

Managing Human-Wildlife Conflict and Conservation Threats in and around the Urban Landscapes of Greater Guwahati, Assam, India

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Abstract

Human-Wildlife Conflict (HWC) is fast becoming a serious threat to the survival of many endangered species in the world. Considering the current human population growth in the urban landscapes of Greater Guwahati, increasing demand for resources and access to land, it is clear that human wildlife conflicts will not be eradicated in the near future. For this reason a better understanding of conflict management is crucial. Guwahati, the largest metro of North-east India is also a dwelling place for a variety of wildlife, due to the present habitat with 18 (eighteen) hillocks and 7 (seven) reserve forests. With increasing human population in the metro and decreasing wildlife habitat, wildlife-human conflicts have become a common occurrence in past few years, especially with Common Leopard (*Panthera pardus fusca*), which justify detailed monitoring of leopard population and the driving factors of conflict, in order to minimize losses to both leopard and human. The study recommends two different approaches to resolving HWC: short-term mitigation tools need to be combined with longer-term preventive strategies, along with techniques that are effective with diverse species. When low environmental impact strategies and traditional low cost deterrents are not effective, more invasive approaches such as regulated harvesting, wildlife translocation or human relocation should be considered. Irrespective of the approaches adopted, there is a need to implement those designed specifically for local species and if possible these should be empirically tested for cost-effectiveness and any potentially negative impacts on the ecosystem equilibrium. Moreover, the study suggests that, protected areas and the presence of wild animal populations inflict costs on local communities. In turn, local residents can develop negative attitudes towards reserves and wildlife, exacerbating the conflict and undermining conservation efforts. In order to break this

cycle, there is a need to protect rural livelihoods, reduce their vulnerability and counterbalance losses with benefits and foster community-based conservation. Both people and wildlife suffer tangible consequences and the different stakeholders involved should commit themselves to tackle and resolve such conflicts in the future.

Key words: HWC, Leopard, habitat loss, encroachment, Guwahati.

Introduction

Human-wildlife conflict (HWC) is fast becoming a critical threat to the survival of many globally endangered species, in particular to large and rare mammals such as the Sumatran tiger (*Panthera tigris sumatrae*) and the Asian lion (*Panthera leo persica*), but also to less endangered species such as the snow leopard (*Uncia uncia*) and the Red colobus monkey (*Procolocus kirkii*). The numerous cases (Distefano 2005; Buttler 2000; Hans 2003) from countries all over the world demonstrate the severity of human-wildlife conflict and suggest that (IUCN - World Conservation Union - Red List of Threatened Species, 2003) an in depth analysis is essential to understand the problem and support the conservation prospects of threatened and potentially endangered species.

Leopards are a highly adaptable species that live in and around many human dominated, agricultural landscapes. It is a daunting challenge to ensure the peaceful coexistence of leopards among high densities of humans of the order of 200 or more to a sq.km. Carnivore density is known to be dependent on prey density (Carbone and Gittleman 2002; Karanth et al. 2004). Research indicates that even in such high human density areas, attacks on humans and domestic animals in most cases can be kept to very low levels (Seidensticker 1990; McDougal 1991). The goodwill and trust of people especially in rural areas are vital to dealing with crisis situations arising out of loss of life and livestock

by leopards in rural areas. The Forest department is the first to face the heat of the public reactions and requires the goodwill and confidence of the rural community much more than any other government department. This paper provides a framework not only to address the conflict after its occurrence, but also to minimize such conflicts through adoption of necessary pro-active measures.

