

HUMAN-WILDLIFE CONFLICT IN INDIA

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Introduction

Conflict between humans and wildlife – which takes many forms, and varies greatly in intensity – is one of the most serious threats to India’s wildlife. Not only does conflict directly threaten individual species (through, for example, revenge killings) and their habitats, it also indirectly exacerbates other factors (the illegal trade in wildlife, for example) that threaten the continued existence of wild India. Further, the *causes* of human-wildlife conflict are, in many cases, themselves factors that *independently* threaten wildlife. It is essential, therefore, to place instances of conflict within a wider context of habitat destruction, population growth, poverty, and a largely unresponsive legal/administrative climate.

Human-wildlife conflict is a highly politicized issue that evokes heated opinions and, often, knee-jerk responses. It is not a new phenomenon, but the scale and scope of this conflict has been growing exponentially over time, and is likely to do so indefinitely, given India’s ever-growing population, its ever-shrinking forests, and a host of other factors. For the sake of simplicity, and in a search for pragmatic *solutions* rather than *scapegoats*, this paper adopts a deliberately narrow scope; it defines human-wildlife conflict as instances where the actions of wild fauna cause damage to human beings or their property. This does not mean, and it should be taken to mean, that wildlife is ultimately *responsible* for these outcomes. Technically, human actions that cause harm to wildlife and its habitat – and many such actions can be readily identified! – could also be regarded as cases of “human-wildlife conflict.” However, such actions are assumed here to be among its *causes*; this helps us to more easily identify solutions.

We firmly believe that elimination of wildlife in a conflict situation should be the very last option when all else has failed. It must never be forgotten that conflict arises largely due to encroachment by humans into wildlife habitats. Equally, it must be remembered that all species were created equal and have an inherent right of survival.

Where readily available, figures are presented to illustrate the extent of conflict between humans and individual wild species. In most cases, such data is not available at the local, state, or national level. Quantifying the full range of human-wildlife conflicts is beyond the scope of this paper, and deserves a separate in-depth study (or studies). Rather, this paper identifies at a broad level, the types of conflict that occur between humans and individual

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species, the locations of the most visible/serious conflicts, and possible causes and solutions. Nor is this paper exhaustive in terms of species or locations covered. By presenting some prominent cases, we hope to construct a framework through which field practitioners, policy makers, and other interested parties can approach other situations of conflict. However, because human-elephant conflict is on a magnitude of its own, with respect to damage done, attention it receives and information available, the paper will be divided into two main sections.

The first section looks at some wide-ranging themes connected with human-wildlife conflict, and a set of species-specific case studies, addressing species other than the elephant. The section concludes with a summary of our findings. The second section is a more in-depth look at human-elephant conflict, its causes, conflict reducing measures, a number of site-specific case studies and finally conclusions of the problem.

1: Human-Wildlife Conflict: Some General Considerations

1.1. Broad Causes of Conflict¹

At a general level, we can identify five main categories of “causes” leading to human-wildlife conflict:

1. A reduction in the size and quality of available habitat due to encroachments, deforestation, denotification of Protected Areas (PA), expansion of cultivation and habitation, etc.
2. The easier availability and/or greater abundance of palatable food and other resources to a given species outside a protected area than inside, even in cases where the PA is both large and nutrition-abundant.
3. Behavior and social organization of a given species, such that individuals and groups may be forced to split from the main population, and thereby establish themselves on PA fringes, close to (or within) human settlements.
4. Poverty and other constraints that force disadvantaged humans to enter protected areas and to exploit natural resources (through hunting, grazing, collection of wood, leaves, fruits, etc.), bringing them into conflict with wild species, both directly and indirectly.
5. High rates of human or wild animal population growth, which increases the number of encounters between the two “sides” and exacerbates other factors leading to conflict. (Wild animal populations may grow beyond the carrying capacity of a PA, causing individuals and groups to “spill over” into human settlements and cultivations.)

1.2 Linking the Human-Wildlife Conflict and Other Threats to Wildlife

Even more disturbing than the direct impact of the human-wildlife conflict is its fallout on other threats to wildlife. In localities with a high degree of conflict, not coincidentally, we observe that wildlife is threatened to a disproportionate extent by other factors as well. There are two explanations for this: (1) The presence of causal factors, outlined above (Section 1.1), leads to greater conflict; and (2) Human-wildlife conflict (whatever its causes) heightens antagonistic feelings towards wildlife, thus exacerbating other threats.

¹ Extracts (except for Point 5) from draft comments by Atul Gupta, Wildlife Institute of India

It is generally observed that a close association exists in particular, between human-wildlife conflict and the illegal trade in wildlife.² How does one understand this? In areas with a high degree of conflict (in the form of crop raiding, cattle-lifting by carnivores, man-killing or, more infrequently, man-eating), local people become increasingly hostile towards wild animals. This gives rise to feelings of apathy or even violent anger, causing people to directly or indirectly engage in/support illegal hunting/trapping for both consumption and the wildlife trade. Even people who do not directly engage in hunting/smuggling may be tempted, under these circumstances, to aid outside poachers or traders in their nefarious activities. A vicious cycle exists: various causal factors – poverty, population growth, deforestation – may lead to human-wildlife conflict, which in turn fuels the wildlife trade and other threats.

² Ibid.

1.3 Species-Specific Case Studies

This section presents an overview of human-wildlife conflict across India, on a species-by-species basis. The table below provides a brief summary.

Table 1: Summary of human-wildlife conflict across India

Species	Types of Conflict	Areas of Major Conflict
Tiger (<i>Panthera tigris</i>)	A. Cattle lifting B. Injuries or death to humans/ man-eating	A. All India B. Sunderbans
Leopard (<i>Panthera pardus</i>)	A. Livestock depredation B. Injuries or death to humans/ man-eating	A. All India B. Garhwal, Kumaon, Himachal Pradesh
Snow Leopard (<i>Uncia uncia</i>)	Livestock depredation	Ladakh, Himachal Pradesh, northern Uttaranchal, parts of North-East India
Lion (<i>Panthera leo</i>)	A. Habitual livestock depredation B. Injuries or death to humans	Gir Forest, Gujarat
Elephant (<i>Elephas maximus</i>)	A. Crop raiding B. Injuries or death to humans	A. All wild elephant bearing areas B. Injuries or death caused by domestic elephants
Wolf (<i>Canis lupus</i>)	C. Livestock depredation D. Child-lifting	C. Pockets of Northern, Central, Western India D. Uttar Pradesh
Bears (1) Asiatic Black Bear (<i>Ursus thibetanus</i>) (2) Sloth Bear (<i>Melurus ursinus</i>) (3) Himalayan Brown Bear (<i>Ursus arctos</i>)	A. Livestock depredation (Brown Bears) B. Injuries or death to humans (Sloth Bears)	A. Ladakh B. All India, particularly Central India
Deer, Antelopes, Wild Cattle, Wild Boars	Crop raiding	All India
Reptiles	A. Injuries or death to humans B. Man eating (Salt water or Estuarine Crocodiles)	A. All India B. Sunderbans
Birds / Bats	A. Crop raiding B. Bird hits to aircraft	All India

1.3.1 Human-Tiger Conflict

Common perception would place the scale of human-tiger conflict above any other form of conflict with wildlife. Myth, and history, record countless cases of “rogue tigers” that have turned to cattle-lifting or man-eating. Rudyard Kipling’s man-hating Sher Khan, immortalized in *The Jungle Book*, symbolizes the archetypical tiger (*Panthera tigris*) to most people. In fact, direct human-tiger conflict, particularly in the form of man-eating, occurs at a relatively low intensity level.

A relatively small number of people are killed or injured by carnivores around tiger reserves annually. Since official figures often do not distinguish between a tiger-inflicted and a leopard-inflicted casualty, this suggests a relatively low level of injuries or deaths caused by tigers.³

Habitual man-eating must be distinguished from injuries and deaths resulting from (often accidental) encounters between tigers and humans. This does not rule out “outbreaks” of man-eating which may occur in a general area over a period of time. The Sundarbans, where a large proportion of tigers have resorted to habitual man-eating, is a notable example; here, proven man-eating has continued regularly for centuries. In Kheri District of Uttar Pradesh, between 1978 and 1988, an outbreak of alleged man-eating occurred in the sugarcane fields around Dudhwa National park during which 110 people were killed, and 13 “man-eating” tigers were shot.⁴ A suspected man-eater is reported to have claimed eleven lives around Manas National Park between 1979 and 1981 (Project Tiger Status Report). These are exceptional situations, though, and do not represent the norm. In general, then, injuries caused by tigers are largely due to accidental encounters, but when a tiger becomes a man-eater, its removal usually brings an end to such incidents in a given area. A large number of village folk across Asia continue to live peacefully in tiger areas and go about their normal activities without fear.

Cattle-lifting, on the other hand, occurs on a larger and more alarming scale. Tiger reserves around the country report numerous cases each year; in retaliation, irate villagers sometimes poison unfinished livestock carcasses. There are many causes of cattle-lifting, ranging from old age and incapacitation due to injury, to a low natural prey base (which itself may be the result of hunting, grazing, and other human-induced factors). Its extent varies quite widely, ranging from about 20 cattle injured/lost in and around Panna National Park to places such as Melghat, Corbett, and Dudhwa National Park, where hundreds of cattle are lifted annually. A very conservative estimate suggests that a **minimum** of 50 tigers have been killed by villagers across India since 1994 in retaliation for cattle lifting or suspected man-eating.⁵ In the recent past, revenge killings have claimed numerous tigers around Corbett and Dudhwa. (Six tigers were found poisoned around these reserves in early 1998.) During the last few years, however, the timely payment of compensation in Corbett has significantly reduced the incidence of revenge killings.

³ Extracts from Project Tiger Status Report by Pushp Jain

⁴ Dr. R.L. Singh, Chief Wildlife Warden, Uttar Pradesh, pers. comm.

⁵ Wildlife Trust of India Tiger Seizure/Mortality Database

At a more indirect level, the very existence of tiger reserves can be regarded as a form of human-tiger conflict. India's 27 tiger reserves cover 37,761 km², or 1.14% of the country's land mass.⁶ Direct human-tiger conflict, crop damage by the tiger's prey species in surrounding fields, and the general limitations placed on villagers' access to forests, creates great hostility towards tigers.

To illustrate the extent of human-tiger conflict, it is useful to look at the situation in two very different areas: the Sundarbans (on both sides of the India-Bangladesh border), and Kanha National Park in Madhya Pradesh.

1. The Sundarbans: This vast mangrove forest, stretching across over 6000 km² of tidal swamps in West Bengal and Bangladesh, is home to at least 350 tigers. Many reasons have been suggested (including a high level of water salinity and a very low prey base) for the proclivity of these tigers to engage in habitual man eating. Regardless of the causes, it is beyond doubt that a large number of people are killed by tigers every year. The Sundarbans attract a large number of forest users, especially fishermen, honey-collectors, leaf-collectors, and shrimp farmers. Over 35,000 individuals pass through the Indian Sundarbans each year.

