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Sindhu Radhakrishna
and
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LIVING WITH ELEPHANTS

EXPLORING THE NATURE AND CAUSE OF HUMAN–ELEPHANT CONFLICT IN INDIA



NATIONAL INSTITUTE OF ADVANCED STUDIES

Bangalore, India

BACKGROUNDERS ON CONFLICT RESOLUTION

Series editor: Narendar Pani

This series of backgrounders hopes to provide accessible and authentic overviews of specific conflicts that affect India, or have the potential to do so. It is a part of a larger effort by the Conflict Resolution Programme at the National Institute of Advanced Studies, Bangalore, to develop an inclusive knowledge base that would help effectively address major conflicts of interest to the country. In pursuit of this objective it carries out research that could help throw up fresh perspectives on conflict even as it develops mechanisms to increase awareness about the nature of specific crises. The backgrounders form an important part of the second exercise.

The backgrounders are targeted at the intelligent layperson who requires a quick and yet reliable account of a specific conflict. These introductory overviews would be useful to administrators, media personnel and others seeking their first information on a particular conflict. It is also hoped that as the series grows it will act as an effective summary of scholarly information available on conflicts across the country.

By their very nature these backgrounders attempt to provide a picture on which there is some measure of consensus among scholars. But we are quite aware that this is not always possible. The views expressed are those of the author(s); and not necessarily those of the National Institute of Advanced Studies.

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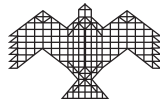
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Backgrounders on Conflict

LIVING WITH ELEPHANTS

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Human-wildlife conflicts occur when coyotes kill sheep, raccoons destroy someone's garden, a beach is closed because it is littered with goose feces, or mice chew a hole in a cereal box.

- Michael Conover, 2002

EXECUTIVE BRIEFING

In February 2010, the Ministry of Environment and Forests, Government of India, issued an edict announcing the formation of a Task Force on Project Elephant. In the words of the memorandum, the objective of the Task Force is “to provide detailed recommendations to ‘upgrade’ the Project to bring about a more effective conservation and management regime for the species in India”. The same document also briefly mentions the constitution of Project Elephant in 1992, the need to strengthen conservation measures for a species that is of great ‘cultural significance’, and the problems facing the welfare and survival of the Indian elephant in India. In a sense, this memorandum encapsulates the entire issue of human-elephant conflict in India. The elephant must be conserved, not only because it is a biologically significant species, but also for its cultural importance. Conservation measures for the species have been in place for many years now but they have not been successfully implemented due to various reasons. Living peacefully with elephants is an end desired by many; the route

towards this goal, however, is not yet very clear.

From historical times, the elephant has been a significant part of culture and life in India. People have domesticated and used elephants for various purposes, killed them for sport or to protect property and lives, and worshipped them as religious icons. Human-elephant conflict is implicit in many of these interactions and yet it was only with the turn of the nineteenth century that the conflict between the two species had acquired perilous proportions. Factors such as dwindling forest habitats and large-scale sport hunting during the British Raj have dramatically reduced elephant range and numbers and today, they are only found in the northeastern, northwestern, eastern and southern parts of the country. The remarkable technological progress of the 20th century and the enormous rise in human populations have led to increasing human habitations, reduction of forest cover and the extensive conversion of forest land to large swathes of agricultural fields. Although their numbers have reduced, elephants still require large areas to move around in for food and shelter,

and this brings them into greater contact with people living beside forest areas, leading sometimes to crop raiding, injury or death to humans and other form of conflict.

THE ISSUES

Conflicts between humans and elephants in India are expressed in many forms, some more direct than others. Two predominant forms of conflict that have received more attention than others are crop raiding and property damage by elephants and the injury and death to humans caused by these large animals. Elephants cause enormous financial losses to farmers and householders when they raid crop fields and storage houses to feed on cereals, grains, fruits and other foods. To a poor farmer, the loss of a season's harvest may be enormous and repeated crop depredations by elephants has created great ill will against the species in many parts of India. Elephants also cause human death or injury during crop/property raiding, movement through human settlements near forests and during accidental encounters in these contexts. The majority of human injuries or deaths due to elephants, however, have occurred during crop raiding incidents, as these are the most common instances of interactions between humans and wild elephants.

Death or injury to elephants by humans is another form of direct conflict between the species. This can distinguished as two main issues: (i) elephant killings for sport or to protect human life and property, and elephant deaths due to trains, and (ii) elephant poaching in order to obtain meat or ivory. Elephant sport hunting, made fashionable during the colonial era, is, of course, banned now but some state governments still use the option of shooting 'rogue' elephants as a solution to elephant depredations. Elephant killing by poisoning, electrocution, or other means, in retaliation for crop damage or in order to protect crop fields is a potent form of conflict that is increasing in intensity in the country. Elephant deaths due to collision with trains occur in many parts of India where railway lines run through or near protected forests. Elephant poaching for meat and ivory has transpired at certain intervals in certain parts of the country; the increase in elephant poaching for ivory in the last two decades, however, indicates a more recent country-wide phenomenon that could finally decimate the Indian populations of this species.

A very insidious, and perhaps the least acknowledged, form of conflict that occurs between humans and elephants is the survival threat to elephants caused by

cattle grazing on forestland. This not only reduces the forage available to elephants but also results in reduced quality of habitat, increasing the time required for vegetation to regenerate.

CONFLICT AND INSTITUTIONS

Many institutions, both national and international, are embedded in this human-elephant conflict in India. Most prominent, of course, are the elephants and the farmers, both victims and aggressors simultaneously. Also involved are the body of poachers and traders, who benefit from the harvest and sale of elephant-related products. The governing state, which enacts rules for the conservation of elephants and the protection of people, the state forest departments that attempt to implement them in the field, and citizen wildlife conservationists, who work with the people and for the elephant, represent a third set of institutions.

External institutions also impact the course of human-elephant conflict in India – the global market, for example, plays a role by controlling the market value of elephant-related products and agricultural commodities, which, in turn, crucially affects the poaching intensities of elephants or agricultural practices in the country. International wildlife bodies also make their presence felt in this

conflict, not only through monetary help to resolve conflict issues, but also by ratifying international laws that aid elephant conservation.

OPTIONS

Many measures have been practised to mitigate or resolve elephant-human conflict in India. Some of them have worked in the short-term although it is not clear if they will prove equally successful in the long term. Another stumbling block, particularly with respect to some of the techniques that have been implemented in the field, is the prohibitive cost connected with their large-scale application. Hence, state governments and most wildlife conservationists tend to focus on identifying low-cost mitigation techniques that will consistently work in the long term and cause minimal damage to elephants and people. Needless to add, however, as crop damage by elephants is the biggest issue facing humans in this conflict, mitigation measures typically address only this part of the conflict. Some of the more common techniques that have been practised include:

- i) Traditional crop protection measures that involve chasing elephants away from cropfields or habitations by creating loud noises through shouting, beating drums and bursting fire crackers, burning fires or using

- powerful search lights and torches;
- ii) Elephant-proof trenches and rubble walls to prevent elephants crossing over to cropfields;
- iii) Ringing the periphery of croplands or human habitations with electric or solar power fences to prevent the entry of elephants;
- iv) Early warning communication systems, such as trip wire alarm systems, satellite tracking and informant networks, whereby people receive prior information about the movements of elephants;
- v) Human-elephant conflict mitigation squads, consisting of village youths and trained elephants (*kumkies*), that are stationed at strategic locations to drive back wild elephants from cropfields and human habitations;
- vi) Planting buffer/unpalatable crops to make certain areas and crop fields unappealing to elephants;
- vii) Simple removal of conflict by capturing and translocating ‘problem’ animals;
- ix) Elephant drives, whereby large groups of elephants are driven away from the conflict area into safer zones;
- x) Compensation schemes, in which monetary compensation is paid to victims of elephant conflict in order to reduce the economic losses borne by them due either to crop depredation or the injury or loss of human life; and
- xi) Voluntary relocation of people from elephant habitats and effective land-use planning to reduce the effects of forest fragmentation.

