of non-immunized livestock to enter the peripheral villages where livestock had been previously immunized against FMD. This poses a serious risk in terms of breaking the immunological barrier.

NAVEEN PANDEY

Grey squirrel introduced into the UK in the 1870s poses a threat for the native red squirrel

Overabundance of wildlife due to stringent conservation measures in India is an underrated fact. Populations of some wild animals like tigers, lions, rhinos, and many species of deer, among others, have locally increased, while their range may have suffered from fragmentation and encroachment. Increased livestock population under open air farming and an overabundance of wild animals are risks worth noting. Introduction of hosts (for example, grey squirrel in the United Kingdom) have been linked to disease risks in many situations. Such risk situations are often anthropogenic, and need to be factored in while designing wildlife management programmes.

Challenges

- Lack of basic knowledge of many wildlife diseases
- Lack of baseline data of disease epidemiology in India between wildlife and livestock
- Lack of accurate population estimates of many wildlife species
- Challenges and feasibility of immunization of wild animals
- Lack of effective disease surveillance

Is the future bleak?

Despite the constant and evolving threat of disease transmission between domestic and wild species and vice versa, persistent vigilance, integrated planning,

ANDY HOPKER

Engaging communities for disease identification and control is a key step in mitigation of human-wildlife conflict

and advancing technology will ensure that the outlook does not have to be bleak. Our domestic species act as sentinels, and may allow us to detect emerging diseases early in wildlife populations and give us the chance to mitigate and intervene in potential animal health disasters. This requires a holistic, multidisciplinary approach, drawing on the skills and experience of a host of people of differing levels of education and social status.

Listening with respect, and understanding the concerns of farmers, paravets, and forest department employees, allows diseases to be detected. Careful clinical examination of animals must be performed, supported by appropriate laboratory diagnostic techniques, and information must be fed back to meticulous state and national disease recording mechanisms. Taking a broad overview enables early detection of disease outbreaks, which could otherwise be overlooked, giving intervention a chance before a disease reaches epidemic proportions. Laboratory scientists can identify strains of disease, estimate virulence, and prepare vaccination strategies. Epidemiologists can now plot the development of disease outbreaks and trace them back to the initial cases, then use this knowledge to develop disease mitigation strategies. Vaccine technologies are advancing all the time; they need to be deployed to develop vaccines which are efficacious, long-lasting, cheap to produce, and practical to store, transport, and administer in a field situation.

Effective interventions need not be only laboratory- or policy-based; they must be applied with intimate knowledge of the local situation and full engagement of the local stakeholders, particularly farmers. This requires building trust through ongoing dialogue via field workers of all kinds from the public and private sector, and the development of locally appropriate interventions tailored to the needs of individual communities and animal populations, rather than a top-down 'one size fits all' strategy. An effective mechanism of reporting infections in wild animals would facilitate 'one health risk assessments'. A partnership of national bodies, local farmers, non-governmental organizations, and private individuals can work together and rise to combat this 21st century challenge to both wild animals and sustainable farming.

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Human-Nature Interface: Philosophical Meanderings

Pranav Trivedi

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A pair of sarus cranes in a paddy field

"Everything is determined by forces over which we have no control. It is determined for the insect as well as for the star. Human beings, vegetables, or cosmic dust – we all dance to a mysterious tune intoned in the distance by an invisible piper."

– Albert Einstein

From an inner tug of war between our rational, thinking selves to the primeval yet powerful emotional selves, and from intra-human to human-wildlife interactions, conflict is very much a part of being human. With an increasing human population leading to acquisition, loss, and degradation of more and more natural habitats, the nature of human-wildlife interface has acquired a bitter flavour in recent times. The obvious result of this uneasy interface (often termed conflict) has been loss of life on both sides and bad publicity for the process of nature conservation.

Is this strained interface really a recent phenomenon? Was there any time in the history of humans when we had a settled co-existence with wildlife? Lest we assume so, let it be known that from time immemorial, humans have been competing with and even outdoing other species. From microbes to large carnivores such as wolf and bear, this list is quite long. Whether it was 'megafaunal extinctions' or eradication of species through pursuits such as agriculture and hunting, we humans have been a powerful and largely negative influence in the scenario of life on earth.