Since 1950, upwards of 1000 people have lost their lives to tigers on the Bangladesh side. Since 1989, an average of 23 people of people have been killed annually (unofficial figures are perhaps 30% higher). Fisherman (53%) and leaf-collectors (40%) make up the bulk of the casualties. The retaliatory killing of tigers, meanwhile, is continuing: more than 33 tigers were killed on the Bangladesh side between 1989 and 2000⁷.

In the Indian Sundarbans, the situation is much the same. Estimates vary, but between 30 and 100 people are killed each year. Between June 1999 and April 2001 alone, 56 people were killed by tigers (Chatterjee in Tigerlink, 2001). The victims, as in Bangladesh, are fishermen, honey-collectors, and prawn-seed and wood-collectors. Most victims entered the reserve illegally: only 6 held permits for either fishing or honey collection. In retaliation, a large number of tigers have been killed: during December 1999-June 2001, 15 tigers were killed in retaliation.

Possible Solutions:

Several methods have been used to combat man-eating in the Sundarbans:

1. Placing human dummies fitted with electric wires connected to car batteries. By administering shocks when touched by a tiger, these dummies teach tigers not to attack humans.
2. Wearing a mask of a human face on the back of the head. This method, used successfully for years, appears to be losing its effectiveness as tigers have begun to discover this trick.

⁶ Presentation by Dr. Rajesh Gopal, Director, Project Tiger, before GTF International Symposium on Tiger, New Delhi, 6th-8th November, 2001

⁷ Presentation by Zahir Uddin Ahmed, DFO (Wildlife), Khulna, Bangladesh before GTF International Tiger Symposium, 6th-8th November, 2001

3. Better regulation of human activities in the forest: stricter entry controls; awareness programs for those entering legally; finding alternative livelihoods outside the reserve.
 4. Improving the tiger's prey base by releasing ungulates, controlling the hunting of prey species, or improving the habitat.
2. Kanha National Park: This tiger reserve, covering 1995 km² in Madhya Pradesh, is home to over 100 tigers. As one of India's best-managed protected areas with a relatively low level of human-tiger conflict, Kanha presents a very different picture than does the Sundarbans. Nonetheless, cattle-lifting does occur, as does a certain amount of human injury and loss of life. These phenomena are well documented. Between 1990-91 and 2000-01, 743 heads of cattle were lifted by carnivores, an average of about 67 per year, with a low of 22 in 1994-95 and a high of 131 in 1998-99. During the same period, 13 people were killed and 21 injured by carnivores⁸. A precise breakdown by species of carnivore is not available.

Solutions to Human-Tiger Conflict:

The most useful questions to ask about human-tiger conflict concern its extent, its exact location, and its causes. Are most cattle lifted on the periphery of reserves, or in their core areas? Is there an adequate, non-cattle prey base for tigers? How many people are killed within the core area? Are there substantiated cases of man-eating, or are human injuries and deaths the result of accidental encounters? Is adequate compensation paid promptly, and by whom?

In general, the mitigation of low-level human-tiger conflict involves four aspects:

1. A detailed assessment and delineation of the impact zone.
2. Site-specific, participatory eco-development work.
3. The timely payment of adequate compensation or ex-gratia.
4. Education / communications aimed at target groups around the reserve.⁹
5. Improving non-cattle natural prey base by various means, including control over hunting of prey species.

1.3.2 Human-Leopard Conflict

In the hills of Garhwal, Kumaon, and Himachal Pradesh, the leopard (*Panthera pardus*) is feared above all predators. Human-leopard conflict levels in this region, in terms of human injury and loss, as well as livestock predation, far exceed those elsewhere in the country. Across India there are sporadic reports of humans being injured or killed by a leopard (most frequently in the tea gardens of West Bengal); in rare instances, a confirmed man-eater may stalk an area for a period of time. In Garhwal, however, the situation is both precarious and rapidly deteriorating. Man-eating in this region, instead of being an occasional occurrence, has become alarmingly regular. Several reasons explain this phenomenon.

⁸ Presentation by Dr. Rajesh Gopal, Director, Project Tiger, before GTF International Symposium on Tiger, New Delhi, 6th-8th November, 2001

⁹ Ibid.

Unlike the tiger, the leopard is characterized by its flexible diet and its high degree of adaptability to varied habitats. Leopards can subsist on both small and large prey species, and can live in highly degraded habitats, in close proximity to human settlements. They are still found on the fringes of large cities, such as Mumbai, Vadodara, and Ahmedabad; individual leopards recently entered Chandigarh and Faridabad towns. While living in proximity to humans, leopards attain a level of familiarity and extreme boldness that even a man-eating tiger rarely does. In Garhwal, leopards are exposed to an increasing level of biotic pressure, made worse by deforestation, habitat fragmentation, and the depletion (partially because of hunting) of such prey species as goral, barking deer, wild boar, jungle fowl, and langur. Together, these factors have led leopards to prey on livestock, and, with greater frequency, and when opportunity allows, women and children.

The scale of this conflict can be gauged from some recently-published figures. In Pauri District alone (according to official figures), leopards killed 141 people between 1988 and August 2000; in response, 93 leopards have lost their lives. Another survey indicated that, in the 1-20 age group, roughly 55% of the 89 victims were female; in the 21-80 age group, only 3 out of 37 victims were men. Roughly 68% of the victims were below the age of 15.¹⁰ Across Uttaranchal, at least 60 people were killed and 35 injured between May 2000 and May 2001; 26 died in Pauri and Landsdowne Districts of Garhwal.¹¹ Unofficial figures are even higher.

A recent paper¹² looks for patterns in these killings, and thus indicates some ways to mitigate the problem. A majority of the killings have taken place in the rainy (45.2%) and winter seasons (42.1%), when a denser cover of vegetation allows leopards to live closer to humans. In terms of time of the day, 54% of cases have occurred between 5 and 8 pm; 11% between 3 and 8 am; and 19% between 8 and 10 am. These coincide with such activities as children going to or returning from school, women coming from or going to cultivated fields or to forests, and women and children going to the toilet. The majority of cases occurred in degraded forest or scrub lands. Other factors, such as the presence of an adult male, the availability of electricity, and the presence of a dog, appear to reduce the probability of a successful attack. Not coincidentally, an increase in leopard deaths leads to a (delayed) reduction in human deaths.

Solutions:

What solutions does this study, and past experiences, suggest? The following is a partial list:

1. Awareness programs in affected regions to encourage the following:
 - a. Moving about in groups, preferably with an adult present
 - b. Avoiding or reducing movements away from human settlements at certain times of the day
 - c. Making noises (such as coughing) when approaching areas of dense vegetation
 - d. Avoiding hunting or consuming the leopard's prey species
2. "Encounter Training" programs to teach people how to react in encounters with leopards (e.g., pointers on eye contact, posture, etc.)

¹⁰ WII Technical Report

¹¹ The Pioneer, New Delhi, May 20, 2001, p.1

¹² WII Technical Report

3. Reforestation activities in the Garhwal hills to enhance the natural prey base. To be effective, this must be done in conjunction with finding alternative sources of energy.
4. Alternative sources of energy, thus reducing biotic pressure on surrounding forests, and, indirectly, reducing the number of human-leopard encounters
5. Creation of toilet facilities
6. Compensation for injuries/losses to both humans and livestock
7. Education programs that teach people about the leopard, its habits and its needs

1.3.3 Human-Snow Leopard Conflict

The snow leopard (*Uncia uncia*), inhabitant of the high Himalayas, is found in fragmented ranges across the mountains of Central Asia. In India, the few remaining snow leopards (estimates range from 200 to 600 individuals) are found largely in Ladakh, Himachal Pradesh, northern Uttaranchal, and in isolated pockets in the North East of the country. The snow leopard is not known to attack humans; conflict with humans is thus confined to livestock depredation. The revenge killings that livestock depredation provokes, however, seriously imperil the future of this species.

Hemis National Park in Ladakh is a good case study of this conflict. Covering 3,350 km² in the trans-Himalayas, this is ideal habitat for snow leopard, wolf, and four species of wild sheep and goats. About 1600 people, living in 16 settlements across three valleys, inhabit the park. These people, largely agro-pastoralists, grow barley and certain vegetables, and own over 4,000 heads of livestock, of which 81% are sheep and goats and 11% are yaks. A recent survey found that over half of the households interviewed lost 1-15% or more of their domestic stock to predators (492 animals in total, valued at US\$23,500). Snow leopards were associated with 55% of these losses, and wolves 31% (Jackson & Wangchuk, 2001). Notably, three settlements accounted for 54% of the losses. These losses have led to a spate of revenge killings.

At least four factors, in conjunction with each other, explain the high level of depredation:

1. Poorly constructed corrals: attacks within pens accounted for only 14% of incidents, but led to over 50% of all losses.
2. Lax daytime guarding practices: due to changes in socio-economic patterns, more children are going to school, and youths are less willing to watch over livestock. Even small (and very vulnerable) livestock are left unguarded.
3. A dramatic increase in livestock numbers due to increased use of modern animal husbandry techniques. Domestic livestock now vastly outnumber wild prey populations.
4. An apparent increase in predator numbers due to increased protection within this PA.

Solutions:

Several possible solutions have been proposed, and several are currently being implemented (Jackson & Wangchuk, 2001):

1. Workshops involving local stakeholders, the Forest Department, and national and international NGOs, which attempt to identify cost-effective and ecologically compatible measures for reducing wildlife losses; to provide training in wildlife damage alleviation techniques; and to promote community-based wildlife stewardship and increase awareness.

2. Compensation for livestock losses: the Ladakh Wildlife Department offers compensation for livestock depredation. However, the long time taken in processing claims (up to two years), and the low level of compensation paid (10-30% of the animal's market value) has rendered the scheme ineffective. To make matters worse, the Department finds itself committing about 60% of its annual budget to paying compensation. An improved system of compensation payments would help mitigate this conflict.
3. Encouraging alternative forms of livelihood: eco-tourism in this area has great potential. Local stakeholders can capture some of its benefits by starting new "tea-houses", or improving existing ones. This would have the effect of reducing the dependence of local people on income from livestock, and thereby would reduce conflict with snow leopards.

1.3.4 Human-Lion Conflict

The range of the Asiatic lion (*Panthera leo persica*), as is well known, is now limited to the 1452 km² Gir Protected Area in Gujarat. Approximately 320 lions inhabit this dry deciduous forest; increased protection has allowed the forest's lion population to grow, arguably, beyond its carrying capacity. Within a 10 km radius of the forest live over 160,000 people and over 100,000 head of livestock; up to 20,000 livestock are brought into the forest annually for seasonal grazing. The pastoralist Maldhari community, comprising approximately a third of the PA's human population, are an integral part of the eco-system, and have been so since about 1860. Despite this, overgrazing is a serious issue in Gir, leading to significant soil impaction and erosion.

Human-lion conflict in Gir comes in two associated forms: livestock predation, and attacks by lions upon humans; lions are frequently killed in retaliation. Both conflicts have given rise to an antagonistic relationship between humans and the forest, and continue to threaten the future of this highly endangered sub species.