LIVING WITH ELEPHANTS

FLASHPOINTS

These innocent migrants from Karnataka, which move into Maharashtra and Goa, wouldn't have thought they would be triggering a new border row. Karnataka, which already has disputes with these two states over language, place and water, now has to tackle the jumbo row. Maharashtra and Goa are holding Karnataka accountable for the elephant migration. They claim their crops are being damaged and want Karnataka to control the pachyderms. The problem has assumed such serious proportions that a series of high-level official meetings have taken place between Karnataka and Maharashtra. Six months ago, Maharashtra additional chief secretary held a meeting with then Karnataka forest secretary Sudhakar Rao. The jumbo problem began two years ago when elephants in the forests of Khanapur in Belgaum district found in Goa a new destination. For reasons best known to them, they crossed into Goa via Kolhapur. Forest officials said as the direct route to Goa is very steep, the elephants may be taking a detour. On the way, elephants pass through farmlands, damaging crops. This has irked Maharashtra. On the other hand, Goa has a different problem: it has little exposure to these giants and people are curious to see them, even if it means risking an attack. Every time elephants move into Goa, the government seeks Karnataka's help to drive them back. But Maharashtra thought of digging elephant-proof trenches at Kanakumbi in Khanapur region, from where elephants usually cross the border. Says chief wildlife warden Indu B Srivastava: "We admit there is a row over elephants. Elephants are migratory animals and don't understand the border issues. Even now, a herd of elephants has reached Goa and their government is seeking our help. We're trying to ensure that people and crops are not harmed when we drive the elephants back home. A senior officer and member of Maharashtra Project Elephant will visit Bangalore in a day or two to discuss the problem.

The Times of India, June 28, 2008

The Maoists may have hogged the headlines in these elections, but in the forests of Jharkhand bordering West Bengal and Orissa, it's the elephants that are a bigger problem. Ever since Jharkhand became an independent state in 2000, rampaging elephant herds in the forest areas have claimed nearly 800 lives. They are a source of concern to the authorities conducting the polls in tribal areas. In fact, even the city of Jamshedpur has not been left untouched; all along the Dumka, Sahibgang, Jamshedpur-Dumka and Chaibasa belt and in the Shikaripada and Jamtara areas, the jumbo problem is a serious one, and the villagers are demanding protection from the animals. The herds march through the jungle areas unhindered and destroy standing crops, houses and claim human lives on their way. People in these areas live in fear, and despite efforts by the administration to deal with the situation, nothing has changed for them. "The state has a forest cover of around 32 per cent and this enviable situation has become a curse for the villagers living in the forest tracts along the borders of West Bengal and Orissa," according to Raj Singh Munda of Singhbhum. People say that given a choice between the Maoists and elephants, they would prefer to kill the latter first. Although the price rise, law and order, development, power, roads and water are major issues, the most important issue here is the elephant menace. Forest officials said that people were being supplied kerosene oil to burn when the elephants approach their villages, but that this does not always work. A proposal for getting Kumki elephants from Orissa to train the rampaging elephants has been hanging fire for years. People often spend the nights on trees out of fear; there are cases where women have delivered babies on makeshift tree houses. Of the 14 Lok Sabha constituencies in the state, the elephant menace is a major issue in at least five: Ranchi, Khunti, Hazaribagh, Chaibasa (Singhbhum) and Dumka. Of the total 24 districts of the state, at least 13 districts are affected. In many areas the villagers have put up posters demanding action from political parties and the administration for their tusker-related problems. Although political parties have in the past promised action, nothing has changed. The villagers are no longer ready to believe in promises. What they want is action.

The Hindu, April 21, 2009

The ambitious proposal to build the world's first flyover corridor for elephants over the national highway and the railway line that cuts through Rajaji National Park linking the major pilgrim towns of Haridwar and Rishikesh, has been shelved after an elephantine gestation period of two years. After debating over the environmental viability of the project, the Supreme Court on Friday allowed National Highway Authority of India (NHAI)'s original prayer for constructing three flyovers for vehicles on the highway linking the pilgrim towns to allow the elephants to go underneath while crossing from one side of the forest to the other...Amicus Curiae Harish Salve scoffed at the idea of having a flyover for elephants and told the Bench comprising Chief Justice K G Balakrishnan and Justices S H Kapadia and Aftab Alam that nowhere in the country had this been tried and elephants, unlike smaller animals, could face problems in climbing the flyover. Though NHAI would be happy with the flyovers for vehicles, as it would cost it much less than the elevated elephant corridor, the main problem highlighted by environmentalists remains — a large number of deaths of elephants reported on the railway track linking the two most popular holy towns of Uttarakhand. The proposal for the elevated elephant corridor was agreed to by both NHAI and the railway ministry. It included two elevated corridors separated by 600 metres, each of which would be 1.2 kilometre long and 100 metres wide at the highest point and 300 metres wide at the ground level. The 'Grand Trunk Road' had the clearance from the apex court-appointed high-powered Central Empowered Committee (CEC), which green flagged it by a wafer-thin majority of 3:2. But, Salve had consistently expressed his reservation to the proposal, quoting environmentalists who felt that if at all there had to be a flyover, it should be for humans and not animals.

The Times of India, July 25, 2009

The human-elephant conflict issue in India manifests itself at various levels in the nation; the news reports above merely exemplify a few scenarios in the recent years. These incidents serve to highlight the severity of the issue and the importance of finding workable solutions to this problem. At the core of the issue is a conflict between

two species for the resources provided by a gradually overpopulating planet and the inequity that arises from this. In this report, we survey the history of this conflict, its nature and consequences and review the various techniques that have been used or recommended to mitigate the effects of this crisis.

TERRAIN

The Asian elephant (*Elephas maximus*) has a fairly wide distribution, extending over 13 countries in south and southeast Asia, including India, Nepal, Bangladesh, Bhutan, China, Burma, Thailand, Kampuchea, Laos, Vietnam, Malaysia, Sri Lanka and Indonesia. In comparison, its close relative, the African elephant (*Loxodonta africana*) is restricted to the African subcontinent, south of the Sahara desert. In terms of numbers however, the latter has survived better – current population estimates for the Asian elephant are numbered at 41,400 to 52,300, while approximately 472,300-639,300 African elephants are found in the wild today. The dwindling numbers of the Asian elephant has been attributed to loss of habitat, while the primary reason for decrease in African elephant populations is hunting.

Adult elephants feed on a varied diet of grasses, aquatic plants, bamboo, foliage, roots, bark, fruits, pith of several plants such as bananas and require about 150-300 kg of forage in a day. The area used by an adult elephant or elephant home range sizes may vary, depending upon the quality of the habitat. In India,

elephant home range sizes range from 274 km² in the Rajaji National Park, Uttarakhand, to 2837 km² in northeastern India and 235 km² in Nilgiris, southern India. Ecological studies on African elephants note that elephants occupying dry or arid habitats tend have larger home ranges than those occupying moist habitats. For example, elephant range sizes averaged about 350 km² in the western part of the Tsavo National Park in Kenya, while it averaged about 1580 km² in the drier eastern part of the Park. Such variations in home ranges sizes have been attributed to the amount of rainfall, and its effect on plant productivity levels in different areas. Heterogeneous habitats, such as secondary forests, that comprise a wide array of plant species, represent an easily accessible and nutritious food source for elephants; hence home range sizes in heterogeneous habitats tend to be smaller than home ranges in homogeneous habitats. It has also been observed that the availability of water is a critical factor affecting the movement of elephants and restricting the size of their ranges. Elephant populations may also migrate

over large distances regularly in response to seasonal changes that trigger food shortages. Apart from these environmental factors, elephant movement is also profoundly impacted by human settlement patterns. Rapidly expanding human habitations accompanied by the large-scale conversion of forests to agricultural land not only reduce the ranging area for elephants but also fragment their habitats, thus, impeding their migratory routes.