Study area

Guwahati, the largest metro of North-east India bounded by $26^{\circ} 05' N$ to $26^{\circ} 10' N$ latitudes and $91^{\circ} 30' E$ to $91^{\circ} 50' E$ longitudes is also a dwelling place for a variety of wildlife. With increasing human population in the metro and decreasing wildlife habitat, wildlife-human conflicts have become a common occurrence in past few years, especially with Common Leopard (*Panthera pardus fusca*), which required further investigation and detailed monitoring of leopard population and the driving factors of conflict, in order to minimize losses to both leopard and human. Indian Common Leopard (*Panthera pardus fusca*) considered to be Near threatened by IUCN, 2011 and being offered the highest level of protection under the provision of Indian Wildlife (Protection) Act 1972 as a Scheduled 1 species. This elusive, yet highly adaptive species do inhibit in human proximity, which sometimes leads conflicts resulting in losses on both the sides. Within Assam, leopard-human conflict is probably at its peak in the past few years in Guwahati. The conflict shows an increasing trend within Guwahati for past few years, especially in areas like Silpukhri, Pandu, Boragaon, Maligaon, Adingiri, Fatasil, Gotanagar, Nilachal, Narakashur and Kalapahar hills etc., with as many as five instances within a span of 30 days in the fall-winter and on-set of monsoon of 2011-2012. This increasing conflict can be attributed to increasing human population in the metro, with decreasing

habitat and natural prey base. Guwahati is surrounded by 18 hillocks, 7 Reserve Forests and Amchang Wildlife Sanctuary, which provides shelter for the leopards. Due to increasing human pressure in the fringes of the forests as well as straying leopards in the human habitation in search livestock as easy prey, conflicts are often unavoidable. Leopards can live near humans with low levels of conflict (Seidensticker 1990; McDougal 1991) and this has also been seen in India (Athreya and Belsare 2004).

The present severity of the problem demands preparation of immediate action plan for mitigation of Leopard-human conflict as well as conservation of existing leopards through population management. This required first hand information on identification of areas with leopard presence, estimating abundance and mapping areas in terms of the severity of conflicts. However, population monitoring of large carnivores are difficult to conduct because they are often elusive, secretive and nocturnal and roam over large distances (Schipper et al. 2008).

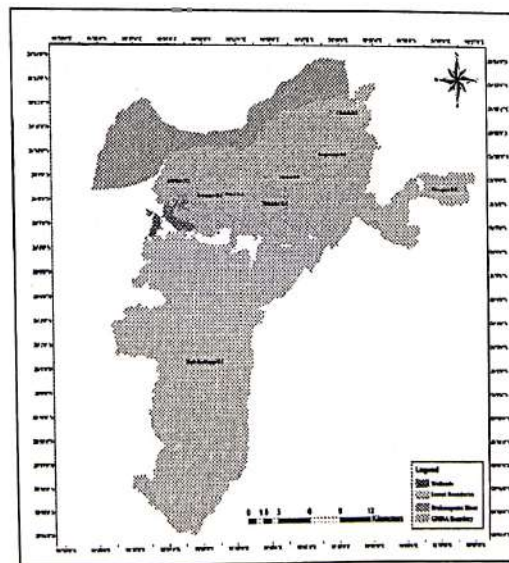


Figure 1: Map showing study area of Guwahati Metro reflecting locations of Reserve Forests (Source: Field Study)

Land use change of Guwahati city

Guwahati, the capital city of Assam is the major hub of economic activity of North-East India. The city began to expand in all fronts at a tremendous rate when the capital of Assam was shifted from Shillong to Dispur in 1973. During the last four decades, the increase in population and construction activities has resulted in increase in density of settlement and pressures on infrastructure in the city. A large scale conversion of hills to settlement, construction and quarrying is noted in the city. Moreover, the city is currently facing problems like shortage of proper dwelling areas, drainage congestion, landslide, flash flood etc.

Physiographically, the study area is divisible into three units consisting of low to moderately high denuded hill ranges, alluvial plains and some areas of swampy or marshy lands and beels. The average elevation of the plain areas of Guwahati is 56.52 meters above mean sea level (msl). The river Brahmaputra flows from East to west and the whole area is drained by its tributaries many of which die out during the dry season. Some of the hillocks have fairly dense, mixed jungle while others are deforested for construction or quarrying while wetlands, beels and low lying back swamp areas support marsh vegetation and aquatic life (Shukla et al. 1989). The important hills of Guwahati city are, 1) Nabagraha-Chunsali hill series, 2) Japorigog hill, 3) Sonaighuli-Jutikuchi hill, 4) Udayasal-Kalapahar hill, 5) Nilachal hill, 6) Fatasil hill, and 7) Jalukbari hill. The general trend of the majority of the hill ranges is E-W having similar height. The Nabagraha-Chunsali hill series in the north eastern part of the city has a maximum height of 216 meters and 240 meters respectively above msl. The altitude of the isolated hill Sarania is 173 meters above msl. Towards the south of Nabagraha-Chunsali hill series lay the Japorigog