Livestock has historically formed a large component of Gir lions' diets, a condition necessitated by the forest's relatively low wild prey base. A study in 1973 found livestock hair in 75% of over 1,800 lion scats; the wild ungulate population of Gir at that point was estimated at a mere 6,200. More recent studies have indicated a decline in the livestock component, aided by a dramatic increase (to about 43,000 heads) in the wild ungulate population: 48% of lion scats, examined by Sinha in 1987 contained livestock hair; a 1993 study by Chellam estimated that 30-35% of known lion kills consisted of livestock.¹³ The latter, however, was probably an overestimate, due to the relative ease of locating livestock kills. Although this represents an improvement, livestock continues to remain an important component of lions' diet (1,650 heads of livestock were taken by lions in 1995 alone), and an alarming source of conflict.

Human injuries and losses from lion attacks are closely related to livestock predation, but vary with other factors. The Maldhari community over time learned to accept a certain amount of human and livestock casualties; a cautious coexistence prevailed, and Gir lions earned a reputation for being relatively docile towards humans. Lion attacks on people, prior to 1987, averaged about 7.3 per year, 14.5% of which resulted in mortalities. The severe

¹³ IUCN: Wild Cats Status Survey and Conservation Action Plan, pp.37-41

drought of 1987-1991 changed this balance. Water holes dried up, prey species dispersed, and lions moved towards the forest fringes in search of sustenance. These conditions, combined with an existing over-familiarity with humans (lions were in the past bated for tourists) heightened livestock depredation as well as attacks on humans. During the drought years, lion attacks on humans averaged 40 per year, and, for the first time, lions began to feed off human corpses.¹⁴

Human-lion conflict in the past was partially mitigated by compensation payments. With increased attacks on humans, and with an unwieldy compensation system in place, the Maldhari community has begun to lose its tolerance. Stray lions are now being killed with greater frequency, either electrocuted by live wires left in fields, or fed poisoned bait. In the first six months of 2000, official sources recorded the electrocution of 3 lions; unofficial numbers are possibly much higher. Tellingly, electrified fences are quickly replacing traditional thorn fences around village fields.¹⁵

Solutions:

A number of solutions have been proposed:¹⁶

1. Controls on illegal harvesting of firewood or grazing within the reserve, and supplying alternate energy devices to fringe villages.
2. Making livestock compensation systems simpler and more equitable.
3. A gradual relocation of the Maldhari community to suitable areas outside Gir. An abrupt relocation would disrupt the existing ecological balance by removing livestock from lions' diet. Such efforts in Gir have failed in the past, and any new effort must be handled with great caution and sensitivity.
4. Habitat restoration around water holes.
5. Consolidation of park boundaries, including the possibility of exchanging parts of the existing PA for revenue lands that project into the PA.
6. Greater involvement of the Maldhari community in forest management. This would reduce biotic pressure on the forest and would reduce the level of antagonism among Maldharis towards Gir and its wildlife.
7. Encouraging Maldhari involvement in eco-tourism, and therefore a lower dependence on livestock for income.
8. Improving public opinion among local stakeholders regarding living with lions, and offering financial incentives to these people.
9. Eco-development initiatives that effectively meet local needs. Gir is one of seven PA's selected for the GEF India Eco-development Project, which began in 1996. Its work includes the following components: biodiversity conservation; village eco-development; environmental education and extension; and research and management studies.

1.3.5 Human-Wolf Conflict

A mere 1,500-2,000 Indian wolves (*Canis lupus*) survive in the wild, scattered across densely populated regions of northern, central, and western India. Serious human-wolf conflict – in

¹⁴ Report on www.care4nature.com

¹⁵ The Indian Express, New Delhi, June 30, 2000

¹⁶ Abstracted from several internet sources, including the Asiatic Lion Information Center & www.care4nature.com

the form of livestock predation and, in some areas, child-lifting – continues to imperil the future of this sub-species, one of the smallest of wolves.

Livestock predation occurs, at varying degrees of intensity, across the wolf's range. In Hemis National Park in Ladakh, for instance, they account for about 31% of livestock depredation.¹⁷ Shepherd communities elsewhere in India, particularly around such PA's as the Great Indian Bustard Sanctuary in Maharashtra, suffer regular losses to wolves. Accurate numerical estimates of the scale of depredation are difficult to determine. No compensation is presently offered in such cases.

Child lifting, while not common, is an issue of growing concern in Uttar Pradesh. Between 1996 and 1999, 65-70 children were either killed or injured by wolves. Sporadic reports of such attacks continue to filter in. Antelopes, the wolf's natural prey in the area, have been hunted to extinction, and wolves subsist largely on livestock (Kumar, 2001). Research indicates that most attacks on children occur when adults are busy supervising livestock.¹⁸ Denied access to domestic livestock, and protected by legislation, wolves have become increasingly desperate, and simultaneously, unusually bold. Some wolves involved in attacks on children may also be captive wolves, or wolf-dog hybrids, thus conditioning them to human presence.

Solutions:

1. Compensation payments: no compensation is currently paid in cases of livestock depredation by wolves; a small compensation is paid in Maharashtra in cases of child-killing. While some wolf experts regard compensation payments as encouraging “a state of permanent conflict”(Fritts, 2000), others see it as one of the only alternatives in the Indian context. Private funding for compensation payments is a possibility.
2. Finding ways, in consultation with local stakeholders, to reduce the extent of livestock depredation.
3. Awareness programs to prevent people from keeping captive wolves.

1.3.6 Human-Bear Conflict

Conflict between humans and India's three bear species – the Asiatic black bear (*Ursus thibetanus*), sloth bear (*Melursus ursinus*), and Himalayan brown bear (*Ursus arctos*) – varies enormously in form and extent from region to region. Conflict with the brown bear occurs largely in the form of livestock predation. On the other hand, sloth bears have been known to injure humans in (usually accidental) encounters.

The brown bear's range in India is confined largely to Jammu & Kashmir, while the black bear ranges across the Himalayas. A recent study on the Zaskar and Suru Valleys of Ladakh reveals the extent of human-brown bear conflict.¹⁹ In the Zaskar valley, where the brown bear is relatively abundant, this species accounts for about 33% of livestock depredation cases. In Suru, on the other hand, they account for just 7% of cases. It must be noted however, that in a large number of livestock predation cases, the identity of the predator was

¹⁷ See section on snow leopard – human conflict (above)

¹⁸ Extracts from “Wolves”, The Wolf Society of Great Britain's Newsletter, Autumn, 2000.

¹⁹ Sathyakumar, S. Brown Bear-Human Conflicts in Zaskar and Suru Valleys, Ladhak. Presentation at WII Annular Reserarch Seminar, October 2001.

unknown. Sheep and goats were lifted most frequently, followed by cattle. Most kills took place in summer, mostly around villages and “doksas” or summer grazing camps. The study identifies two “high conflict zones”: the Shagar-Tangar-Ranthakshah areas and the Chibra-Hamling-Achoo-Abran areas of Zanskar. Here, brown bears accounted for 60% and 38% of livestock predation cases, respectively.

Sloth bears range across much of India, except for large parts of north, northeast and western India. Their numbers are concentrated in central India, a region where human-sloth bear conflict is both serious and (relatively) common, and where people fear the bear above the tiger and the leopard. The Bilaspur-Mainpuri region is badly affected, as are the fringes of certain PA’s. Encounters between the near-sighted sloth bear and humans are almost always accidental. Frequently, a person will literally stumble upon a bear (or vice versa), causing the bear to attack in self-defense, often resulting in grievous injuries. Official figures from Melghat Tiger Reserve indicate that 4, 10, and 5 people were injured by bears in 1996, 1997, and 1998, respectively; in Kalakad-Mundanturai, bears are known to enter villages, sometimes injuring people in the process (Project Tiger Status Report).

In Panna Tiger Reserve, human-bear conflict occurs, but not very frequently. A recent study of this area yields findings that can be generalized for much of Central India.²⁰ Most attacks take place in the early morning and late evening, when these nocturnal, solitary creatures are most active. Most encounters occur around caves, and in the lantana bushes that bears use as cover. Since sloth bears subsist on ants, termites, and fruits, the ecological impact of human activities may affect local food availability (this aspect is currently under study by the WII), and may therefore be a cause of human-bear conflict.

Solutions:

1. In areas of high livestock predation by brown bears, a possible solution, as in the case with wolves and snow leopards, is to evolve better methods for protecting and shepherding livestock. Consultations between local stakeholders and NGOs are essential.
2. Provisions for first aid and other necessary treatment of victims of bears attacks.
3. Where sloth bears are known to injure people, precautionary measures need to be taken. These may include:
 - a. Beating sticks on the ground or making loud noises while in densely-forested or lantana-infested areas.
 - b. Avoiding caves and other potential bear dens.
 - c. Not entering the forest in the early morning or late evening, when bears move about.
 - d. Monetary compensation in appropriate cases.

1.3.7 Blackbuck, Cheetal, Sambar, Nilgai, Monkeys, and Wild Boar

Across India, and especially around forestlands, crop raiding by wild animals is a serious and growing concern. Few, if any, of India’s Protected Areas are free from crop raiding, which takes different forms in each area. Such species as blackbuck (*Antelope cervicapra*), cheetal (*Axis axis*), sambar (*Cervus unicolor*), nilgai (*Boselaphus tragocamelus*), wild boar (*Sus scrofa*), and monkeys are most frequently blamed for this occurrence, which threatens to undermine

²⁰ Yoganand, K. Evaluating Panna NP with Special Reference to the Ecology of Sloth Bear. Presentation at WII Annual Research Seminar, October 2001.

India's wildlife conservation efforts. In response to crop raiding, farmers have sometimes resorted to extreme counter-measures, including shooting, electrocuting or poisoning intruders; in certain areas, small explosives have been placed in dough-balls.

Crop raiding may arise for a number of reasons, which vary from location to location:

1. Increased populations of these species, due to heightened protection over the past three decades, and because of high poaching pressure on predator species
2. Inadequate forage in forests due to intense grazing pressure by domestic cattle
3. Conversion of open grasslands into crop fields, thus removing important buffer areas that, in the past, served as deterrents to wild animals
4. Higher nutritive value and better accessibility of crops, especially where the habitat is highly fragmented or where it consists of interspersed crop fields and forests
5. Better availability of water within or beyond crop fields
6. Destruction and degradation of forest habitats through encroachments and a lack of habitat protection (including quarrying and illicit felling of trees, etc.)
7. Planting of such crops as sugar cane, which are highly valued by, for instance, wild boar
8. Certain species, such as wild boar and nilgai, find safety in crop fields during their gestation periods, or when nursing young.
9. The gradual erosion of traditional methods of crop protection, such as the use of thorn bushes and trenches. In some areas, fences have made way to increase the area under cultivation.
10. Increase human population pressures, resulting in:
 - a. Pushing of villages and crop fields to the very edge of forests. In Madhya Pradesh, for instance, about 10,000 villages lie within a 2 kilometer distance from forest lands
 - b. More reports of conflict, creating perceptions of heightened conflict

Certain crops are more prone than others to crop raiding by certain animal species. In parts of Maharashtra, a study finds, blackbuck, nilgai and wild boar all damage jawar crops. Wild boar, in addition, raid potato, rice, bajari and ground nut crops; blackbucks enjoy wheat, tomato and chilly crops; and nilgai raid oil-seed fields.²¹ In Assam, wild boars are known to damage paddy fields; in M.P., wheat, maize, gram, paddy and pulse fields are frequently raided by all of the above-mentioned species. In Western Maharashtra, wild boars cause the greatest amount of damage, raiding sugar cane, rice, groundnut, wheat, nachna, and corn fields.²² Blackbuck cause severe losses to farmers in Gujarat, Rajasthan, and parts of Maharashtra; wild boar and nilgai do so across the country.