Early records in literature attesting to the presence of the Asian elephant in India date back to nearly 4000 years ago – the Rig Veda (17-11 BC), the Upanishads (9-6 BC) and the Gajashastra (6-5 BC) abound in elephant myths, details of elephant habits, and directives on how to capture and train elephants. Elephants once ranged across almost the whole of India, including the present-day states of Rajasthan, Punjab, Gujarat and Madhya Pradesh. A combination of pressures such as hunting, capturing, and habitat loss has completely wiped them out from many parts of their original range. Today, the total elephant population in India

numbers about 27,000-29,000 individuals (about 50% of the global Asian elephant population) and is restricted to four main regions in India – northeast, northwest, eastern and southern India. Of these, the largest populations are found in northeastern India. In this region, north of the River Brahmaputra, about 2700-3000 elephants range over northern West Bengal through the Himalayan foothills and the Duars to northern Assam and Arunachal Pradesh, while 6800-7200 elephants are distributed south of the river. Other large populations of the mammal are found in eastern and southern India – 2400-2700 in Orissa, Jharkhand and southern West Bengal, while about 6300 elephants are distributed over the Western and Eastern Ghats in the states of Kerala, Tamil Nadu, Karnataka and Andhra Pradesh. A significant number of elephants are also found in the Uttarakhand district – about 1000 elephants are found in six isolated populations west of the River Ganga, between the Ganga and Sharada rivers, and between Khatima Range and Katerniaghat.

HISTORY

The large size of elephants has been the focal point that has defined relations between humans and elephants in India. From ancient times, elephants have been an important part of human society – humans initially hunted elephants for meat; later, and as early as Harappan times, elephants were captured and domesticated for use in carrying timber and great loads. It is not certain when elephants began to be used in wars but the first documented instance of an army of elephants appears in descriptions of the Battle of Hydaspes River between Alexander the Great and King Porus in 326 BC. The importance Indian rulers placed on elephants is underlined by the Arthashastra (300-300 AD) that digresses in some detail on the duties of the Overseer of Elephants and lays down clear rules on the setting up of *hastivanas* or elephant sanctuaries on the outskirts of the kingdom. Although ivory from elephants was certainly prized and exported during these times, it is unlikely that large numbers of elephants were hunted for the ivory trade, as only male Asian elephants carry tusks and tuskers were required for the armies. The use of

elephants in wars declined with the advent of gunpowder and explosive artillery. The maintenance of elephant stables, however, continued to be a symbol of prestige and honour for the Mughal kings; Emperor Jehangir's stables, for example, reportedly comprised 12,000 elephants and his empire, nearly 40,000.

Its great size and prowess made the elephant a useful beast of burden, a powerful war machine and an emblem of grandeur and dignity. Its size also required and even today, continues to demand a need for large spaces that has made coexistence with humans difficult, particularly with the onset of agriculture. The Gajashastra reports great destruction caused by elephants during crop raiding while the Arthashastra recommends that elephants be eliminated from river valleys that form the mainstay of agriculture. Retaliations against crop-raiding elephants took the form of elephant bounty hunting during the nineteenth century. This, combined with the sport hunting of the British Raj and the agricultural needs of a burgeoning human population, resulted in the fragmentation of elephant habitats, the isolation of

elephant herds in central and northern India and the gradual disappearance of elephants from many parts of the country.

An integral part of human-elephant relations in India has been the human veneration of elephants as a representative of the elephant-headed Hindu deity Ganesha. This cultural belief in the sacredness of elephants manifests itself at several levels – in the occurrence of temple-maintained elephants, the central role of elephants in religious ceremonies and temple celebrations, and most significantly, in the tolerance and forbearance shown by farmers whose crops have been destroyed by elephants. Cultural mores, however, as is wont, transmute in their convictions and values across time and space; few issues demonstrate this more tellingly than the multiplicity of perceptions that shroud the subject of human-elephant conflict in twenty-first century India.

Conflict, in varying degrees, has always characterised human-elephant interaction in India. The momentous developments of the twentieth century however greatly exacerbated the nature of the conflict. Human population in India nearly quadrupled in the 20th century (from 238 million at the beginning of the century to a little over 1 billion today), resulting in an acute struggle for land and resources. The

development projects of post-independence India laid much emphasis on large dams, extensive agriculture and intensive mining, accelerating deforestation and the conversion of forestland to commercial plantations or open/cultivated land. In the years 1920-1990, for example, the annual rate of deforestation in the Western Ghats mountain range, along the western coast of southern India, was estimated to be 0.57%; nearly 40% of the original forest cover was converted to plantations and agricultural land. The scene in other parts of India is not much different. In Orissa, high levels of encroachment and intense population pressure caused by an influx of refuge settlements has resulted in considerable loss of forest cover in many areas. In the Nawrangpur district alone, for instance, there has been a loss of nearly 1043 km² of dense forest cover from 1973-2004. The annual rate of deforestation in northeastern India was calculated to be 1.3% for the period 1990-1995, and the situation has only worsened since then. The Kameng and Sonitpur Elephant Reserves of Assam and Arunachal Pradesh experienced habitat loss of nearly 344 km² from 1994 to 2002. The annual rate of deforestation in the area for this period was calculated to be 1.38%. In addition, civil unrest and insurgency in many parts of northeastern

India negate efforts by state forest departments to prevent tree felling and wildlife poaching, thereby compounding problems associated with the protection of elephant populations and their habitats.

Loss of forest cover and forest fragmentation (the break-up of a large forest area into smaller patches) affect elephants in two ways. One, it reduces the size of their ranging areas and two, their access to customary migratory routes is blocked or lost. This leaves them with little space to find food or shelter; in addition, they are also subjected to high levels of disturbance in their existing home ranges due to the presence of cattle and human activities such as logging, and collection of forest produce and firewood. Consequently, elephants tend to move out of their habitual areas in search of new places where they can obtain forage, water and shelter. This brings them in greater contact with people, resulting in interactions that cause damage and devastation to both species. In areas where

elephants have been a part of the environment, albeit a perilous part, their interactions with people are tempered by culture – human reactions and retaliations are often leavened with acceptance, and, even if not always, with tolerance. Some elephant populations have, however, even moved into areas that are not traditional elephant habitats, as has occurred in Andhra Pradesh, Maharashtra and Goa. This results in a situation, where people who are unused to the concept of living with elephants, are forced to interact with them and deal with the outcomes. Andhra Pradesh, which had not seen elephants for over 300 years, is a textbook example of such a state of affairs. A small herd of elephants had migrated into Andhra Pradesh in 1985, has since then grown in number, and taken up permanent residence in the Palamner forests. From 1987-1993, more than 30 people and 12 elephants have died as a result of the human-elephant conflict that has since developed in this region.

ISSUES AND CONTENDERS

Two individuals/groups have a conflict of interest when both seek the same object but only one can gain it, or both seek different objectives and one can prevent the other from achieving its goal. Little surprise therefore that human-wildlife relations in India today are characterised by conflict – both parties require the same basic natural resources; moreover, these resources are finite and limiting in nature; interactions between them are thus bound to be inequitable. In India, although a very small percentage of the geographical area (less than 5%) has been set aside for the protection of fauna and flora, in reality, few forest areas are inviolate from human intrusion and exploitation. Loss of habitat or loss of access to habitat brings elephants in greater contact with human populations leading to interactions that result in injury and sometimes even death for both species.

Human-elephant conflict in India manifests itself in several ways, most notably, elephant poaching, retaliatory killing of/injury to elephants, crop raiding by elephants, injury to humans or human mortality, and destruction of property,

houses and buildings by elephants. From the human perspective, naturally, two predominant aspects of human-elephant conflict in India have been causes of much debate, in-depth study and great concern, namely crop damage caused by elephants and elephant-caused human death and injury.

RAIDING

The most public face of human-elephant conflict is the raiding of crop fields and grain storage centres or houses by elephants. Cultivated grains and commercial crops, in comparison to the wild grasses and plants that form the natural diet of elephants, represent rich and easily digestible sources of nutrition. Cereal crops like finger millet and paddy provide higher levels of protein, calcium and sodium than do wild grasses and hence, feeding on such crops translate to greater foraging efficiency for elephants. Crop raiding, however, carries a high amount of risk for individual animals and many studies have observed that male elephants raid crops more frequently than do female elephant herds. Commenting on this phenomenon, Sukumar and

Gadgil (1988) posit that the key to understanding this lies in the high competition between male elephants for mating access to females. Better growth and greater body size due to the better nutrition provided by crops would give a male elephant greater dominance over other males in the population. Hence, male elephants may be more willing than female elephant herds to court risks for the nutritional gain of crops. Other studies, however, caution that though all elephants who have access to crop fields do not necessarily turn into crop raiders, it is instructive that elephants who have lost part of their home range to crop fields tend to raid crops much more frequently.