hill with a peak height of 277 meters above msl. The highest altitude of Udayasal-Kalapahar hill with Birubari-Dispur-Kacharibasti in the north eastern side and Jatiya -Kahilipara-Odalbakra in the south and southwestern side is 267 meters above msl. In the west-central part of the city lies Nilachal Hill having its peak at 293 meters at msl. Towards south, lies the Fatasil Hill trending in NE-SW direction with Santipur-Gotanagar-Teteliya in the north western side, Fatasil Ambari-Ganeshpara-Katabari in the eastern side and Garchuk-Teteliya at its southern side. The highest altitude of this hill is 292 meter above msl. In the westernmost part of the city lie two small hillocks having the highest altitude 168 meters above msl. known as Jalukbari hill.

There are several low lying areas and beels scattered within the city. The Deepar beel located in the south-western part (Figure 1) and is the major one. Several small beels, namely, Raja Beel, Ghuguli Beel, Hahchora Beel, Susuki Beel, Pata Beel and Pitni Beel lie in the extreme northeast corner of the city. In the east lie Damal Beel, Silsako Beel and Tepar Beel while in the central part lie the Borsola and Sarusola Beels. Though the fluvial processes and weathering have played the dominant role in shaping the landscape of the area, the impact of human activity in modifying the landscape for urban settlement, industrial growth, irrigation and agricultural practices cannot be ruled out (Shukla et al.1989). Many of them are being filled up in recent times because of the rapid pace of urbanization. Another type of landform of Guwahati area is the isolated remnants of Archaean rocks which stand conspicuously above the general level of the terrain (Goswami 2010).

The rapid built up environment by predictable development activity of the city has emerged at low relative relief area. The low slopes thus correlated positively with

the extent of being built up and preferred for urban development while those areas with moderate hills and sharper contours have remained untouched of much urban activity. (Hazarika et al. 2008). The land use change of the Guwahati city Figure 2 and Figure 3 can be identified in the Forest land, Open spaces/ area, Water bodies and Wetland-Table1 (Saharia, D and Singha, K 2012).