In a number of states of northern India, nilgai have taken to living permanently in crop fields, broken lands around canal banks, ravines etc. Depredation levels are high causing serious resentment. Farmers in Haryana have taken to electrocuting nilgais but by and large the carcass is buried and not consumed.

²¹ Preliminary Report on Crop Damage in Maharashtra by Nature Conservation Society, Amravati. Source: Kishore Rithe

²² Responses to a questionnaire sent by Kishore Rithe to concerned individuals and institutions across India.

Two case studies illustrate the potential for damage caused by crop raiding:

1. **Blackbuck in Gujarat:** In Mehsana district, north Gujarat, blackbucks annually destroy crops (mainly cotton) valued at around Rs.2.34 crore.²³ A group of 12-15 blackbuck migrated to this area in 1975; due to strict protection, their numbers have now swollen to over 6,000 individuals. Farmers have tried a number of solutions to the problem, without success. Attempts to plant johar and pulse crops in place of cotton have not deterred crop raiding. The Forest Department has tried three other solutions without success. A relocation attempt resulted in the death of six blackbucks; a planned safari park failed when local panchayats refused to give up promised lands; and a shared-cost fencing plan proved too expensive for farmers.
2. **Wild Boar in Western Maharashtra:** Across large sections of western Maharashtra, wild boars account for most recorded cases of crop damage. The spread of sugarcane cultivation in this area over the past twenty years, along with a ban on hunting, has enabled the wild boar population to grow enormously.²⁴ Earlier, traditional community hunts would keep the population in check. Wild boars engage in crop raiding even in areas with abundant forest cover, and they feed on a wide variety of crops, notably sugarcane. The species has now become so abundant and widespread that it has gained vermin status. Farmers have taken to using explosives and live electric wires to deal with problem animals; the Maharashtra government, in a controversial decision, recently allowed the shooting of problem boars and nilgai.

Solutions:

1. Changing crop patterns: in areas immediately around forests, growing crops that animals find unpalatable may prevent raiding. Mustard, for instance, has been successfully (and profitably) grown around Ranthambore National Park.
2. Agro-forestry: tree plantations, largely immune to raiding, yield high profits to farmers, albeit after the 5-7 years it takes for trees to reach maturity. Several timber companies offer bankable/guaranteed returns schemes in north-east India (these provide annual income plus a lump-sum payment at the end of the scheme), which allow farmers to overcome their cash-flow problems. Extending such schemes to elsewhere in India would go a long way to reduce crop raiding.
3. Green fences: the use of hedge fencing has great potential for reducing crop raiding. Farmers successfully used euphorbia hedge fences in the Gir forest prior to the 1985-1987 drought, when they were cut down for use as fodder and fuel. As a result, crop raiding, particularly by cheetal, has greatly increased.²⁵ Green fences have several advantages: they support the growth of medicinally-valuable plants; harbor lizards and snakes that prey on harmful insects; give refuge to owls that prey on rodents; and, when pruned, yield valuable firewood.²⁶
4. Trenches around agricultural lands: this is particularly useful in preventing raids by wild boar, nilgai, and blackbuck.

²³ Extracts from The Indian Express, November 7, 2001

²⁴ Response by Mr.Karansingh Ghorpade of Kolhapur, Maharashtra to a questionnaire sent by Mr. Kishore Rithe

²⁵ Email from Mahesh Singh, DCF Gir (W) to Natural History of South Asia discussion group, September 27, 2000.

²⁶ Email from Renganai Ganesan to Ashish Kothari, October 13, 2000

5. Traditional methods of crop protection: using firecrackers; night-patrolling; beating drums; using trained dogs; lighting fires along field boundaries; tying threads to crops along boundaries; placing a scarecrow/statue in the field.
6. Government/NGO support in constructing fencing.
7. Compensation schemes or crop insurance to offset crop damage losses.
8. Controlled hunting: only on a case by case basis, and only for problem animals.

1.3.8 Human-Reptile Conflict

Reptiles of all varieties – snakes, scorpions, crocodiles, and lizards (especially monitor lizards) – have been credited for more than their share of attacks on humans. Snakes and scorpions, as is well known, are involved in thousands of encounters with humans every year. By contrast, the monitor lizard's fearsome reputation for attacking humans is unfounded.

Crocodiles, specifically the mugger or marsh crocodile (*Crocodylus palustrus*) and the saltwater or estuarine crocodile (*Crocodylus porosus*), have developed a (highly exaggerated) reputation for man-eating. The saltwater crocodile has earned a special notoriety the world over: this giant crocodile, which can reach lengths of 7 meters, is known to be especially aggressive and prone to man-eating. Sporadic cases of man-killing or man-eating are reported, but these are far and few between. Two cases of muggers attacking humans were reported in 1991 in Gujarat: a boy was killed in Vadodara District, and a man attacked near Bhuj.²⁷ Humans living in and around the Sunderbans suffer perhaps the most from crocodile attacks: between January 1999 and September 2000, 8 people were killed by crocodiles in the area.²⁸

Solutions:

In the case of reptiles, caution is perhaps the best preventive solution. Beating sticks on the ground near bushes, wearing adequate clothing and footwear, and entering water in groups in crocodile habitats, are some possible solutions. Traditional methods for dealing with conflict need to be explored.

1.4 Human-Bird/Bat Conflict

A large variety of birds and bats cause damage to agricultural fields. Peacocks damage young shoots of newly planted crops. Cranes and water birds forage on agricultural crops, passerines, parakeets and bats damage fruit orchards. This conflict is widespread across the country. Quantification of such damage will be an enormous task, and it not worthwhile to undertake such an exercise on an all-India level.

Traditional methods of reducing conflict are generally acceptable to farmers. These involve scaring away offending species at the critical time of sprouting and ripening. The argument of bird trappers and bird traders that their activities reduce crop damage is not valid because their catch comprises of a negligible share of the population.

Bird hits to aircraft is a serious form of conflict, which sometimes results in human injuries or death, and damage to aircraft. Steps to reduce bird hits have been suggested in a BNHS study. A full record of bird hits to aircraft has not been maintained by any agency.

²⁷ Crocodile Specialist Group Newsletter, Vol.13, No.4

²⁸ TigerLink News Vol.7, No.1

1.5 Conclusions and Recommendations

This section has provided a broad overview of human-wildlife conflict in India, that is, an overall picture of the situation (extent, causes, solutions) with reference to a few key species (except for elephant, which will be dealt with in the next section). Where possible, figures are provided to (somewhat) quantify the severity of conflict, but in most cases, data is simply unavailable.

Four valuable lessons emerge:

1. It is essential to monitor and evaluate human-wildlife conflict in all its forms across India, and to compile data on conflict situations, their causes, and solutions.
2. Research, planning, and a long-term policy/management framework is required to mitigate human-wildlife conflict, which will continue to occur indefinitely but can be substantially reduced through concerted efforts. Ad-hoc solutions are not feasible in the long term, and a national action plan needs to be formulated in this regard.
3. Successful mitigation of the human-wildlife conflict requires a combination of national- or state-level initiatives and local, site-specific methods. A coalition of government agencies, local stakeholders, non-government organizations, research institutes, and other concerned individuals, is required for successful mitigation.
4. Traditional and time-tested methods of conflict mitigation must be effectively combined with modern techniques from around the world.

Within these broad categories, several key steps must be implemented:²⁹

- A. Monitoring & Evaluation:
 - i. Collect detailed data, at the local-, state- and national levels, on the extent and forms of conflict, including:
 1. Injuries/loss of lives
 2. Crop/livestock destruction
 3. Costs borne to prevent/reduce conflict (fencing, etc.)
 4. Compensation payments received, and time taken to receive payments
 5. Current/anticipated land use patterns
 6. Population growth estimates for humans and wildlife
 7. Demographic/socio-economic data on affected individuals
 - ii. Document traditional methods, both proactive and reactive, for mitigating human-wildlife conflict
 - iii. Compilation of data on modern mitigation methods
 - iv. Research current and historical causes of conflict, including ecological factors leading to conflict
- B. A Long-term Policy/Management Framework:
 - i. Foster the recognition that there will always exist some conflict between humans and wild animals, particularly large carnivores. Thus, compensation payments and other methods of conflict mitigation must be seen as a “subsidy” that has to be paid to ensure the survival of these species.

²⁹ Extracts from draft comments by Cheryl Nath, AERC/CES

- ii. Equally, foster a recognition that reducing human-wildlife conflict will help ensure the survival of habitats, their biodiversity, and, ultimately, people living within and around these PAs.
- iii. Create funding mechanisms to organize meetings and workshops at a local/district/state level for stakeholders to exchange information, receive training, and create local solutions to conflict situations.
- iv. Use information gathered, especially on causes of conflict and land use patterns, to anticipate and counteract conflict situations.
 - v. Formulate more effective compensation payments systems.
- vi. Develop local monitoring and evaluation systems and innovative responses, such as group insurance of people, crops, and livestock in high-conflict areas.
- vii. Identify and institutionalize systems for funding and implementing conflict mitigation and eco-development schemes through different government ministries and agencies.
- viii. Mainstream wildlife conservation work in general, and human-wildlife conflict resolution in particular, within socio-economic development initiatives.

2. Human-Elephant Conflict

Human-elephant conflict poses a considerable threat to an Asian elephant (*Elephas maximus*) population already on the brink of extinction due to poaching for ivory, habitat loss, fragmentation and alteration. Approximately 20% of the globe's human population resides near or in the present range of the Asian elephant (WWF Species Status Report, 2000). The extensive alteration of elephant habitat by the human population is constricting the species into small pockets of land that are connected only by human settlements, and these pockets are hardly adequate to meet the food and water needs of the elephant. As elephants have very distinct patterns of movement by which they seasonally utilize the optimum habitats, it is likely that during this movement, they come into contact with settlements (Sukumar, 1986).

The damage incurred by humans due to conflict may include economic losses of crops, property or livelihood opportunities, and occasionally bodily harm or even death. This naturally encourages a sense of frustration and anger, which may then manifest itself in direct conflict, the farmers attempting to save their livelihood and the elephants attempting to regain habitat that they previously used. Elephant mortality caused by conflict may be defined as that caused intentionally without a motive for ivory or meat (Menon et al, 1997). However, it is often difficult to distinguish between a death caused by poaching or one that is genuinely a case of non-commercially motivated conflict (Menon et al, 1997).