HUMAN DEATH AND INJURY

Elephants kill or injure humans during crop raiding, during encounters in the forest, and during movements through human settlements beside forests. Many cases of human mortality due to elephants are inadvertently caused, as when elephants damage buildings and thereby kill people, or when they are surprised by people in the forest and therefore respond violently against a perceived threat. Elephants also tend to react aggressively to the presence or actions of people when the latter try to obstruct them from their

intended goal of feeding on crops and large numbers of people are killed or injured due to this behaviour. It has been noted that the intensity of aggressiveness on the part of elephants varies between regions and experts on elephant behaviour point out that this variance may well reflect the nature of interactions between humans and elephants in different areas. In the period 1991-2001 alone, wild elephants caused a total of 2,116 human deaths across the country. The highest number of deaths occurred in West Bengal (664), followed by Assam (437) and Karnataka (335).

Typically, more men than women or children have been killed by elephants and this difference is easily explained by the fact that men, more than women, go into the forest to graze cattle or guard crops at night. Both herds and bull elephants have been found responsible for human deaths but since the majority of human-elephant interactions happen during crop depredations by elephants, many studies have found that more humans have been injured or killed by bulls rather than by herds. The common belief that male elephants in *musth*¹ are largely responsible for human deaths though, has little evidence to support it. Male elephants that have caused human deaths

¹ An annual phase of increased aggressiveness and sexual activity in male elephants that is associated with discharge from a gland between the eye and ear.

or injuries may be more aggressive than other individuals due to festering injuries or, perhaps because of a propensity to raid crops, may have learned from experience to respond more aggressively to humans.

ELEPHANT KILLING

Elephants were and continue to be killed in India for a variety of reasons – for sport, to obtain meat and ivory, and to protect human lives, crops or property. Sport hunting of elephants is a centuries-old tradition in India. Various references in literary epics like the Ramayana (c. 900 BC) attest to the fact that shooting wild elephants was a prestigious sport enjoyed by many kings. Under colonial rule, in the 18th and 19th centuries, elephant hunting turned into a fashionable sporting event that decimated hundreds of elephants. In 1972, sport hunting of elephants was prohibited by law in India; however, hunting licenses to shoot elephants to prevent crop damage continued until 1981. Shooting ‘rogue’ elephants to defend human lives and property is still an option practised by many state governments in the country.

Elephant mortality due to collision with trains is another issue of human-conflict in India that has only increased in importance over the years. Several protected forest areas in the country that

contain critical populations of elephants have railway lines running through or near them. Elephants that cross the tracks at night in order to move to areas on the other side of the railway line are sometimes run down by trains resulting in their gruesome deaths, sometimes even of the entire herd. This issue is particularly pronounced in Assam, Tamil Nadu, West Bengal and Jharkhand, where scores of elephants have died due to collisions with speeding trains. Assam recorded a total of 35 elephant deaths due to trains in the period 1990-2006. The main reasons responsible for elephant-train accidents have been identified as (i) the high speed of trains in spite of well-advertised warnings to the contrary, (ii) the location of track sections around sharp curves, which prevent train drivers from seeing elephants until too late, and (iii) the steep mounds on the side of the tracks that slow the movement of elephants and prevent them from crossing the tracks quickly. In an interesting experiment, the state forest department of Uttarakhand joined forces with the Wildlife Trust of India and Northern Railways to implement mitigation measures to resolve this particular form of human-elephant conflict in the Rajaji National Park. Based on suggestions made by both forest managers and wildlife experts, steep banks along the tracks were flattened to

facilitate animal movement in the Park and water bodies on one side of the track were de-silted so that elephants would not need to cross the tracks to gain access to water source on the other side. In addition, night patrols were conducted along the tracks in order to warn train drivers of the presence of elephants on the track so that they either reduced the speed of the trains or stopped them completely. It is illuminating that not a single elephant has died due to train collisions in the Rajaji National Park once these measures were implemented.

Elephant deaths by poisoning, electrocution, or other means, in retaliation to crop depredation and human injury or in order to prevent elephants from entering cropfields and human habitations has steadily been on the rise in the past few decades. According to the Elephant Mortality Database of the Wildlife Trust of India, a non-governmental wildlife organisation based in New Delhi, 175 elephants have died due to human-elephant conflict in the country between the years 1997-2001. The wave of elephant poisoning incidents in Sonitpur, Assam in 2001 and the steady increase in the number of elephant electrocutions in the Nanjangud/Kollegal area of Karnataka in recent years mark this as a serious threat to the survival of elephants in India.

It is tempting to link the number of elephant retaliatory kills in various conflict-dominated areas in India to the extent of crop damage, and human death and injury caused by elephants in those parts. Reality, however, is neither that simple, nor does it offer easy answers. Perceived damage to crops or property shapes responses to the perpetrating animals far more strongly than actual loss and this largely dictates the nature of retaliation. Agricultural pests like rodents, insects and pathogens cause far more economic losses than do larger crop-raiding wildlife species like primates, wild pigs and elephants; yet farmers, either due to a poor understanding of the precise nature of fiscal damage caused by agrarian pests or because high intensity conflicts, despite their low frequency, are more memorable than everyday, low intensity conflicts, typically rank the latter group as more intolerable than the former. Frequently, farmers' reports of damage caused by wildlife species greatly exaggerate the scale of actual loss. This could be to maximize compensatory benefits or due to a genuine misconception of events for fear of the wildlife species and the devastation they could potentially bring about. Cultural mores also colour views on which animals are blamed for causing damage and destruction; typically the larger, more

conspicuous, and ‘culturally iniquitous’ species receive the larger part of the blame. However, while the average monetary loss of crop damages due to ‘wildlife pests’ like elephants may not be large over a particular region, the actual loss to an individual farmer might be quite catastrophic.

ELEPHANT POACHING

Elephant poaching in India for meat or ivory has historically been of low intensity or occurred at sporadic intervals in various parts of the country. However, in the more recent years, this practice has reached alarming proportions across India. For example, in the late 1970s and 1980s, a poaching wave of considerable intensity spread across southern India; northern and northeastern India were, at this time largely unaffected by this problem. In 1981-82, 65% of elephant mortality in southern India was due to poaching while 42 elephants were killed for ivory in Tamil Nadu alone during the period from 1983-1986. In 1986, the Indian government banned trade in Indian ivory; this was followed, in 1991, by a ban on the import, export, carving and sale of African ivory as well. These moves, it appeared in 1992, were successful in ending elephant poaching for ivory but this phase was, unfortunately, very short-lived. The early

1990s saw an increase in poaching incidents in central Kerala and by the mid 1990s, poaching was firmly established in most elephant range states in India. In 1996, elephant poaching rapidly escalated in India, with 88 tuskers being killed for ivory across the country. The situation only worsened the next year, with 102 elephants being killed. It has been estimated that although elephant poaching is a widespread phenomenon across the country, Tamil Nadu and Orissa register the highest number of cases. Exact numbers are not available, but Veerappan, an infamous bandit who ruled the forests on the Karnataka-Tamil Nadu border for nearly two decades, appeared to be alone responsible for the killing of 200-odd elephants. Since 2000, elephant poaching has increased in scale, particularly in northwestern India. The Wildlife Protection Society of India, another non-governmental organisation based in New Delhi, has recorded the loss of over 43 elephants countrywide due to poaching from September 2000 to March 2002.