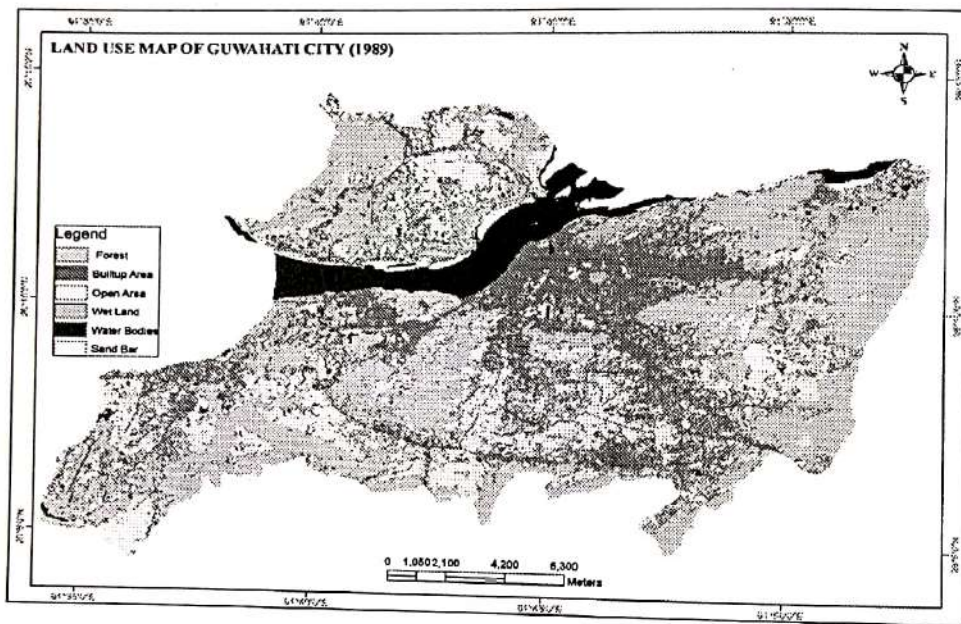


Fig. 2: Land use map of Guwahati city 1989

Source: Singha, 2010

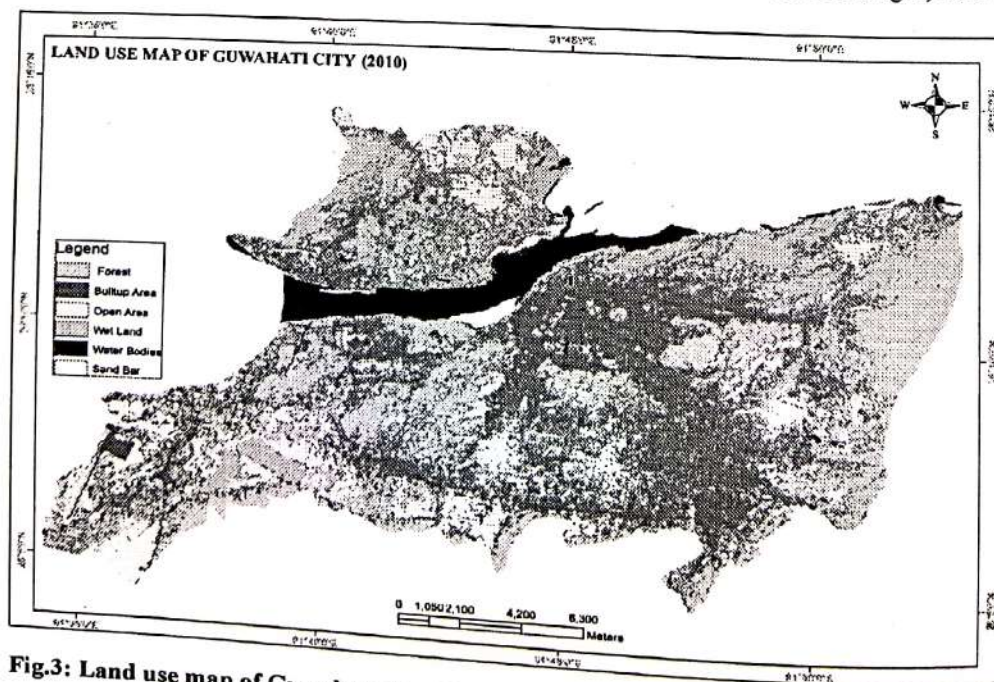


Fig.3: Land use map of Guwahati city, 2010

Table 1: Status of Land use in Guwahati city (1989-2010)

Land use Categories	Year 1989		Year 2010	
	Area in Ha.	Area in %	Area in Ha.	Area in %
Forest land	9978.9	31.1	9236.0	29.1
Open area / Field	8623.9	26.9	6685.2	21.1
Built-up Area	8759.2	27.3	12775.9	40.2
Water Bodies	2183.7	10.1	1706.0	6.6
Wetland	2516.9	4.6	1401.0	3.0
Total	32062.6	100	32062.6	100

Source: Saharia, D and Singha, K 2012

Leopard Conservation and Information Facility in Assam

The main purpose of this research work to assess the current state of the leopard conservation in Assam with special reference to urban landscape. This will involve monitoring the state of leopard -human conflict and establishing the current distribution range both within and outside the protected area network. The current distribution range of the leopard will be mapped and compared to data from the 1990's to quantify the shrinkage in leopard habitat over recent years. The leopard is one of the most adaptable and widely distributed species but although it is resilient in the face of human pressure it has suffered a decline in its population over the last decade (Athreya et al. 2004). To make matters worse, farmers and illegal hunters also destroy leopards - 150 leopards were killed in Assam due to conflict. This research aims to encourage local communities to develop and refine their traditional means of mitigating human - leopard conflict by using non-invasive techniques.

Objective

GIS based habitat change detection and understanding present conflict in terms of leopard abundance and habitat change.