Wherever humans will be found living in the vicinity of wildlife habitats, there will be some degree of conflict. However, elephants are increasingly being regarded as pests, the latter being typically defined as any animal, bird or insect that feeds on crops, at any point of the agricultural cycle (Naughton et al, 1999). In certain areas, the situation is worsening to the point that given a choice, most local farmers would eliminate elephants from their environment. The relatively small elephant population, which presently resides in Andhra Pradesh, having migrated from Karnataka and Tamil Nadu during 1983-84 has during the period 1987-1995 suffered 66% total mortality due to conflict (Rao 1995 in Menon et al, 1997). Thus, as conservationists, a way to increase tolerance levels must be found. But tolerance has a limit. This limit varies from farmer to farmer depending on various factors including land availability, so as to absorb the shock of the damage, success of the growing season (i.e. drought versus good rainfall season) and so forth. In addition to the monetary loss incurred during raiding, farmers also invest in scaring devices such as firecrackers, thus investing a great deal of time in guarding their fields – including nights (Sukumar, 1994). In many parts of the country, it is due to religious and cultural beliefs that the tolerance of farmers has withstood the time that it has, however, probably not for much longer.

The following is an overview to human-elephant conflict in the country, including an account of why elephants are thought to crop raid, the measures used to minimize and prevent raiding and a number of case studies from various elephant habitats across the country as examples.

2.1. Reasons For Raiding

The question that arises foremost is why elephants crop raid. The arguments for this are necessity versus crop raiding being a part of the foraging strategy (Sukumar, 1991; Balasubramanian et al, 1995). Many large mammals are polygynous species that display

distinct sexual dimorphism such as males being larger in adult body size than females and exhibiting secondary sexual characters such as horns (Sukumar, 1991). According to Sukumar (1991), because males would therefore have a greater variance in reproductive success than females, the selection for these characters would favour a “high-risk-high-gain” strategy to promote reproductive success. He goes further to state that it is this behaviour that brings bulls into greater conflict with humans and that not only do bulls raid more frequently, but they consume more per raid than any member of the herd. Due to their larger body size and therefore greater food requirements, bulls tend to consume about twice as much per raid as any member of a herd (Sukumar, 1994). This observation of increased raiding frequency by bulls is supported by other studies too (Balasubramanian et al, 1995; Datye & Bhagwat, 1995).

The argument is, if elephants are raiding as part of a foraging strategy, then all elephants should follow this strategy. However, in Nilgiri Biosphere Reserve, only some elephants (specific herds and males) raided crops while others did not, even though the opportunity existed (Balasubramanian et al, 1995). Furthermore, greater raiding was recorded in better habitats that had been lost to agriculture (Balasubramanian et al, 1995). Thus, this study supports the hypothesis that elephants raid crops out of necessity and not as a part of their optimal foraging strategy (Balasubramanian et al, 1995). The necessity being brought about by the loss or degradation of a part of their home range to a point where the resources within are not adequate to support them. Males were also found to be less influenced by habitat loss than herds, with the distribution of females being more likely to influence them (Balasubramanian et al, 1995).

It is important to answer this question however, as it will influence the management strategy adopted to counter conflict. If elephants raid out of necessity, then as shown by Balasubramanian et al (1995), only a specific proportion of the population need be targeted. Identification of the correct proportion is then of paramount importance.

There are numerous anthropogenic activities that contribute to conflict (Naughton et al 1999). These are identical to those that aggravate conflict with other species as described in Section 1:

- ❖ Spread of agriculture into previously unoccupied, prime wildlife habitat
- ❖ Elephants become packed into protected areas by habitat loss and poaching
- ❖ Over exploitation of edible plants such as bamboo may affect the carrying capacity (defined as the number of individuals or biomass that can be supported given the size and productivity of the habitat) of the habitat, forcing elephants to fulfill their requirements from cultivated land (Sukumar, 1986, 1994)
- ❖ Human activities in forests such as logging may disturb elephants pushing them into closer proximity with human settlements
- ❖ Artificial water sources attract elephants to human settlements during droughts or naturally in regions where water is scarce (Sukumar, 1986, 1994)
- ❖ Cultivated crops also tend to be more palatable and succulent than the fibrous siliceous wild grasses, providing significantly more protein, sodium and calcium (Sukumar, 1986)

- ❖ The construction of canals, roads, factories, power installations, mining, dam construction and other such developmental activities may cut off traditional migration routes, leading to conflict.
- ❖ In areas which practise *jhumming* or slash-and-burn agriculture, there is a change in the *jhumming* cycle. With the increase in the human population, the viability of the *jhum* cultivation practice reduces. This is because the essence of shifting cultivation is the time cycle allowed between cultivations on a particular piece of land. A *jhum* cycle of at least 10 years is thought to be necessary to make the practice economically and energetically viable (Ramakrishna, 1992 in Williams & Johnsingh, 1996). However, the actual cycle becomes dependent on the human population of the area and the area of forest owned by the villages, and with the increase in human population at its present rate, the cycles are likely to be further reduced and thus cause further degradation in habitat.

2.2. Damage Done

Raiding does not tend to be a year-round nuisance, but rather a seasonal one, with most damage occurring during the time of crop maturation, and this depends on the crop. Damage to crops is done by eating and trampling. All cereal and millet crops such as paddy, sorghum, maize and finger miller are targets for elephants, as well as sugar cane, banana, jackfruit, cocounut, legumes, oil palm and mango (Balasubramanian et al, 1995; Datye & Bhagwat, 1995; Nath & Sukumar, 1998; Karanth & Madhusudhan, 2002).

2.3. Human Casualty To Elephants

While annually, as many as 300 people are claimed killed in confrontations with elephants (Kemf & Jackson, 1995 in WWF Species Status Report, 2000), government figures show an average of 192 over the past ten years in India³⁰. Most incidents take place in one of three instances; while protecting crops, during chance encounters with elephants along elephant trails or when bull elephants turn into rogues and trample people in their huts. In Karnataka, south India, Sukumar (1986, 1994) found that the majority of human victims of conflict to be adult men, with most casualties being inflicted by adult bulls.

Table 2: Human mortalities caused by elephants till 31/12/01

STATES	NUMBER OF CASES OF HUMAN MORTALITY DUE TO ELEPHANTS										
	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-01	2001-02
Andaman & Nicobar	-	-	-	-	-	-	-	-	-	-	3
Andhra Pradesh	2	3	1	1	7	3	-	3	-	-	-
Arunachal Pradesh	3	1	-	2	3	1	5	1	1	1	-
Assam	31	44	52	40	38	24	48	35	46	46	33
Bihar/Jharkhand	39	32	21	24	32	27	7	-	-	19	65
Chattisgarh	-	-	-	-	-	-	-	-	-	2	11
Karnataka	45	23	30	32	19	42	32	42	28	30	12

³⁰ Project Elephant, 8th Meeting of the Steering Committee, April 2002

Kerala	2	6	2	3	6	5	4	-	4	3	-
Meghalaya	3	12	-	4	-	5	4	2	-	-	4
Mizoram	-	-	-	-	-	-	-	-	-	-	1
Nagaland	-	-	-	1	7	5	5	3	3	6	3
Orissa	7	17	21	17	30	6	15	21	31	23	2
Tamil Nadu	5	2	4	3	8	10	6	2	13	18	12
Tripura	-	-	-	-	-	-	-	-	-	-	1
UP/Uttaranchal	-	-	9	6	3	-	-	-	-	2	3
West Bengal	67	80	65	44	56	52	57	47	67	43	46
TOTAL	204	220	205	177	209	180	183	156	193	193	196

Source: Project Elephant, 8th Meeting of the Steering Committee, April 2002

2.4. Mitigation Measures

The following are descriptions of methods currently used in various states to reduce and mitigate conflict. Generally, the success of crop protection methods tends to be a function of the effort put into them (Balasubramanian et al, 1995). No method is foolproof and some amount of raiding will most likely remain, therefore, the focus should be on means to reduce conflict but not eliminate it (Balasubramanian et al, 1995).

2.4.1 Compensation

Paying compensation for damage incurred by people and caused by wild animals is a method commonly considered for increasing the tolerance threshold of the affected people (Tchamba 1995 in Williams & Johnsingh, 1996). In many states, there is often considerable delay between the filing of a compensation claim and the Forest Department settling that claim. This is because the shortage of manpower and logistical problems make the verification of the claims by site visits to assess the damage a very time consuming process. This verification is essential, as the filing of false claims is a valid problem. As a consequence, while this tolerance may be high initially, it must be noted that the delays in verifying and paying compensation, and the costs borne by the people, may it be crop or property damage or even injury and death, are reducing tolerance levels (Williams & Johnsingh, 1996). Although this system may not be completely efficient, in the face of a lack of effective measures to reduce the levels of conflict, this compensation scheme may be vital. Generally, compensation is not paid in cases of death or injury that are incurred within the boundaries of areas controlled by the Forest Department (Williams & Johnsingh, 1996).

2.4.2. Guarding techniques

The most common methods used to chase elephants include shouting, beating tins, lighting fire torches and in some cases firing shots over the heads of the elephants. However, these measures mean that the farmers are at greater risk of being injured or trampled if chased.

2.4.3. Elephant Proof Trenches (EPT's) & Walls

Stone or rubble walls are costly to erect and not very effective in keeping elephants out. Experiences from Africa such as Laikipia District of Kenya, which is an area particularly burdened with conflict, have shown stone walls to be particularly ineffective, being broken many times (Thouless & Sakwa, 1995). The effectiveness of EPT's are found to be reduced by people creating pathways across these trenches in order to gain access to the forests for themselves and their livestock, and it is across these pathways that elephants can also cross.

Elephants will also push earth into the trenches to create passages. Other problems include erosion and filling up due to rains and for this reason trenches do not work along steep slopes. Therefore, in this case, without proper maintenance and the cooperation of the villagers, EPTs will prove ineffective (Balasubramanian et al, 1995; Datye & Bhagwat, 1995; Nath & Sukumar, 1998, Karanth & Madhusudhan, 2002). Costs of a trench may range from Rs.25, 000 to 50,000 per kilometer with added maintenance costs (Sukumar, 1994).

2.4.4. Power Fencing

An electric fence usually consists of two or three wires appropriately strung on hard wood or stone posts and connected to an energizer, which draws power from either a battery or the mains. A current of 5000V is passed in pulses of 1/3000 of a second, thus, elephants will receive a severe shock but are in no danger for their lives (Sukumar, 1994). Although initially effective, elephants eventually learn how to break fence posts and pull down the strands, and therefore, unless maintained properly, these fences also prove ineffective in the long run (Balasubramanian et al, 1995; Datye & Bhagwat, 1995; Nath & Sukumar, 1998; Karanth & Madhusudhan, 2002). Other reasons for failure include delay in switching on the electricity, short-circuit, wide gaps under the fence where it passes over streams, failure of the solar energizer, breaking of the fence by elephants and cutting and selling of large sections of fence by locals (Datye & Bhagwat, 1995). Subsequently, private fences are preferred to those owned by the Forest Department, due to the difference in maintenance efforts. In Assam, it is mainly the tea garden owners who make use of such fences. Fencing erected by the government and non-governmental agencies is not proving very effective in the Nilgiri Biosphere Reserve because there is no follow up on the maintenance, and although the fence is there for the benefit of the local villagers, it is not felt so by them, they do not feel responsible for the fence and therefore do not maintain it (Balasubramanian et al, 1995). An electric fence might prove more effective if the area being protected was small where maintenance could occur on a daily basis. Confining elephants to a degraded habitat by electric fencing has implications for the habitat as well assuming the elephants stay inside. If food is scarce within the boundary, a fence cannot be a long term deterrent for a migrating population.