Selective hunting of male elephants for ivory (in Asian elephants, unlike their African counterparts, only the males carry tusks) has severe consequences for wild populations of elephants in the form of female-biased sex ratios, reduced genetic

variation in populations, increase in the number of *makhna* (tuskless) males and decreased mating success for females. In the Periyar Tiger Reserve in Kerala, which had witnessed one of the worst spates of elephant poaching in the 1980s, the male-female sex ratio on the elephant populations has been severely skewed – in 1969, the male-female ratio was about 1:6, whereas, following the poaching incidents, it was 1:122 in 1987-1989 and 1:101 in 1994-1995. In a new and disturbing trend, in October 2008, 10 kilograms of elephant molars and 250 grams of elephant tusk were seized in Bijnore in Uttar Pradesh and 5.9 kilograms of ivory from Laldhang division in Uttarakhand, close to the Rajaji National Park. This indication of trade in elephant molars that could affect both male and female elephants poses disturbing implications for the survival of the species. Another form of poaching, which also affects both male and female elephants, is hunting for elephant meat. This practice had traditionally been restricted to Mizoram and Meghalaya in northeastern India but the resurgence of this practice in Tripura, Assam and other parts of Meghalaya in recent years and the organised way in which elephants are hunted and their meat canned and preserved before

transportation argues that a new commercial market for elephant meat exists, probably outside India, and this bodes little good for the future existence of the elephant in northeastern India.

GRAZING PRESSURES

A less known or recognised aspect of human-elephant conflict is the danger posed to elephants by the very common practice of livestock grazing inside forests. Across India, people living beside forest areas graze their cattle inside forests, thereby reducing the forage available for elephants. Overgrazing also destroys the quality of the habitat weakening the rate of replenishment of browse availability. Additionally, grazing livestock inside forests raises the risks of transmitting diseases such as anthrax, rinderpest and foot-and-mouth disease to wildlife species that are potentially much more vulnerable to them.

DIFFERENT STROKES

It is a truism that every individual is different; so too, despite the commonality of the issue, human-elephant conflicts in different parts of India vary in their form and intensity. A brief examination of human-elephant conflicts in different parts of India throws up diverse issues and the need for realistic solutions suited to local needs.

Valparai, in the midst of the Indira Gandhi Wildlife Sanctuary, in Tamil Nadu, southern India is dominated by tea and coffee plantations. Here, property damage is the more frequent form of conflict. Elephants occasionally raid ration shops, school kitchens and houses and cause much damage in the process. In 2002-2003, 156 incidents of property damage were recorded, of which 31 were cases of stored grain/provisions raiding. Herds that stray into tea estates are chased from one into another during the day. Consequently, by nightfall, the hungry animals that are stranded amidst a mosaic of tea plantations raid the nearest ration shop or granary in search of food. Unsurprisingly, the majority of such incidents have occurred close to the traditional migratory routes of the elephants across the Valparai plateau. Elephant-caused injury or fatalities to human life are relatively low in comparison to other parts of India (27 cases in the period 1994-2003) and have occurred only in coffee or tea plantations and near forest fragments. Moreover, no fatalities have been reported from forest areas or in any of the tribal settlements within the Indira Gandhi Wildlife Sanctuary and elephant retaliatory killing or poaching has also not been reported from Valparai although a few elephants have sporadically died due to accidental poisoning from stored pesticides.

In Kodagu district, the Coffee Bowl of Karnataka, in southern India, the situation is more alarming. Human-elephant conflict here takes the forms of crop raiding, human injury and deaths, and retaliatory killings of elephants. Previously one of the highly forested districts of Karnataka, Kodagu is currently dominated by coffee and cardamom plantations. In the mid-twentieth century, large swathes of forestland were converted to agricultural land and this is reflected in the dramatic decrease of forest cover from 64% in 1977 to 46% in 1997. In Kodagu, an average of 600 crop damage cases occurred annually between 1996-2002 alone while a total of 102 human death and injury cases was reported for the period 1995-2005. Importantly, although there has been no significant increase in the number of crop damage cases in recent years, there has been a rise in the number of human death and injury incidents. From 1990-2004, 54 elephants were killed in the district in retaliation for the damage and destruction they had caused. They died mainly due to gunshot wounds and electrocution.

In Rajaji National Park in northwestern India, human-elephant conflict takes on the forms of crop raiding, injury and death to humans, and death of elephants due to trains. From 1996-

1998, a total of 159 incidents of crop raiding occurred in 22 villages in and around Rajaji National Park. Unlike in some other elephant ranging areas in India, the risk of elephants being killed in this area has been much higher than that of humans being killed by elephants. Eleven cases of human death or injury caused by elephants occurred during the period 1994-1999, while 22 cases of elephant deaths occurred from 1992-1999, largely due to train accidents and electrocution from high-powered electric fences placed around fields. Trains run at least 24 times daily between the Chilla and Motichur sanctuaries and have been responsible for more than 70% of elephant deaths. Elephant poaching, previously unknown in this area, has also steadily started increasing since 2001. It has been recommended that unless mechanisms are immediately put in place to prevent elephant-train collisions, stop poaching and regulate fuelwood and fodder extraction from within the Park, the future survival of the elephant population here remains a cause of worry.

By far, the most ominous warnings have been reserved for the human-elephant conflict situation in West Bengal. Although the elephant population in the state is approximately only 1% of the total population in the country, the intensity of human-elephant conflict is one of the

highest in India. Much of the conflict is concentrated around northern West Bengal in the tea plantation-dominated districts of Darjeeling and Jalpaiguri, and in the southern districts of Midnapore (currently divided into East and West Midnapore), Bankura and Purulia. People living in these parts incur huge losses due to crop and property damage, and many human lives are lost yearly during crop depredation. In the period 1986-1995, human casualties numbered a staggering 402. It is estimated that approximately 4000-4500 ha of agricultural land and 1000-1200 houses are destroyed by elephants annually in northern West Bengal. In the period 1991-1995 alone, nearly INR 94 lakhs was paid out by the Government of West Bengal as compensation to people for losses sustained due to elephants. Human retribution is reflected in elephant killings and injuries through pesticide poisoning, local weapons, and state-sponsored 'rogue elephant shooting' (of the 24 elephant deaths from 1987-1996, 67% were a result of human-elephant conflict). What is remarkable, however, is that despite the hardships suffered by smallholdings farmers in southern West Bengal, the majority of them still revere the elephant.

In contrast, case studies in northeastern India clearly concur that very little tolerance exists for the elephant in

these parts. In Assam particularly, extensive crop and property damage by elephants and injury to or loss of human lives due to elephants has led to a simmering resentment against the great beast that surfaces, either in a wave of elephant poisonings (22 elephants poisoned, for example, in Sonitpur district in 2001-2002) or elephant injury and death through gunshots and electrocution. It is clear, however, that much of the people's bitterness seems to be fuelled by the seeming apathy of the Forest Department officials to address the needs of the villagers or compensate them for their losses. Immediate compensation of economic losses and effective measures taken up by governmental authorities to prevent elephant crop depredation would go a long way in reducing conflict levels, at least in terms of retaliation against elephants. Elephant deaths due to train accidents are another grim aspect of human-elephant conflict in Assam. Between 1990 and 2006, at least 35 elephants were killed due to train hits in Assam. More than 50% of the elephant deaths occurred in Karbi Anglong West, Digboi and Kamrup East Forest Divisions of the state. The highest frequency of elephant-train accidents occurred in Kamrup district, followed by Nagaon, Karbi Anglong and Sonitpur.

Gurung and Lahiri-Choudhury (2001) point out that although human-elephant conflict is not a recent phenomenon in the state of Meghalaya (they quote P D Stracey as describing the crop and property damage, and human deaths caused by marauding elephants as early as 1967), shortening *jhum*² cycles resulting in reduced elephant habitat is the single main reason for the drastic increase in human-elephant conflict levels in the state. In the states of Mizoram and Nagaland and in parts of Meghalaya and Manipur, another form of human-elephant conflict exists – poaching elephants for meat. This practice has locally extirpated the species from large parts of Mizoram, Manipur and Nagaland. Many tribes of northeastern India including, for example, the Karbis and the Garos, do not customarily consume elephant meat; hence, the recent sprout of elephant meat-poaching incidents in the Garo Hills of Meghalaya is troubling. There are also clear indications that this trend is dictated by commercial interests rather than subsistence hunting and thus has more serious ramifications.