Methodology and Database

Identification of the conflict level zones within the study

area and use this information in developing a capture-mark-recapture sampling strategy.

The entire area will be stratified based on leopard presence information and unsupervised habitat classification in GIS environment. Leopard presence will first be accessed through "Review of media reports sighting and leopard-human conflict during 2010-2012.

On the basis of this information, areas of high, medium and low conflict will be identified and incorporated into the GIS environment.

Managing Conflicts

Effective management of human wildlife conflict involves the use of multi-pronged strategies that focus on management, both of wildlife and livestock, financial mechanisms, and education and outreach. The development of these strategies is generally based on existing threats and options to reduce and mitigate those threats. A threats-based conceptual model of conflict management is presented in Figure 4, showing the main causes, desired target conditions, and examples of effective management interventions.

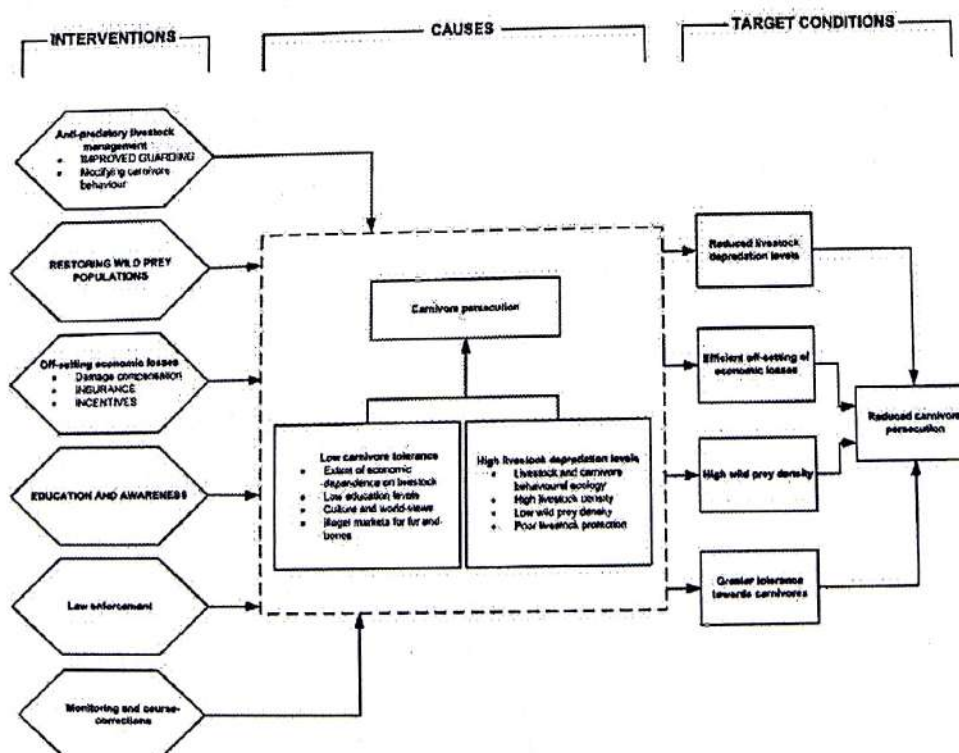


Figure 4. A conceptual model of human-wildlife conflict showing causes, interventions, and target conditions. (The capitalized interventions shown in this model have been employed in a human-snow leopard conflict program in India.). Source: - Report prepared for WCS TransLinks Program (Morrison et al. 2009)

Awareness Generation and Involvement of People

The overall aim should focus on a participatory approach, ensuring support of local communities and other stakeholders for conservation and management of wildlife. Awareness programmes should target the people sharing space with leopards, in human dominated landscapes like sugarcane fields, tea gardens, fruit orchards, etc., and also the local communities living in forest dominated landscapes, especially in the hilly States of North-East India (especially, Guwahati city), Uttarakhand, Himachal Pradesh and Jammu and Kashmir.

Sensitizing the media about the nuances of the problem of human-wildlife conflict in general and leopard depredation in particular should be an essential part of the awareness strategy. Media should contribute to diffusing the tense situation surrounding conflict with objective reporting aimed at highlighting the measures to mitigate conflict (Athreya and Belsare 2004).