In Africa, experiments also shown over time, that elephants learn fence-breaking techniques (Thouless & Sakwa, 1995). The majority of the fence breakers were bull groups or solitary bulls. Even 11-strand fences, which use PVC insulators, were broken. After modifications to the fence in an attempt to increase effectiveness, elephants broke through but simply running at it and accepting a 7KV shock in the process (Thouless & Sakwa, 1995). While complicated fence designs such as the former have not worked very successfully, ironically some single strand fences have been known to be quite effective despite low voltage and only moderate levels of maintenance. It could be that this success be attributed in part to a strict policy of shooting violators (elephants) from the inception of the measure (Thouless & Sakwa, 1995). However, in other cases, it is impossible to know just how much of the population one would need to be shot to instill this fear in the elephants.

2.4.5. Elephant Scaring Squads

These usually involve temporary workers being employed by the Forest Department whose main job it is to drive herds of crop raiding elephants back into the forest, with members of the department, using mainly gunshots and firecrackers, and if possible, vehicles with bright lights and occasionally kunkis to assist. The function of the scaring squads is concentrated in

the few months that depredation occurs. Elephant scaring squads are probably the most cost-effective and simplest method used by the Forest Department to provide temporary relief to the farmers (Nath & Sukumar, 1998). However, limitations include not only that it will not work forever, but also the lag time between being the time of actual crop raiding and the arrival of the squad.

2.4.6. Removal of problematic individuals/herds

It is common for villagers and officials to attribute an increase in the number of elephants seen by them to the termination in elephant capture. While the swift removal (either by culling or translocation) of rogue elephants so as to avoid further loss of lives and damage to property has been offered as solution by several elephant experts, Forest Department officials, and even villagers, this still remains a contentious issue (Sukumar, 1991; Balasubramanian et al, 1995; Williams & Johnsingh, 1996; Karanth & Madhusudhan, 2002). Sukumar (1991, 1994) argues that the removal of male elephants identified as habitual crop raiders or rogues may be the best form of population management considering the inherent predisposition of adult bulls to raid compared to females of a herd, with the least impact on population demography. The problem arises with the presupposition that all raiders are bulls, and vice versa and therefore does not allow for the correct identification of the rogues by managers. Herds do just as much damage, if not more, as bulls (Datye & Bhagwat, 1995; Balasubramanian et al, 1995). Under pressure to solve the problem, random capture or killing of elephants can occur and therefore, not necessarily solve the problem, as not all elephants, herds or bulls, will raid even if the opportunity exists (Balasubramanian et al, 1995). Furthermore, elephant capture can only be conducted under the right conditions and depends on the terrain (in states where capture is done by tranquilisation, particular caution is required in this regard, as a steep terrain could result in the elephant falling), must be the right season, and in an area not too densely populated by elephants (Nath & Sukumar, 1998). Furthermore, in certain states, the current demographic situation may make capturing of rogue bulls a non-feasible option (Sukumar, 1991). African experiences show that elephants subject to intense culling or hunting pressure form large groups and cause even greater damage to local crops and vegetation (Southwood, 1977 in Naughton et al 1999). Thus, control operations may lower crop loss on a regional basis, but intensify conflict on the edges of parks and reserves.

2.5. Case Studies

2.5.1. Meghalaya

Conflict is a serious concern in many parts of northeastern India where, the sentiment of the people is a threat to the future of the elephant. Meghalaya is a key elephant bearing state of the northeast, holding an elephant population of approximately 2,872 as per the 1993 census, with the most elephant bearing regions in the state being the Garo hills and the west Khasi hills (Gurung & Lahiri Choudhury, 2000). Unlike the rest of the elephant ranges in the country, in northeast India, a considerable proportion of the elephant population resides in private and unclassed state forests. In Meghalaya, a mere 12% of the 8,514km² of forestland is under Forest Department control, with the rest being under the control of village communities and district councils (Gurung & Lahiri Choudhury, 2000; Anon 1994 in Williams & Johnsingh, 1996). The estimated elephant population in the Garo hills is 1,400 spread over a forest area of 3,150km² of which approximately 20% falls under the Forest Department's control (Williams & Johnsingh, 1996). *Jhum* or slash-and-burn agriculture is

the main agricultural practice of the indigenous people in the forest areas. In areas not under the Forest Department's control, *jhumming* and mining greatly threatens the future of the state's elephants. Besides this, another form of land use that is causing widespread modification to the existing tree cover, is the replacement of the latter with extensive plantations of species not favoured as fodder by elephants, such as teak, eucalyptus, rubber and some cash crops such as orange and cashew nuts (Gurung & Lahiri Choudhury, 2000).

The elephant range in the west Garo hills experiences very high levels of human-elephant conflict. Most of the elephant habitat is highly degraded as a result of being under *jhum*. Anthropogenic activities being initiated across the country are severely affecting vital elephant habitat. In February 1996, mining started near the village of Damal Asim, an area that is crucial for elephants within the range. Similarly, the east Garo hills elephant range has shrunk considerably, with large areas around Dobu and Nangwalbibra undergoing coal mining. The border of Darugiri Reserve Forest is being severely encroached and in the face of these massive disturbances the elephants are retreating and not frequenting the Songsak and Darugiri Reserved Forests as they previously used to (Williams & Johnsingh, 1996). While the Nokrek-Angratolli elephant range is still relatively less disturbed, the construction of roads, the threat of logging and mining could also place this area in jeopardy. Regrettably, the extensive tracts of undisturbed evergreen forests in the west Khasi hills range are not under Forest Department control. Subsequently, there is nothing the department will be able to do to stop logging or other anthropogenic activities from degrading the area (Williams & Johnsingh, 1996).

The area under *jhum* in Meghalaya is estimated to be 760km² (Husain, 1981 in Williams & Johnsingh, 1996). The vegetation is thus, a mosaic of *jhum* fields, primary and secondary (fallow land) forests. Predictably, the movement of elephants through forest areas brings them into crop fields. These crop fields provide a source of highly nutritious food that is easily available and therefore, crop raiding becomes a common occurrence. Williams and Johnsingh (1996) showed that 86% of the verified 23,755 cases of depredation in Meghalaya between 1985 and 1993 occurred in the Garo hills. They also showed the west Garo hills district to be the most seriously affected, accounting for 83% of the total number of cases. This area has a very high human density, with 63-177 people per km². Government records show that the minimum depredated area in Meghalaya between 1992-1997 was 6,639.53ha with much of this depredation being done by herds or family groups (Gurung & Lahiri Choudhury, 2000). The maximum number of human casualties of conflict, either elephant related injuries or deaths are consistently recorded from the west Garo hills district. The majority of depredation occurs between the months of June and December with a peak in July/August and another smaller one in November (Williams & Johnsingh, 1996; Gurung & Lahiri Choudhury, 2000). The peak in July/August coincides with the ripening of the paddy and the peak in November coincides with the availability of cotton flower buds. The damaged area ranges between 50m² and 5,470m², with paddy being the most popular crop being raided (Williams & Johnsingh, 1996). Many other crops are damaged by trampling, with some tree species, such as arecanut trees also being pushed over by the elephants. The economic loss borne by the farmers ranged from Rs.48/- to Rs.4,570/-. Huts are also destroyed during raiding by elephants. Between July and August 1995, 9 *jhum* huts and one house were destroyed out of 18 sampled villages in the Garo hills (Williams & Johnsingh, 1996).

Between 1984 and 1995, 115 human deaths and injuries were recorded in east, west and south Garo hills. Most of the victims have been males (Williams & Johnsingh, 1996). Between 1992 and 1997, 28 deaths and 28 injuries were recorded in the Ri-Bhoi, west Khasi hills, east, west and south Garo hills districts of Meghalaya, all mainly caused by accidental purposes (Lahiri-Choudhury, 2000).

Compensation totaling Rs.1,21,30,805 has been paid in Meghalaya between 1985-1993 for elephant damage to crops and property (Williams & Johnsingh, 1996). This state is an example of the delay between filing a compensation claim and granting of the claim due to a lack of manpower to chase up each claim. People in the Garo hills are generally not happy with the compensation scheme.

Besides the normal methods, only few villages have adopted preventative measures in the form of trenches and rubble walls, which they claim have been more effective (Gurung & Lahiri Choudhury, 2000). The Forest Department has been found supporting depredated villages by sending out their elephant scaring squads (Gurung & Lahiri Choudhury, 2000).

During investigations, Menon et al (1997) found that in certain sections of the east Khasi hills, where crop raiding by elephants from the Karbi Anglong hills occurs, the local village leaders were encouraging their people to shoot the elephants since assistance from the Forest Department was not dependable or effective.

Solutions:

Alternative land use patterns to *jhum* should be offered to the villagers such as bee-keeping, piggery, poultry etc. Awareness needs to be implemented with regards to alternatives to *jhum* and the harmful affects the short *jhum* cycle (Gurung & Lahiri Choudhury, 2000). The following corridors need to be secured in this region:

- a. With respect to long-term elephant conservation, the south Garo hills elephant range, comprising of the Balphakram National Park (estimated area of 490km²) holds the maximum potential. This can only be realized if this National Park is strengthened through the acquisition of the Baghmara Reserve Forest corridor area and the extension of the eastern boundaries of the park to encompass areas from the adjoining west Khasi hills elephant range. This vital corridor would enable the maintenance of the contiguity of about 600km² of elephant habitat, most of which is under Forest Department control (Williams & Johnsingh, 1996). However, the rich deposits of coal also make it an area vulnerable to anthropogenic activities.
- b. Propositions of limestone mining and establishing a cement factory are threatening the future of the Siju-Rewak corridor. If this vulnerable corridor is not maintained, the continuity of the elephant range between the south Garo hills and Nokrek-Angratolli will be dissolved (Williams & Johnsingh, 1996)
- c. Similarly, coal mining is threatening the viability of the Imangiri-Nokrek corridor, which connects the Imangiri Reserve Forest with the Nokrek National Park. This, compounded by the fact that very little of this land is under Forest Department control could result in the fragmentation of this elephant population (Williams & Johnsingh, 1996).

2.5.2. Assam

Previously in Assam, management of the elephant population was through annual capture of younger elephants and killing of the older more mature ones. The indicator of successful management would be the level of property damage and human killing per year³¹. Elephant capture in Assam was discontinued in 1981 but in 1986, as a one-time affair, capture was performed. Between 1979 and 1993, elephants killed 649 people with a definite increase the year after capturing as a management tool was discontinued³². This only worked however, while the human population was also small enough to not exert extreme pressure on the elephant habitat and other natural resources.