Human-elephant conflict in Chhattisgarh exemplifies a singular aspect of this strife that is, unfortunately,

² Nomadic swidden agriculture, wherein a patch of land is cleared by fire, crops are grown and post-harvesting, the patch is deserted until the soil regains its fertility.

becoming more common. Although elephants ranged in northern Chhattisgarh until the end of the 19th century, they became locally extinct from the state in the early part of the twentieth century. In 1988, a small herd of elephants first moved into Chhattisgarh from Jharkhand; since then, the number of elephants moving in has steadily increased. Experts have linked their reappearance in Chhattisgarh after a period of more than 100 years to the rapid loss of forests and elephant habitat in Jharkhand and Orissa due to illegal felling encroachments, mining and industrialisation. Since 2000, the problem has only increased in dimension, and between government-sponsored abortive elephant captures and entire villages fleeing their homes to escape being trampled underfoot by elephants, the only significant change that has occurred in this conflict is the transformation of the elephant from divine succour to a devilish fiend in people's imaginations.

This brief geographical review clearly reveals the plethora of issues that either drive human-elephant conflict in different parts of the country or emerge from the aftermath of the conflict. Each region of our country is as socially and culturally diverse as the next, and so is the nature of the conflict that occurs there. It is

indeed a frustrating exercise to try and classify these complex interactions into simpler categories although we have attempted to do so above. The real crux of the problem, however diverse it may appear to be, actually lies in the people's threshold of tolerance for damages incurred due to elephants. This not only differs between communities, but also varies greatly between individuals. Wealthier farmers are more able to cope with the economic losses caused by elephants; yet plantation owners who have invested in cash crops are the most intolerant group in some areas while they may be more tolerant in other locations. India, in comparison to North America and many countries in Asia and Europe, has a commendable record in preserving its wildlife and their habitats. Considering the enormous pressure that is brought upon the natural resources of the country by the continually increasing human population and their demands, human-wildlife conflict appears inevitable. The more surprising, and inspiring, part of this issue, however, is the forbearance displayed by scores of poor farmers all over the country, whose season's harvest has almost completely been destroyed by a herd of elephants and yet who remain remarkably tolerant and aware of the needs of the animals themselves.

INSTITUTIONS

People-wildlife conflicts are universal, and whether they occur on land, in the sea, in rural areas, in urban conglomerations, they have been a feature of our past and are an inescapable part of our present. Battles with wildlife affect the economic development of the state and the quality of life of its human citizens and, to this extent, they are matters of grave concern for a state. Simultaneously, they are also grim issues of animal conservation, particularly in the case of large, wild mammals. It follows that multiple institutions, with varying perspectives, are involved in human-elephant conflicts in India. On one side are ranged people, who live in close contact with elephants and are affected by their very existence. This community not only includes poor and wealthy farmers, whose crops, and therefore financial security, are damaged by crop-raiding elephants, but also plantation workers and people who live in settlements near or inside the forests and whose lives and property are endangered by the movement of elephants near their homes. An important unit of this body are poachers and traders, who

gain much from their exploitation of elephants. The other side of the conflict is, of course, represented by the elephants, which have lost much of their habitat and food resources due to continual ingression by humans into lands of which they were once masters. The governing state, which finds its most visible expression in the judiciary that lays down laws about the exploitation of elephants and state forest departments that implement them, along with citizen wildlife conservationists, symbolise a third side to this strife that attempts to mitigate the effects of the conflict and resolve it through various methods and schemes.

Apart from domestic institutions, external forces like the global market and the international wildlife community also play critical roles in determining the course and structure of human-elephant conflict in India. Some of these forces directly impact human-elephant conflict levels, as, for example, the existence of an international market for elephant products such as ivory and meat increases elephant poaching intensities in India. The global economic linkages that exist today, however, also ensure that

fluctuations in the international export levels of commodities like coffee could significantly influence human-elephant conflict levels. Studies on the nature of livestock grazing in the Bandipur Tiger Reserve in Karnataka, for instance, have revealed that the increase in livestock numbers due to a lucrative dung trade (supplied as manure to the coffee growers in the hill districts of Wynad, Kodagu and Nilgiris) results in overgrazing and degradation of wild herbivore habitat within the wildlife sanctuary and therefore, in drastic decline of their numbers within the sanctuary. A different kind of role is played by international wildlife bodies like the IUCN (International Union for Conservation of Nature) that not only provide monetary funds to research and mitigate human-elephant conflict situations in India, but also pressurise the country's government to step up protection levels for elephants through instruments like CITES (Convention on International Trade in Endangered Species of Wild Flora and Fauna). CITES banned international trade in Asian and African elephant ivory in 1976 and 1989 respectively, and the Indian government followed suit with a ban on trade in Indian ivory in 1986 and a ban on all imported ivory in 1991. The sharp decline in elephant poaching in India in the early and mid-nineties is

directly linked to these actions. In 1997, however, CITES permitted the down-listing of African elephant populations in the African countries of Zimbabwe, Namibia and Botswana, and the resumption of partial ivory trade in these countries. Elephant conservationists link the recent rise in poaching levels of the Indian elephant to this resolution and argue that this decision of CITES not only sends a message to ivory traders that the ivory ban may be lifted worldwide, it also currently provides an avenue for illegal export of ivory from India to other countries.

Clearly, the many actors engaged in this struggle hold deeply polarised positions that beget precarious compromises or ad hoc solutions. The primary contenders – forest department personnel, local communities and elephants – are caught up in a confrontation that does not offer easy resolutions. State forest departments operate as authoritarian institutions that use punitive measures such as fines or imprisonment by law to prevent killing of elephants or disturbance of their habitats in order to ensure the long-term survival of elephants in India. They also address the elephant-related woes of the local communities through conflict mitigation measures and help them in their efforts to reduce damages caused by

elephant depredations. Their efforts are not always successful and local communities, who are negatively affected by elephant activities, but are legally, and perhaps morally, prevented from seeking retribution, feel exploited in this process. Ironically, elephants, which, of course, form the cornerstone of the conflict, have little say in either party's actions.

Much of the reasons for the uneasy alliance between the government and the local communities, which are affected by conflict with elephant, lie in the nature of forest stewardship in India. Forest reserves declared under the protection of state forest departments are wholly controlled by the latter – extraction or use of forest resources, such as timber or other forest produce and the killing of wildlife is strictly controlled or prohibited by law. Local communities, who, through the circumstances of their livelihood, are forced to interact with elephants, therefore, see it as protected by and 'belonging' to the forest department. Fear of the elephant and anxiety for the damage it causes translates into resentment against the forest department for failing to prevent the elephant from destroying their property and for delaying restitution. The state, for its part, expends crores of rupees every year as compensation benefits, and yet, the sheer scale of damage involved and the bureaucratic process and

corruption inherent in successfully claiming compensation usually defeat the very purpose of the scheme, eroding the goodwill of farmers. During investigations into people's attitudes towards human-wildlife conflict in villages adjacent to the Rajaji National Park in Uttarakhand, the villagers expressed a complete lack of trust in the abilities of the forest department to solve their wildlife conflict problems. The following responses sum up a collective attitude of frustration and resignation:

“Forest Department authorities are sitting in their air-conditioned rooms—they do not know anything about the poor people.... All villages have the same situation; all people are troubled like this. Whichever village is near the Park, all people are troubled.”

“We feel that conflict with wildlife is our destiny and we have to live with it.... The God of Development has not yet been born, and so we just wait. What else do we do?”

“What can the villagers do by themselves? The FD (Forest Department) will do it by itself – they release the wild animals, so they will do it. What can villagers do? If villagers kill them [animals] then they are arrested. There is danger to the villagers, even from the FD.”

Studies on human-wildlife conflict emphasise the point that apart from visible costs (direct economic losses), people also suffer from hidden costs that are difficult to quantify but nevertheless strongly impact attitudes towards the conservation of wildlife species. These hidden costs refer to the loss of social and economic opportunities because an individual's time and energy is spent on combating wildlife conflict but which could have been utilised otherwise. In her gender-based approach to problems associated with human-elephant conflict in a village in Uttarakhand, Ogra (2008) argues that the conflict results in hidden costs like decreased food availability, greater workload, decreased physical and psychological well being, economic hardship, and greater risk to the physical self, and that women disproportionately bear the greater burden of these costs.