Teamwork in Tackling Conflict

Efforts should be made to involve all departments, wings and agencies of the Government to use a well coordinated mitigation approach which is scientific, field tested and practical, and inter-alia, capable of dealing with emergencies related to attacks by leopards. In this regard, it is vital to involve the Police and Revenue Departments as they are crucial for maintaining law and order in the face of extreme public reactions. Proper training of police and local

administrative staff, and constitution of a Primary Response (PR) Team, along with awareness campaigns is essential ingredients of a successful conflict mitigation strategy.

Primary Response Team

These teams may comprise of paid or volunteer members from the local communities, who are trained to respond immediately to a conflict situation. Their primary aim should be to control the crowd and secure the area until the next level of help arrives. In the hills, where the terrain is difficult, and where houses are scattered in a forest landscape, an Emergency Response (ER) team may take time to reach the conflict site. The establishment of a Primary Response (PR) team is important to ensure crowd control before the ER team reaches the spot.

Management of Crowd

Crowd management is crucial to any successful animal rescue operation. The ER team, more often than not, is obstructed and hindered in its activities by furious mobs, making it difficult to discharge its responsibilities. Support and cooperation of the police and civil administration should be ensured in advance to facilitate effective crowd control and to discourage formation of crowds. The area should be cordoned off with barricades, and the public alerted through a public address system. Regular updates should be made available to the administration and local public.

There should be an ambulance kept ready to take care of any medical emergencies

Rescue measures for the Animal

The objective should be to give the animal enough space and opportunity to return to its habitat, and situation-specific rescue measures should be followed. The best method of dealing with a wild cat, in the absence of attacks on humans, is not to intervene.

Unconfined or Open Area

Open situations could mean a barren land, grassland, street, thicket, crop field with standing crop or woodland, with the leopard being either up on a tree or on the ground. If the animal is in an open area surrounded by people, all attempts should be made to keep the crowd and local people from approaching near the animal and the animal should be allowed to escape under the cover of darkness. Drug immobilization should be avoided in situations where the animal is in the open, even if the target presents itself in an appropriate position, since a darted animal in the open can retaliate injuring people. To trap the animal, a suitably designed light-weight trap that minimizes injury to the animal, should be used.

Semi-confined

If the animal is confined in a dry well or trench, a ladder let down into the well will allow the animal to escape in the night.

Here too, the public must be kept away from the site, and the rescue team should monitor the situation until the animal escapes.

Animal Confined in a Closed Area

If the animal is confined in a closed area, for example in a house, garage, under a culvert, or caught in a snare, etc., the surrounding entrance and exits should be made secure to ensure no injury to the public.

If the area is adjoining a forested area, the animal should be allowed to escape in the night, but if it is in a high human density area it should be tranquilized.

Capture and Handling of the Trapped Animal

Captured leopards should not be put on display after capture. Such unintended forced close contact with humans may alter the behavior of captured animals with highly

adverse consequences following their release. Ideally, such leopards should be kept in covered cages. Only healthy fit individuals should be returned to the wild. All captured animals, irrespective of the method used to capture (chemical/trapping), should be chemically restrained for evaluation of its condition for prognosis and suitability for release.

While confined, the animal can be micro-chipped, scanned (if already micro chipped), treated, and various morphometric parameters recorded. If the animal is to be released back in the wild in a few days, it should be housed in a suitable transit facility with minimum exposure to humans.

If the animal is to be placed in captivity, the life time care facility to house the animal should meet the standards prescribed by the Central Zoo Authority.

If an animal kept in captivity is intended to be released, thorough investigation of its fitness and evaluation of its response to humans should be conducted before releasing it into the wild.

If the animal has been kept for more than a month in captivity, it should not be released back into the wild. If the animal is injured beyond recovery or permanently disabled, euthanasia is recommended as the best option. Even if the exceptional decision for euthanasia has been arrived at, the animal must be chemically restrained. NSAIDs (Non-Steroid Anti Inflammatory Drugs) should never be used for treatment of the animal as these are contraindicated in felids. Long acting antibiotics should be used for sustained therapeutic effects even after release.