The Kameng-Sonitpur interstate reserve proposed by Project Elephant forms a continuous belt of forests that extends well into Arunachal Pradesh boundaries. However, the east-west continuity is broken in two points due to encroachments while the north-south continuity is disturbed in the north, again due to encroachments. However, the movement of elephants within Assam and to Arunachal Pradesh remains uninterrupted. Depredation in the tea gardens and villages along a 5km area along the south of the above belt is therefore a regular phenomenon. There are, along Charduar, and Rowta Reserve Forests no resident elephant populations, only those that migrate to Singri Hill Reserved Forest, and it is these elephants that cause extensive damage in this block annually³³. Another depredation prone zone is from south of Balipara Reserve Forest extending southward to Salonibari near Tezpur Airport and Panpur area east of the Bharali river³⁴,³⁵. The depredation peak periods coincide with the two main harvest seasons, May-June and November-January, the latter season being heavier. A number of factors could contribute to this depredation. In winter, water and forage become scarce in the upper reaches of the habitat, and during the same time, elephants in Arunachal are reported to be disturbed due to forestry operations and *jhumming* being practiced in the nearby forest areas. These factors may cause the movement of the elephants into the Assam portion of the habitat, increasing their density there at this time³⁶.

Up to 18 elephants were poisoned in the Sonitpur district in 2001, of which 10 died in Nameri National Park, and 5 died in the Holleswar and Goroimari villages near Tezpur. These killings occurred within a short span of only four months. The episode succeeded in accentuating the gravity of this problem in the region to officials, experts and conservationists across the nation. The seasonal migration of elephants from Balipara Reserve Forest down to Goroimari Reserve Forest and splinter groups either moving directly back, or to Singiri Hills Reserve Forest first, has been known to occur for over 70 years, even prior to the establishment of human settlements along the route. The cropping up of human settlements however, has not prevented this migration, with the result that each year, many of the villages and tea gardens along this route experience elephant movement, and are subject to crop raiding and property damage. Most locals are living below the poverty line with rice cultivation being the sole income source for most in the region. The majority of farmers practice single time, rainfed farming of this crop on their own land, largely for subsistence purposes, with some possible commercial sale. The farmers

³¹ Project Elephant, Assam state report, 1995

³² Ibid

³³ Talukdar, B.2002, Pers. comm., Range officer, Nameri National Park, Assam

³⁴ Sarmah, P. 2002, Pers. comm., Range officer, Nameri National Park, Assam

³⁵ Talukdar, B. 2002, Pers. comm., ACF, Assam Forest Department

³⁶ Project Elephant, Assam state report, 1995

do not receive any state or central government subsidies for their cultivation. Thus, even slight damage of the crop is problematic for the farmers. Crop raiding by elephants has been recorded from most parts of Assam, with the quantity of crop damaged increasing each year. This has led to a decrease in the tolerance levels of the farmers for crop raiding, and has consequently led to the killing of elephants, at least in parts of Assam. Although these villagers may have been experiencing crop raiding each year, they claim that the intensity and frequency has increased over the past two years.

Once the harvesting season is over, the elephants then attack the storage granaries. During the peak depredation period in 2001, elephants damaged 12-13 homes in one night. Although maximum damage is done to the paddy, other crops including coconut trees are destroyed during the raids.

High levels of encroachment appear to be the indirect cause for heightened man-elephant conflict. In this region alone, up to 95% of reserve forests have been encroached (Table 3). These buffer zones to core conservation areas are being rapidly lost. In Nameri itself, two encroached villages were evicted by Forest Department in April 2002.

Table 3: Area encroached based on Forest Department report (1999)

SL No.	Reserve Forest	Area (km ²)	Area Encroached %
1	Behali	140.16	42.84
2	Biswanath	105.61	95.60
3	Naduar	144.32	43.19
4	Balipara	189.72	70.10
5	Chariduar	86.00	55.09
6	Rowta	97.42	3.00

The considerable anthropogenic disturbances to the habitat by coal mining and other activities around the forest areas of the Dibru-Saikhowa interstate reserve, *jhumming*, forestry, extraction of resources from the forest such as bamboos for the paper mill in parts of the Kaziranga-Karbi Anglong Intanki elephant reserve, and extremist activities in the reserve forests of the proposed Borail-Saipung interstate reserve, have aggravated the conflict situation over time. The common migration of elephants from Arunachal Pradesh (Deomali forests) to Jeypur Reserve and upper Dehing areas is accompanied by damage to property and human life along the route³⁷. Flooding within the national park of the proposed Kaziranga-Karbi Anglong Intanki elephant reserve causes elephant movement to the south, to higher ground within the Karbi Anglong district³⁸. However, during this process elephants cause considerable conflict as they cross a belt of human habitation, a national highway and tea gardens. Similarly, during months of water and food shortage, the elephants from the Karbi Anglong East division and from the Nambor reserved forests of the Golaghat division migrate northwards towards Kaziranga National Park causing extensive damage to standing and harvested crops along the way³⁹. The population of elephants that once only migrated

³⁷ Project Elephant, Assam state report, 1995

³⁸ Ibid

³⁹ Project Elephant, Assam state report, 1995

through the southern plains of the Cachar District now resides there for the whole year, causing damage to crops and property on a year round basis⁴⁰.

The Holleswar villagers (where 3 poisoned elephant carcasses were found in 2001) have a village committee where 10-12 people keep guard during the night during the peak depredation period. When elephants are spotted, the whole village is aroused and mobilized to chase the animals away. Unlike Holleswargaon, there is no formalized watcher system in Goroimari, villagers keep guard of their fields whenever necessary and warn others on the approach of elephants. Though numerous compensation claims have been filed, some of them as far back as 7-8years ago, nothing has been received. Only one man in this village has received a compensation amount of Rs. 3,000/- in 2001 by state government of AGP for house destruction, not by Forest Department⁴¹. Others have filed claims but none have been granted as yet. At the moment, government compensation policies are as such: Rs. 20,000/- for death, Rs. 3,000/- for permanent disability and not much for depredation⁴². Encroachers living in the Nauduar and Chariduar Reserve Forests, bordering Nameri National Park, are ineligible for compensation or relief from the state government, their status being one of encroachers, thus removing this as a possible mitigation measure.

Besides the normal methods of chasing elephants, in certain villages, the Forest Department has erected electric fences but a lack of monitoring and maintenance by both Forest Department and villagers has meant that these attempts have also failed to be effective for long. In most villages visited around Nameri National Park and through till Tezpur, villagers commented on the lack of active support by the Forest Department in anti-depredation measures. Very few villages are visited by the Forest Department on pleas for assistance during the depredation period.

While Assam hardly pays compensation at the moment, across the border from Nameri National Park, in Pakke Wildlife Sanctuary of Arunachal Pradesh, fringe villages of Seijosa are showing their content at the efforts of the Forest Department for not only paying compensation, but in alliance with two NGOs, forming active anti-depredation “watcher” squads. Members of these squads are local villagers themselves, a proportion of whom receive menial monetary support from the NGOs on a rotational basis. This is aided in building the morale of the villagers and helped in improving the relationship between the latter and the Forest Department, such that tolerance for raiding has increased. Contrarily, another fringe village, across the border from Balukhpong of Assam, villagers are openly threatening to use any means necessary to rid themselves of this annual nuisance, primarily because they feel alienated and isolated by the Forest Department.

Solutions:

There needs to be a policy change regarding encroachments. For example, certain unclassed state forests have been encroached in the Kaziranga-Karbi Anglong proposed reserve. While it is no longer possible to evict these villages because of both the socio-political situation in the area and the time that the encroachers have been there, it is imperative to prevent a further loss of elephant habitat by preventing further extension of these encroachments into

⁴⁰ Ibid

⁴¹ Villagers, pers. comm., 2002, Assam

⁴² Deka, D. 2002, Pers. comm., ACF, Tezpur

the forested areas. While the concept of multi-use forests is a good one, they must be maintained and managed as such that their roles as elephant habitat do not become secondary or non-functional. Therefore, while these areas will have to meet the demands of timber, fuel and other forest produce for the rural communities, they must be managed to maintain their habitat suitability for the animals as well.

2.5.3. Kodagu, Karnataka

Elephant deaths caused by conflict are not uncommon in parts of Karnataka, such as the Kodagu district and near Bandipur National Park. Elephants are distributed in the Western Ghats of Karnataka in a discontinuous manner due to the development of hydroelectric and irrigation reservoirs, mining, coffee plantations and agriculture into the forested hills (Sukumar, 1986), thus reducing the area available to the elephant. The Kodagu district of Karnataka consists of 1588km² of protected forests. The primary occupation of the residents of this district is agriculture with the most common crops being coffee, paddy, cardamom, pepper, orange, coconut and banana (Nath & Sukumar, 1998). This district has an estimated population of 1730 elephants, either as residents or migrants (Nath & Sukumar, 1998). While the continuous tracts of forest allow free movement of the animals, the highly fragmented habitat to the north of this district mean that elephants often come into conflict with humans.

Nath and Sukumar (1998) found that between April 1992 and March 1996, 2146 cases of depredation were recorded in the district, with a per year average of 472 crop damage cases being recorded. The average number of people killed or injured by wild elephants in the district per year was 6, the majority of which were found to be men. Elephants falling victim to this conflict annually was estimated at around seven, but this also included those killed for ivory. Nath and Sukumar (1998) further showed that the highest number and frequency of crop raiding cases occurred in the northeastern part of the district which corresponded with the least area of protected forest and low estimated elephant densities, thus relating this higher frequency and number to low quality and fragmentation of habitat. The most commonly raided crop was paddy, followed by coffee, cardamom, coconut and banana, in descending order. The average economic loss per raid was estimated at Rs.3,253, with smaller farmers obviously suffering greater loss per year when calculated as a proportion of their average annual income.

Although most people in this area are not in support of killing the animals as a means of reducing conflict, and believe that a lack of food in the forests and the attractiveness of the crops are the main causes for depredation, the concept of collaborative efforts of the Forest Department and the local farmers was viewed with great uncertainty. This only goes to show however, that more effort needs to first be put in to building a relationship of trust between these stakeholders before any joint projects or methods can be started.

During 2001, within a span of a couple of months, 5 elephants in the Chamarajnagar and Kanakapura divisions of Karnataka were electrocuted. Following these incidents, an open forum meeting was held between members of the local communities, Forest Department, other governmental agencies and non-governmental organizations.

On average, the Forest Department paid Rs.7,51,835 in compensation per year. Although 88% of the cases filed have been compensated by the Forest Department, the villagers still

appeared dissatisfied with the system (Nath & Sukumar, 1998). Most farmers resort to the usual methods of scaring elephants. Other farmers who can afford it, will change the types of crops grown, selectively remove plants to which elephants are attracted, illuminate the entire estate with flood lights at night or if possible, erect electric fences. The efforts of the Forest Department towards conflict include elephant capture, scaring, erection of electric fences and rubble walls, and the digging of elephant proof trenches. In the Biligirirangan hills and the adjacent Satyamangalam division of Tamil Nadu, other methods used to scare the elephants included occasionally using loudspeakers, taking jeeps or tractors fitted with spotlights close enough to the raiding animal to scare it. Digging trenches, and running strands of wire along the periphery of the field, illegally electrifying it from the 230V mains are other techniques used to deter elephants (Sukumar, 1994).

In addition to the killing of both males and females by defensive farmers, poaching for ivory in South India is a very real threat that has already seriously affected the sex ratio in certain areas. Thus, in these areas, removal of bulls from the population as a mitigation measure may not be practical as this may have further implications for the genetic variation of the already skewed population.

Future conservation work needs to focus on maintaining the habitat integrity and quality for the major elephant populations.