Elephant conservationists in India function as important links between elephants, the local citizens and the government. They work independently or through the medium of organisations and seek to understand the causes of the conflict and the options for conflict resolution. They may work at regional or national levels and endeavour through their efforts to mitigate conflicts in various areas. The Wildlife Trust of India, Wildlife Protection Society of India, Asian Nature

Conservation Foundation, Nature Conservation Foundation, World Wildlife Fund India and the Samrakshan Trust are some examples of organisations that work in various parts of the country on human-elephant conflict issues, while organisations like Nature's Bonyapran, Aaranyak, Envirosearch, Ecosystems India, Osai and A Rocha India have a more regional focus in their efforts to reduce human-elephant conflict. These organisations or individuals collaborate with state forest departments in their efforts to conserve elephants in various ways:

- ❖ They document and share important scientific information on elephant ecology and behaviour which is highly relevant to conflict situations. Sukumar's (1990) work on crop-raiding behaviour in male and female elephants, for instance, is a good example of how behavioural research has improved our understanding of elephant behaviour in conflict situations.
- ❖ Based on their research, they make recommendations on areas that could be set aside for elephant habitats and on conflict mitigation techniques.
- ❖ They provide forest department personnel with critical equipment

and training to help them in their efforts to reduce elephant depredation.

- ❖ In areas where the forest department lacks sufficient resources, they set up veterinary and rehabilitation care for injured wild elephants.
- ❖ They educate local communities affected by elephant depredations on ways to avoid conflict situations, provide equipment such as powerful torches, and participate in deploying techniques whereby such conflicts may be reduced.

Due to their position as non-governmental institutions, these organisations are often not viewed with the same suspicion that forest departmental personnel engender and tend to be much more accepted by the local population. In the case of regional organisations, of course, acceptance is much easier as they are viewed as being part of the community. Predictably, the latter, comes at a price – wildlife organisations with distinct local affiliations tend to be viewed by state departmental organisations as groups with agendas of their own.

OPTIONS

Countrywide, large-scale developmental projects, growing human populations and the increasing use of resources, particularly land and water, ensure that conflicts between humans and elephants are an inescapable part of our future in this country. A complete resolution of these conflicts is perhaps not possible anymore; instead, the efforts of governmental institutions and elephant conservationists have focused on finding and implementing low-cost mitigation measures that work in the long-term. In an excellent review of human-elephant conflict mitigation techniques practised in India, Kumar (2007) evaluates the efficacy of several techniques in terms of their strengths, weaknesses, cost effectiveness and long-term viability. He notes that out of the 75 publications on this issue, the larger number (75%) suggested or recommended mitigation measures, while only 16% of them evaluated or implemented any technique. Less than 10% of the studies experimented with different mitigation methods and the results of these efforts are yet to be known.

As crop raiding and property damage are the most visibly prevalent forms of human-elephant conflict, the majority of conflict mitigation measures are conceived to deal with and reduce such forms of conflict. In recognition of the more insidious threat posed by the loss of or damage to elephant habitat due to the presence of human encroachments/settlements, deforestation, and livestock overgrazing, concerned institutions have experimented with schemes such as appropriate land-use planning and voluntary resettlement of people from protected elephant habitats. Scientific studies on the causes responsible for elephant mortality due to trains have already show that properly implemented mitigation measures, as was carried out in the Rajaji National Park in Uttarakhand, can resolve this particular form of conflict. Yet, for various reasons, it has not been easy to enact these mitigation techniques in other parts of the country. As observed earlier, legal mechanisms are already in place to thwart elephant poaching for ivory and meat; irregularities in enforcement and the lack of stringent punishments, however,

permit this form of conflict to flourish at the expense of elephants.

Crop raiding by elephants is an age-old phenomenon in India; consequently, many techniques that are used to combat this in various parts of the country are ancient in practice. With the advent of globalisation and sophisticated technologies, many new methods have been experimented with in different studies. In addition, methods that have been used successfully in other elephant countries are occasionally recommended for implementation in India. The use and efficiency of some of the methods that are currently used are discussed below.

Traditional Crop Protection Measures

These involve chasing elephants away from crop fields or habitations by creating loud noises through shouting, beating drums and bursting fire crackers, burning fires or using powerful search lights and torches. Such methods may be used by individual farmers guarding their fields or by a group of farmers or village societies that guard the peripheries of contiguous fields. Platforms built on trees (*machan*) help farmers to detect the presence of elephants from a distance, in addition to providing some degree of safety. The purpose behind such methods is to give signals about the obvious presence of

humans and frighten elephants into leaving. The downside of these methods is that (i) they are limited in applicability to a few square kilometers, (ii) elephants quickly habituate to these methods and cease to be affected by them, and (iii) people often come in close contact with elephants during the use of these methods resulting in serious injuries and sometimes, even death, to the former.

Elephant-proof Trenches

One of the most commonly used physical barriers to prevent the movement of elephants, this technique, when first introduced, was considered a cost-effective and foolproof method to prevent the entry of elephants. Deep ditches or trenches of standard measurements are constructed along the periphery of farmlands to prevent elephants from entering the fields. Over the years, however, this method has largely failed due to several reasons. In many areas, trench dimensions are below the prescribed standard with a lack of proper construction at several crossing points. This aids elephants to cross such trenches. Other factors such as earth filling of trenches by both humans and elephants, improper maintenance, erosion and collapse of trench walls and non-completion of trenches due to trees, boulders and stream beds ensure that trenches do not prevent elephant

invasions into farmlands too successfully. Another weakness of this technique is the high cost involved in building and maintaining elephant-proof trenches. According to an estimate by the Tamil Nadu Forest Department, the present cost of building elephant-proof trenches works out to approximately INR 900/metre. Some studies have, however, indicated that such trenches, along with solar power fences, are indeed highly effective and completely eliminate unwanted elephant incursions.

Electric Fences

Ringing the periphery of croplands or human habitations with electric or solar power fences to prevent the entry of elephants is a popular technique that is widely used in many parts of Karnataka, Kerala, Tamil Nadu and West Bengal. Typically, such electric fences consist of three to four wires fixed a foot apart and deliver a pulse of 4000-8000 volts if touched. Such fences have been put up by private individuals, governmental and non-governmental organisations in various parts of the country. In northern West Bengal, these fences are mainly used to protect human settlements, whereas in Kerala, Karnataka and Tamil Nadu they are usually used to protect croplands and plantations from elephant depredations.

Although good-quality electric fences often successfully deter elephant invasions, the high cost involved in installing and maintaining such fences (the cost of installing an electric fence along the border of the Indira Gandhi Wildlife Sanctuary in Tamil Nadu in 2007, for example, cost almost INR 116,000/km) usually keep them out of reach of the large majority of small- and medium-size land owners. Several state forest departments have erected electric fences in their human-elephant conflict areas; questionnaire-based surveys of people's perceptions of the functional status of electric fences, nevertheless, report that government-owned fences are often seen as being less effective than privately owned fences. Interestingly, the working condition of private fences was also observed to be far superior to state forest department-owned fences. An important downside of electric fences, however, is that many elephant deaths have been caused by high-voltage electric shock that often results from illegal electric connections to high-tension wires.

Barbed wire fences have been used in a few areas in Karnataka; they, however, function more as psychological cues to the presence of humans than as actual physical barriers to the movement of elephants.

Rubble Walls

This is again a physical barrier technique that consists of rough rocks or stones piled up to form a wall of standard dimensions without the use of cement. As with the elephant-proof trenches, however, rubble walls are not built according to prescribed measurements in India. They are typically constructed, along with elephant-proof trenches, to act as barriers to the entry of elephants but have not yet proved very successful in practice. Discontinuities in rubble walls, breakages made by people for access to forest lands, and crumbling and erosion due to rainfall or poor construction are some of the reasons why rubble walls appear to have failed as effective mitigation measures.