Release or Translocation of Captured Leopards

The decision to capture an animal should be the last option. It is very important that human intervention is restricted to the minimum to avoid future conflict. If the captured leopard is to be released, it should be in the immediate vicinity of

capture, i.e. within animal's home range.

Leopards are highly adaptable animals, and exhibit amazing homing instincts. A translocated leopard trying to navigate to its home territory through a dense human landscape may lead to increased incidences of conflicts rather than reducing the same. Therefore, it is best to avoid translocation. No animal captured after a deliberate attack on a human should be released into the wild.

Transportation of Captured Animal

Captured animals often get injured or stressed during transportation. Stress could be detrimental to the health of the animal, which coupled with excessive exposure to humans may adversely alter its behavior towards humans after release. The animal once captured should be kept and transported in a stress free environment, insulated from the public. It is important that humans are not allowed to come close to the caged animal, and that the cage is also completely covered with tarpaulin or other appropriate material. Tranquilized/captured animals must be transported in the trap itself (if suitable) or in a separate transportation cage. Care should be taken to avoid crowded places, and the animal's health condition frequently checked during transit.

Monitoring of Translocated Leopards

The success of translocation or release of leopard has to be measured and evaluated against appropriate post-release monitoring protocols. Translocation very often leads to the transfer of conflict to another unaffected site. Individual identity of all the released animals should be monitored by marking them with microchips and ear tags or color coded collars before release. Radio collars should be put on a subset of released animals to monitor post-release movements and survival. Scientists and experts must be involved in such radio-tracking programmes.

Avoidable "Rescue" of Leopards

A cub without its mother usually does not need "rescue" as the mother leaves the cubs when she goes hunting. Equally, cubs released without its mother have poor survival probabilities. If cubs are found alone, a watch must be kept for their mother without disturbing them. Cubs are not to be "released", but only require "reuniting" with their mother. Reuniting should be attempted immediately in the night in the same area, from where they were picked up. A suitable camera trap placed overnight near the 'reunion site' would facilitate the confirmation of the reunion. Cubs that are hand-reared in captivity have a negligible possibility of future release back to the wild. Lifetime care is the only suitable option for such cubs, since their release in the wild even after a long term rehabilitation process may only worsen the already existing conflict situation.

Helping Rural People Better Protect their Livestock

- Subsidy should be provided for simple but sturdy and leopard-proof livestock sheds.
- Vaccination camps for livestock could also be organized in collaboration with the
- Animal Husbandry Department.
- Possibility of initiating state sponsored insurance schemes for livestock also needs to be explored.

Expeditious and Effective Delivery of Ex-Gratia

Immediate response to loss of life, livestock, and property caused by leopards will help calm people. This will prevent violent reactions towards the problem animal in particular and wildlife in general. Payment of ex-gratia should be made fast and hassle free. The possibility of initiating Self-financed insurance schemes should be explored.

Collection of Information on Leopard Conflict

- Management of a species should be based on systematic

- long term data. Information on conflict incidences should be collected systematically in an appropriate format to aid decision-making.
- Long term research, focused on estimating the population and abundance of leopards in high conflict areas, should be taken up on priority.
 - Identification of conflict prone areas, with data on conflict intensity, nature of conflict, and trends, must be collected for better preparation and pre-emption.

Dealing with Man-Eater Leopards

Attacks by man-eating leopards are deliberate with an intention to kill, and usually result in death, e.g., child being lifted from the precincts of the house, and attacks on people sleeping inside the house. In such cases, every attempt must be made to identify the correct animal, and trap the animal as per the guidance outlined. Immediately after the first attack by a man-eating leopard, orders from the Chief Wildlife Wardens should be obtained to eliminate the problem animal with the help of shooters. Trap cages should be installed to capture the man-eater. This is especially crucial when such attacks occur in highly populated landscapes.

Protocol to be followed in case of Leopard Attacks

In case leopard attacks are reported against human beings or cattle, the following protocols may be followed.