Diverging from the chiefly instinct-driven life of our fellow passengers on earth, and choosing to lead a 'settled' existence dependent on agriculture and animal husbandry, with a plethora of mechanisms and structures to support this arrangement, has only carved out a way for humans to move further away from nature. This, as we shall see later, is the root cause of all the trouble. A worldwide survey of literature on human-wildlife conflict shows that from the poor and marginal farmers of India to the wealthy ranchers of the USA, conflict with wildlife is prevalent in all classes of income and literacy. If one just dabbles into the existing literature on human-nature conflict or human-wildlife conflict at the global level, it becomes apparent that:

- There is often a big difference between 'real' and 'perceived' conflict, the observed gap being an outcome of various socio-political factors.
- Though there is some clarity on contributing factors considered important for conflict, the list is rather long and hence not useful for conflict resolution. Besides, these factors are not isolated but linked in a maze that is quite difficult to disentangle.
- Despite being in the human realm, much of the human-wildlife conflict resolution work has involved ecologists and not anthropologists, mass communication experts, or sociologists.

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Overstocking often leads to high livestock losses to predators

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Uneasy neighbours – children viewing bharal at close quarters may help them form new attitudes towards wildlife

- Though several cases of local 'success' exist, there is no single formula or 'magic recipe' for different situations, nor is there a clear replicability in most cases.

If conflict really had to do only with the outside situation, it would have been solved permanently somewhere. This clearly is not the case so far. Hence, it is reasonable to assume that the root of the problem lies somewhere within us – in the human psyche.

The words of Masanobu Fukuoka beautifully and succinctly summarize the root cause of the uneasy or negative human-nature interface: *"Extravagance of desire is the fundamental cause which has led the world into its present predicament… Fast rather than slow, more rather than less – this flashy development… has only served to separate man from nature. Humanity must stop indulging the desire for material possessions and personal gain and move instead towards spiritual awareness…"* This very cause has been outlined as the reason for human misery in the oldest Indian scriptures, particularly the Vedanta. If we explore the real cause of conflict between humans and other species, it will become clear that it does not fall in the outward domain, but concerns *our inner realm*. An example will probably make it clear. If we don't like a particular human neighbour, we don't seek their eradication, do we? But, we know that in many parts of the world, entire species (e.g. wolf, bear, lesser carnivores, deer) have been eliminated simply because they were regarded as pests or dangerous! This is because we apparently accord a higher status to humans versus other life on earth. Even though it can be argued that all life on earth strives to achieve only one 'purpose', that is to *live long enough to produce as many progeny as possible*, our beliefs, attitudes, and policies seem incongruent with this viewpoint.

So, it is evident that anthropocentrism (or ego-centrism!) – the attitude that human interest is superior to everything else – has been the prevailing paradigm (barring a few isolated indigenous cultures) guiding our interaction with non-human life. At the other extreme lies ecocentrism, wherein life – human or otherwise – is considered a value in itself. In other words, species, ecosystems, or landscapes, and the interaction among these, have interest or values of their own, irrespective of the benefit they accrue to humans. It has also been argued that ecocentrism actually is a more appropriate and holistic view as it entails anthropocentrism (what is beneficial to all life on earth is also beneficial for humanity, albeit in the long run!). However, our limited and often contrived understanding of the mechanisms and scale at which nature operates is a barrier to understanding this aspect. Because a curtailed perception of our true selves (biologically as well as spiritually) and of our fellow beings is a major cause of the present negativity at the human-wildlife interface, expansion of consciousness from self-interest to oneness (shift from anthropocentrism to ecocentrism) has the potential to take us from conflict to coexistence. This entails a movement from the present reactive state to a responsible state – of tolerance, acceptance, adjustment, and ultimately compassion in our engagement with nature. To quote Neale D. Walsch, Conversations with God III: "*Human beings have been trying to solve problems at the 'doingness' level for a long time*