Early Warning Systems

This refers to the use of several kinds of communication systems whereby people receive prior information about the movements of elephants and possible incursions into their croplands. Many kinds of warning systems have been experimented with such as trip wire alarm systems, satellite tracking of elephants and informant networks.

Trip Wire Alarm Systems: This technique comprises a thin wire that is strung over posts placed near croplands or human habitations. The wire is connected to a toggle switch, which, in

turn, is connected to an alarm bell. When an elephant pushes the wire, the switch triggers the alarm bell. The concept behind this system is that farmers receive sufficient notice before the entry of the elephants and therefore are better prepared to chase them away. It also allows them to relax from an otherwise constant vigil throughout the night. This system has only recently been experimented with in Assam and the efficacy of this technique thus remains unknown. The cost of installing this system is about INR 770/metre and a study on the efficiency of mitigation measures notes that farmers in Sri Lanka prefer to use simpler and less expensive variations of this system, wherein bottles and tin cans are strung along trip wires, or trip wires triggered off, in turn, setting off firecrackers or car horn alarms.

Satellite Tracking: In this method, elephants are tagged with radio-collars that help to locate their presence at pre-determined time intervals. Their movements are tracked on GIS maps of the study area and this allows forest officials or wildlife researchers predict elephant movement patterns especially with reference to entry into crop fields. This technology was tested for the first time in India in the Jaldapara Wildlife Sanctuary of West Bengal in 2003. This study indicated that satellite telemetry

techniques, in combination with the GSM phone network, do offer interesting options to track and communicate elephant movement. Considering the cost of deploying this method on a large scale and the scientific expertise required to interpret telemetry data, however, the efficacy of this method as a conflict mitigation measure remains to be tested.

Informant Networks: A simpler and more cost effective mechanism to communicate information about elephant movement was experimented with in Valparai, Tamil Nadu in 2004. It had been felt over the years that sufficient notice about elephant movements could prevent direct encounters between humans and elephants. Subsequently, an initiative was begun wherein information about elephant movement and presence in Valparai plateau was published daily in the local newspapers and displayed on television through cable networks during prime-time evening hours. It is perhaps illuminating that there were no human deaths due to elephant encounters in Valparai from October 2004-June 2007; property damage due to elephants was also reduced by 50%. Despite the obvious effectiveness of this approach, however, its applicability in areas with high intensities of elephant crop raiding and the sustainability of the large-scale coordination required remain unknown.

Human-elephant Conflict Mitigation Squads

An innovative approach was recently tested in Sonitpur in Assam, which has seen some of the worst instances of human-elephant conflict in India. A World Wildlife Fund-funded project began mitigation measures by conducting conservation education and training sessions for the local population that strove to explain the causes of conflict from the animal's perspective. This was followed by the employment of 72 anti-depredation squads, consisting of village youths and over 15 trained elephants (*kumkies*) that were stationed at strategic locations to drive back wild elephants from cropfields and human habitations. The results of this experiment were highly impressive. Average human and elephant deaths declined dramatically from 24 in 2002 to 10 in 2004, and from 26 in 2002 to 10 in 2004 respectively. Retaliatory killings of elephants reduced by 80% and people showed improved conservation attitudes towards elephants. The cost of employing such a measure was, thus, far outweighed by the subsequent savings in terms of agricultural production and human property.

Buffer Crops and Unpalatable Crops

The objective of this method is to make certain areas and crop fields unappealing to elephants by planting crops that they

do not normally consume or find unpalatable. Unpalatable crops may be grown as buffer crops around farmlands or the farmer may switch completely to farming alternative crops. This method does not always work for several reasons. Although elephants do not consume crops like tea, coffee, or lemon, they create quite a bit of economic loss for the involved farmers when they move through their farms and trample the crops. Unless buffer crops are planted in at least a few areas measuring several square kilometres, rendering them completely homogenous, elephants will continue to walk through them to reach palatable crops. Agricultural areas near elephant habitats are usually owned by small- or medium-sized land owners, who tend to grow subsistence crops. Switching to alternative crops may not thus be a financially viable option for them. In the Chirang-Ripu Elephant Reserve in Manas National Park, Assam, citrus species and patchouli plants are being experimented with as economically viable options that work as elephant deterrents. The results of such efforts, however, are not yet completely known.

Elephant Captures and Translocation

A traditional way of dealing with ‘problem’ animals, this technique is still used by state forest departments to rid themselves of continual elephant conflicts

in areas under their jurisdiction. The ‘problem’ individuals are tranquilised, captured and translocated to another forest or sent to elephant camps. ‘Rogue’ elephants may even be sanctioned to be killed by state forest departments. Elephant captures are expensive affairs, involving the use of a dart gun, ropes, chains, trained elephants and a trainer, and may not always be successful. In hilly terrains, elephant captures are difficult and are known to result in severe injuries to the captured individual, sometimes even leading to death. Translocated individuals are unfamiliar with their new area and may come into greater conflict with people. The identity of the problem individual is often difficult to ascertain, and in many instances, the wrong animal has been captured. Removal of males from small populations leads to skewed sex ratios and lowered elephant densities in that area. Elephant conservationists also warn that elephant captures do not provide a long-term conflict solution. It may work only if a sufficient number of elephants are removed simultaneously from an area, but even this may not necessarily guarantee success.

Elephant Drives

Related to the earlier measure, this method involves driving large groups of elephants away from the conflict area and into safer zones. It begins with a large

body of people chasing elephants in a particular direction with the help of *kumkies* and by generating a significant din. Water bodies in the drive are guarded from the elephants to compel them to move on to the next area. Once a section is cleared, it is usually fenced to prevent the elephants from returning. Elephant drives are usually employed by state forest departments across India when they face sufficient public pressure to remove elephants from conflict zones. Elephant drives in Sri Lanka, however, show that these methods negatively affect humans and elephants. Elephants lose part of their home range due to such efforts; they are also subjected to great stress and suffer high mortality. Also, typically, only herds are driven away during such efforts; male elephants that continue to remain in the area may now exhibit increased levels of aggression, often leading to increased human-elephant conflict. It is perhaps noteworthy that elephant drive operations in Valparai, Tamil Nadu have not succeeded though similar drives in Orissa and Assam seem to have provided some relief to the affected farmers.

Compensation Schemes

This refers to monetary compensation paid to victims of elephant conflict in order to reduce the economic losses borne by them due to either crop depredation

or the injury or loss of human life. The psychological impact of this measure is also to increase tolerance levels for the elephants; however, as the schemes often do not function satisfactorily, they tend to result in a festering resentment against the forest department that expresses itself in retaliation against elephants. The major drawback of compensatory programmes is that it is difficult to objectively assess losses experienced due to crop damage. People, consciously or unconsciously, tend to exaggerate their economic losses. Bureaucratic delays in assessing losses and executing compensation further frustrate local citizens and do not encourage them to persist with such efforts. On the other hand, it has also been pointed out that successful compensation measures may encourage people to stop guarding crops and increase agricultural efforts, thereby advancing further into elephant habitats, amidst escalating conflict with the animals.

Many other methods such as chilli rope fences, elephant alarm call playback and supplementary feeding of elephants have been experimented with in other elephant-range countries to deter animals from crop raiding. Their success, however, has been limited and initiatives involving such methods are in their infancy in India. As the root of the problem lies in continual

loss of elephant habitat due to deforestation and forest fragmentation, it has been suggested that voluntary relocation of people from elephant habitats and effective land-use planning may be the only long-term solutions to resolve human-elephant conflicts in many areas. Incentive-driven voluntary resettlement of people from elephant habitats has, for example, worked successfully in the case of the Bhadra Wildlife Sanctuary in Karnataka. Public pressure brought to bear upon the government has also succeeded in

the saving a few forest reserves from the marauding hand of large development projects. Economic realities, political expediencies and societal pressures, however, may not permit similar success stories in all elephant habitats. It would be fruitful at this stage to reflect that much of our wildlife, along with the elephant, has existed largely due the tolerance of spirit that exists in our fellow countrymen and that the continuing existence of our wildlife depends on preserving this “largeness of spirit”.

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