2.5.4. Nilgiri Biosphere Reserve, South India

The Nilgiri Biosphere Reserve covers an area of 5520km² and spreads across the southern states of Kerala, Karnataka and Tamil Nadu. Of the Biosphere Reserve, Mudumalai Wildlife Sanctuary, Waynad Wildlife Sanctuary and adjoining reserve forest areas are interspersed with agricultural pockets. Agricultural villages also lace the peripheries of these areas and the Bandipur Tiger Reserve. In these areas, Balasubramanian et al (1995) found that 9.1% of the areas visited were raided, with the average area damaged being 2.1%. 3.45% of the paddy crop was damaged, 1.53% of the ragi (finger millet) and 1.4% of the maize crop was damaged. Ginger was not eaten but 1.7% of the crop was trampled. Damage to other crops ranged from 0-0.8% which was negligible. Little to no damage was done to horse gram, cotton, sunflower and groundnut. Although paddy showed the highest damage in the study area, the proportion eaten was found to be less than ragi and maize. This could be due to less protection awarded to the crop during the early growing stages, such that more was trampled and less eaten at this stage. No significant difference was found in the area damaged between the different vegetation types of thorny forest, dry deciduous forest and moist deciduous forest.

Balasubramanian et al (1995) classified protection measures into the following: guarding; ordinary fencing and guarding; special protection and electric fencing. Their study in Nilgiri Biosphere Reserve showed ordinary fencing with guarding and special protection to be the most successful of the methods employed for crop protection. Poor maintenance was found to drastically reduce the effectiveness of power fencing. However, electric fencing supported by special protection appeared to be the best combination for crop protection.

The study found that not all elephants in an area raided crops, even when the opportunity existed. Thus, if culling is being considered, managers must first identify the culprits before

capturing and not do so indiscriminately. The sex ratio of a population must be taken into account when planning any management strategy.

2.5.5 Rajaji-Corbett Elephant Range

The Rajaji-Corbett elephant range in the north of the country is home to approximately 650 elephants. The total habitat available to the elephants is approximately 3000km², including the two national parks and adjacent reserve forests (Johnsingh, undated). The Kunaun-Chilla power channel has almost divided the Rajaji-Corbett elephant range into two. This 14km long channel does not allow much opportunity for elephants to cross being 9m deep, 22m wide and having cemented sides at a 45° angle. There are only three points at which elephants may cross, one a bridge, a dry riverbed and an aqueduct. There is considerable pressure on the habitat from the growing human community residing within the boundaries of Rajaji National Park – the Gujjars and by other villages lying on the fringes of the habitat. Thus, the two species (humans and elephants) come into conflict when the humans enter the forests for fuel or fodder collection. There is competition over the water sources and the presence of crop fields on the boundaries acts as an attractant to the animals. Conflict has manifested itself in 70 people being killed by elephants in this area between 1980 and 1990. An average of about 5-10 people are killed each year in encounters (Sukumar, 1994).

2.5.6. Chattisgarh

The census conducted in 2001 estimated the country's eastern elephant population to be around 2500. Of these, a number of groups have begun to migrate to Chattisgarh and have found themselves in the midst of considerable conflict with humans. Anthropogenic activities such as mining, encroachments, and illegal felling of trees has drastically deteriorated the habitat quality of Jharkhand and Orissa (Singh and Chowdhury, 1999 in Singh, 2002). It is this that has possibly forced the elephants to move to new areas such as Chattisgarh. Since 2000, the numbers of migratory elephants in the state has been increasing, causing a subsequent increase in the levels of conflict with humans primarily in five forest divisions: Korba, Raigarh, Dharamjaygarh, Jashpur and Sarguja. Although no real economic analysis of the situation has been done, a site visit has shown extensive damage being caused to property in Dharamjaygarh and Lailunga ranges. Appropriate assessments need to be conducted by the Forest Department before they payment of any compensation. At the end of 2001, 3 people were killed in Bartangarh and another one in Kaya by elephants. Two problematic herds have been identified; one of 14-18 and another of around 6 elephants.

Although the Forest authorities of the region do not have any prior experience with human-elephant conflict, they have made a conscious and commendable effort to reduce conflict (Singh, 2002). They have provided villagers with firecrackers as a means of scaring the elephants in addition to the usual methods used by the villagers. They also organized a daylong awareness workshop on elephant behaviour for the villagers. Since this is a novel problem the villagers, they are inexperienced with how to handle it physically and emotionally.

Solutions:

It is vital that the State authorities address the conflict problem immediately and prepare themselves in advance, rather than waiting till the situation deteriorates. The primary focus should be to increase the knowledge base regarding these elephants, including monitoring

and mapping movement routes and habitat quality in different areas (Singh, 2002). Assessment should also be made of the anthropogenic activities that are presently and could in the future pose a threat to the elephant population. Then the government should decide upon a definite policy towards these new residents. Since the villagers do not have much experience with such scenarios, awareness campaigns must be held for their benefit. The feasibility and advantage of translocating the smaller group should be further investigated. At present, the state government is providing compensation for damage done by the elephants. However, this is not being well regulated, so that a proportion of the public is abusing the system for their benefit (Singh, 2002). Therefore, the compensation scheme must be re designed, with compensation paid in kind rather than cash also being considered. Since this problem is one that originated outside Chattisgarh, an inter-state committee should be created comprising of representatives of Jharkhand and Orissa as well as Chattisgarh, to decide on a relevant management plan.

2.5.7. Dalma Wildlife Sanctuary, Jharkhand

Dalma Wildlife Sanctuary is found on the Chhotanagpur plateau in Jharkhand. Paddy is the staple diet of the locals here, but maize and wheat are also grown in some villages. The presence of a variety of minerals such as iron, uranium, copper and gold have led to the rapid industrialization, deterioration of natural habitat and widening of the disparity between urban and rural in the state.

Damage amounting to Rs.1.8 lakh for 1989 and 1990 and Rs.1.6lakh for 1991 was incurred in the 10 sampled villages of Dalma Wildlife Sanctuary (Datye & Bhagwat, 1995). The damage was found to vary from village to village, with villages on the northern and eastern sides being affected more adversely. This was largely due to the movement pattern of the elephants and the disturbance around Jamshedpur city in the south (Datye & Bhagwat, 1995).

Protection measures include a fence erected by the Forest Department, which as in most other parts of India, does not function when required to function. Villagers keep guard at night from the safety of “machans” (watch towers) armed with bow arrows and spears. As with many other villages on the fringes of elephant habitat, a lack of electricity makes spotting a raiding elephant very difficult. In this area, the hilly terrain would render the trenches ineffective as they would fill up with litter and debris carried by the run-off water. One recommendation is habitat improvement with participatory management.

The problem in this area is aggravated by inadequate compensation schemes and unfulfilled promises for full compensation payment by the government. The compensation received from the state in comparison with the annual economic damage felt by each village due to loss of grain and hay, has been meager.

2.6. Conclusions

Karanth & Madhusudhan (2002) state that policies encouraging “co-existence” with wildlife conservation goals will inevitably lead to increasing levels of conflict and therefore, they promote preventative spatial separation as being a more cost-effective, humane and practical solution to the problem. In the reality of this country however, this does not appear to be an option. And thus, solutions which enable “co-existence” must be found, as difficult as they may be. Human-elephant conflict presents the greatest challenge to wildlife managers across

the globe. With a mounting human population (not only due to the natural population growth but also due to immigration from neighbouring states) exerting increasing pressure on the existing resource base and the conversion of natural habitats into agricultural fields, it is only natural that a large ranging animal like the elephant comes into frequent confrontation with humans. The changes in land use, the shortening of the *jhum* cycle and large-scale encroachments into reserve forests has drastically changed the future of the elephant in this country. Therefore, if solutions are to be found, the one vital ingredient will be the commitment of the involved agencies, especially the government, and arising from this commitment, the willingness to indulge in unorthodox means and to enforce policies once they are made.

One example where elephants and humans “co-exist” at respectful distances of each other is again from Africa. In Amboseli National Park, Kenya, elephants show a fear response to Maasai (Kangwana, 1995), associated with cow bells and mooing, a traditionally nomadic, pastoralist people. Young men of the community traditionally were required to spear wild animals to prove their bravery and practise their war skills, soon after being initiated into manhood. Experiments show that dung density increased with distance from Maasai settlements (Kangwana, 1995). The elephants had adopted strategies, which enabled them to use water sources at times when the Maasai and their cattle were least expected to be there. This is an interesting and encouraging example of traditional practices allowing both species to live within respectful distance of each other with minimal conflict. Maasai have a positive attitude towards the elephants. Maasai spearing is tolerated because it does not significantly threaten the structure or dynamics of the population.

However, the reality in most places, including India, is quite the opposite. Extensive encroachments into wildlife habitat are occurring nationwide, and thus conflict is inevitable. Other than those described above, there are a number of other focus areas that require attention and may assist, in the long run, in mitigating conflict;

1. Land use patterns: Clear land-use strategies must be determined, with a clear and enforced demarcation of **certain** areas for human use and those for wildlife. Furthermore, because at present, non-government forests are neither quantified nor scientifically managed, it is suggested to include all forests under a central state body for proper management (Williams & Johnsingh, 1996).
2. Corridors: Due to the extent of the pressure being placed on the present elephant habitat, and the fact that this species is a large-ranging one, corridors connecting a network of protected areas may be the only conservation strategy left for the problem of habitat fragmentation in India. Thus, maintenance of some continuity of elephant ranges through the acquisition and securing of identified crucial elephant ranges and corridors should be given the highest priority (Williams & Johnsingh, 1996; Gurung & Lahiri Choudhury, 2000). Corridors allow the dispersal and movement of individuals between reserves, thus increasing effective population sizes and thereby decreasing the possibilities of extinction (Brown & Kordic-Brown, 1977 in Williams & Johnsingh, 1996).
3. Research: Research studies on radio-collared elephants should be undertaken to understand their seasonal habitat utilization pattern in an environment that can change drastically due to shifting cultivation, to determine their home ranges, their population structure and habitat assessment (Williams & Johnsingh, 1996; Gurung &

Lahiri Choudhury, 2000). It is only based on reliable background information such as this, that sound conservation strategies can be thought out and applied.

4. Awareness and education: There is an immediate need for awareness and environmental education campaigns in the country. The focus of these campaigns must not only be wildlife conservation and the importance of healthy ecosystems, but more essentially, family planning and importance of literacy. Conservation can only be successful if the human population is managed as well.
5. Eco-development: Socio-economic surveys of rural communities will assist in the conceptualisation of eco-development plans for them. While the concept of eco-development is a good one, the problem arises because biotic disturbances and the user population need to be regulated at a level that can be sustained by the resources of the habitat. However, this is not possible. Possibilities for this scheme could include, the creation of nurseries for fuelwood, medicinal plants, horticultural crops and the like; improvement of agricultural practices of the people using eco-friendly methods and pest control; provision of basic amenities, such as communication facilities, safe drinking water, medicinal care, educational facilities, waste disposal and so forth; promotion of village industries such as weaving, cane and bamboo works, etc; provision of recreational facilities; developing a market for the village produce.
6. The fringes of encroached areas may have to be eco-rehabilitated, thus including the planting of indigenous species utilized by elephants and if necessary, removal of unwanted weeds/species.

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