Precautionary measures taken in designing trap cages

- Trap cages should be completely enclosed (new designs use fiber glass) with holes for ventilation.
- Iron rods should not be used (thick chain link is preferable) anywhere in the trap cage as leopards struggle to escape by pulling at the bars which results in canines being broken.
- Old rusty, iron cages should be discarded, and not used to house leopards.

- There should be a gap of 1.5 inches between the cage floor and the lower edge of the trap door to prevent tails getting slammed.
- Trap cages should be well ventilated.
- Trap cages should be at least 6 feet in length with the trap door activation system being at the opposite end of the trap door. The height of cage should be around 4-4.5 feet and width ~ 3.5 feet. Cages made of fiber glass (currently being used in Maharashtra) are lightweight and can be carried by 4 people. Collapsible cages should also be designed and physically tested in the field to assess their effectiveness.

Some do's and don'ts for holding leopards in trap cages

- a) Trap cages should not be used for long term captivity (no more than one week). Separate temporary transit facility should be created for long term captivity.
- b) Only one animal can be held at a time in a trap cage.
- c) Water should be made available at least two times a day - either through a pipe which can be inserted in a hole at the side of the trap cage or by placing a steel bowl of water inside.
- d) Trap cage should not have any artificial padding (no rubber etc) as leopards have a tendency to rip off and eat it while struggling to escape. These synthetic materials could get lodged in the stomach of leopards and result in their death.

In Case of Attacks on People

Attack on person:

Determine nature of attack

Accidental: Usually results in injuries e.g.

- Leopard follows a dog into the house and attacks people in house

- Leopard is hiding in cattle shed and attacks when seen
- People chase/tease leopard and it attacks
- Person was crouching in foliage and the leopard attacks

Deliberate: Usually results in death e.g.

- Leopard picks up child from outside house
- Unprovoked attacks
- Attempts to take person from inside house in the night
- Immediately report to Forest Officials.
- Set up trap cages for capturing target animal(s)
- Put shooters on standby. Trap cages to be removed once animal is caught/killed. Monitor situation closely.

Educate the Public/media/stakeholders

Avoid setting up of tra

In Case of Attacks on Livestock or Sighting of a Leopard

No attacks on humans

- If fallen in well/ran Leopard sighted into house
- If above not possible, Monitor situation
- Educate public/media/stakeholders (rewrite if possible)
 - Avoid setting trap cages as far as possible
- Capture/tranquilize
- Shift to isolated Forest Department location
- Keep people away
- Release immediately within 10 km of capture site

Attack on livestock

- Pay compensation within a week
- Inform person to not bury or burn the carcass.
- Keep crowd away in the day and allow animal to escape

in the night give in proper reference style (please try to

avoid copy and assemble style)

Conclusion

In conclusion, the simultaneous application of different management practices and the implementation of those designed for local species are recommended. There is no single solution to the conflict and every preventative and mitigative strategy should be empirically tested for its cost effectiveness and possible impact on the ecosystem equilibrium before adoption. The best scenario would imply integrated community development and wildlife conservation promoted by national park managers and supported by local populations. Community-based conservation should give indigenous people the right to limited and sustainable use of natural resources while promoting tolerance towards wildlife, responsible interaction with their natural environment and recognize the value of natural heritage. Hans (2003) proved that the rural villagers, who live in proximity to Waza National Park in Cameroon, appreciate nature's intrinsic value and agree with the necessity to protect forests and their wildlife inhabitants for future generations. Their positive attitude towards conservation arises from the use of natural resources such as regulated harvesting of non-timber forest products, the use of waterholes and fishing.

In order to enhance protected area effectiveness, conservation should be based on sound scientific knowledge, practical local indigenous knowledge and collaboration. Protected areas and the presence of wild animal populations inflict costs on local communities and can erode local support and tolerance. In turn, indigenous people can develop a negative attitude towards reserves and wildlife, exacerbating the conflict and undermining conservation efforts. In order to break this cycle, there is a need to protect rural livelihoods, reduce their vulnerability, and counterbalance losses with

benefits and foster community-based conservation. Both people and wildlife suffer tangible consequences and different stakeholders involved should commit themselves to tackle and resolve the conflict in the near future.

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