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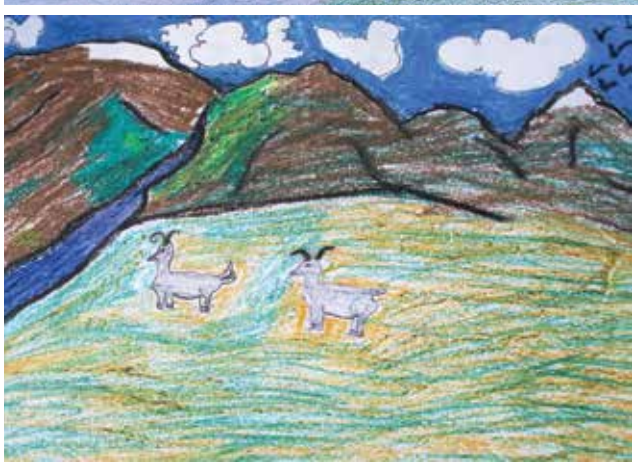
◀ A child's perception of neighbours with whom adults have had conflict

L.: Another view of coexistence from a child who attended a nature camp

R.: From conflict to coexistence ▼



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without much success. That's because true change is always made at the level of 'being', not 'doing'. You clearly will not change what you are doing around until you change how you're being… To act differently is a matter of consciousness (awareness). And you have to raise consciousness before you can change it."

It will be naïve to say that this is easy to achieve. In fact, no human-made policy even reaches close to ecocentrism, though there have been attempts to move towards this philosophy in some way in Scandinavian countries. However, the ongoing efforts of conflict resolution are neither easy nor cost-effective. It seems that to deal with human-wildlife conflict, we have largely invested our efforts into on-ground research and problem-solving, without much success. Alongside these end-of-the-pipeline solutions for conflict resolution, had we also paid attention to raising human consciousness, which is the apt way to move towards ecocentrism, the situation could have looked less grim, if not better.

One of the vital tasks to achieve such an ecocentric outlook is to re-establish and nurture a positive bond between humans and nature. As Stephen J. Gould says, *"We cannot win this battle to save species and environments without forging an emotional bond between ourselves and nature as well – for we will not fight to save what we do not love."* If each and every individual on earth has a strong, personal, and positive emotional bond with nature, the conservation scenario may look different. A relatively easy and sure way to nurture this bond is to take children out-of-doors at as tender an age as possible and immerse them in nature. The joy of exploring the beauty and wonders of nature as well as exposure to her elemental forces proves instrumental in building the character of an individual. What Richard Louv calls Nature Deficit Disorder is taking a toll on young children everywhere. Having a meaningful and fulfilling relationship with nature is vital in the holistic development of the child. Researchers have also shown that early contact with nature is a precursor to developing positive environmental attitudes. Such interventions emphasizing

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Cloud of common cranes over fields in Gujarat

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Crop damage is one of the most common 'problems' of human-nature conflict

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Nature education – a potential tool for nurturing ecocentric attitudes in people

hands-on contact with nature need to be ongoing and not just project-duration (two to three-year) efforts.

The ultimate outcome of this endeavour would be realization of the true 'self' – an inner understanding of the oneness of all, or "*Vasudhaiva kutumbakam*" as emphasized by ancient Indian scriptures. As the Dalai Lama says, *"Compassion is a mind that is motivated by cherishing other living beings and wishes to release them from their suffering."* This, then, is the ultimate milestone that indicates a healthy and enriching relationship of humans with nature. Little doubt that it will also lead to elimination of conflict, both inner as well as worldly.

Pranav Trivedi is a wildlife biologist and environmental educator. He is an alumnus of Wildlife Institute of India, Dehradun and Honorary Associate with Nature Conservation Foundation, Bengaluru

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2019–2020



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July 14	Shilonda Trail at Sanjay Gandhi National Park
July 21	Monsoon Trail at Malshej Ghat
August 3	Herp Night Trail at Matheran
August 11	Monsoon Trail at Malshej Ghat
August 25	Butterfly Bounty at Ovalekar Wadi

NATIONAL CAMPS 2019

August

- Valley of Flowers
  Date: August 3–11, 2019

- Rare and Endangered Flowers camp: Khandala
  Date: August 24–25, 2019

- Ladakh: Roof of the World
  Date: August 31–September 8, 2019

September

Kaas – Maharashtra's very own Valley of Flowers
Date: September 14–15, 2019

October

Namdapha National Park, Arunachal Pradesh
Date: October 12–17, 2019

November

Pachmarhi, Pench and Satpura National Park
Date: November 23–28, 2019

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