FIELD FORESTER

VOICES FROM THE FIELD

VOLUME 1 • ISSUE 3 JANUARY 2016

Editorial Advisory Board

Editorial Board

Editors:

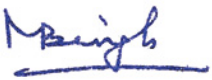
Contents

From the Chief Editor's Desk

Why should biodiversity matter to anyone? Biodiversity, ecosystems and the lives of people are inextricably linked. Millions of species are part of this biodiversity and each species (recorded or undiscovered) is important. Each species has a specific role and the extinction of any species gradually weakens the structure and integrity of our ecosystem and the environment. The dynamics of biodiversity and the ecosystem can be best illustrated with Edward Lorenz's metaphorical theory of the *Butterfly Effect*. The effect of species extinction is indeed like the butterfly effect at work; the connection between rapid deforestation in West Africa and Ebola is already a much discussed subject which needs more study.

Biodiversity loss and species extinction has raised much concern as well as action in conservation circles and governments, however despite all efforts biodiversity loss is still occurring at a disturbing rate. Vital ecosystems continue to be disturbed, degraded and destroyed. This can have cascading consequences including accelerated climate change, threats to human health and serious economic costs.

India, a mega-biodiversity country and one of the richest nations with regard to biodiversity wealth should show greater concern about the management and conservation of its biodiversity. The current issue of the Field Forester covers success stories related to biodiversity management and conservation from all over the country. The proper assessment of biodiversity is imperative for the proper management and conservation of biodiversity. However the same cannot be said about the forest biodiversity in our country. Many a times we manage our forests without knowing properly about its wealth- especially with regard to its biodiversity. It is very important to have proper biodiversity assessment protocols and inventories of the biodiversity. The National Working Plan code, 2014 has made that step towards meticulous recording of observations in the forests which can later go on to supplement more detailed assessments and studies. Only when proper assessment has been done and inventories are in place can a more scientific monitoring of biodiversity take into effect. While efforts are being made to conserve and protect our country's biodiversity it is high time to take a more concerted and scientific approach to biodiversity.



MP Singh

CONSERVATION / MAHARASHTRA

Protecting the habitat of the Indian Giant Squirrel

The forest department has taken a number of steps in Bhimashankar Wildlife Sanctuary, one of the few refuges of the threatened Indian Giant squirrel

VK Borhade

Bhimashankar wildlife sanctuary is located in the Sahayadri Range of the Western Ghats in Maharashtra. The wildlife sanctuary spread over 130 km^2 falls in Ambegaon and Khed tehsil of Pune district. The sanctuary was established in 1984 under the provision of Wildlife Protection Act 1972. The main objective behind the creation of this sanctuary was to protect the habitat of the Indian Giant Squirrel (*Ratufaindica*). The Indian Giant Squirrel is endemic to the Western Ghats and found only found in a few forest patches of Western Ghats. As its name indicates it is much larger in size compared to other squirrels of India.

The Bhimashankar Wildlife has number of sacred groves, maintained by the local tribal people. These sacred groves act as source material of seeds for vegetation in the nearby area and squirrel is the main agent of dispersal. The sanctuary has a large biodiversity of endemic and specialised flora and fauna. Leopard, sambar, stripped hyena, jackal, barking deer, wild boar, common langur etc. A large number of reptiles, amphibians, butterflies and insects are also found here. Recently, Blue Mormon – a butterfly – which is rarely observed in the sanctuary has been declared as the state butterfly of Maharashtra.

Such vast and rich biodiversity hub plays an important role in conserving the critical habitat of the Indian Giant Squirrel. This population of squirrels is distributed in land patches which are not connected to each other; this separation has led to speciation i.e. evolved a new sub species. This speciation has led to a variation in the colour of the species. Recently a new colour combination has been observed in Kolhapur Forest Circle of Maharashtra, during the census of Indian Giant Squirrel.

The Indian Giant Squirrel measure about 35 cm in length and the length of tail is about 61 cm; the body weight is about 2 kg. It has an attractive body with a combination of two colours, white and brown. Sometimes cream colour is observed on the legs. Generally, this species never comes on the ground. The squirrels move from one place to

SFS Batch 2014-16, CASFOS, Dehradun

another by using upper canopy of the tree. It jumps from one tree to another; in one jump it can covers about 6 metres. Their movement is restricted if the patch of forest has discontinuities; this generally happens in degraded forests. This animal is solitary in nature and has its territory which it marks by urine. They never allow another squirrel to enter into their area except mates and young ones. When the young ones grow up, they start to search new areas for establishing their own territories. They are omnivorous in nature; eat fruits, flowers, bark, insects, and eggs of birds. The squirrels play a great role in maintaining the balance of the ecosystem by dispersal of seeds. The main predator of this species are birds of prey and the leopard. When faced with a life threatening condition the squirrel freezes or flattens itself against tree trunk instead of jumping. The species is more active during day time and are most active early in the morning and during evening hours. It uses 6 to 8 nests,located on different trees in its territory. These nests are used as sleeping places and one of them is used as nursery.

Today the existence of the Indian Giant Squirrel is threatened. Dams, highways, industrialization, railway lines etc. are causing a loss of habitat. Illegal tree felling and chopping has reduced the tree canopy in many areas. This has led to shrinking in the boundaries of their habitat. As a result of which their movements are getting restricted, causing separation of one population from another. This results in inbreeding and narrowing of gene pool. All this has affected the population of this beautiful animal. The problem has become so severe that one sub-species out of five, which was endemic to the region of Dang in Gujarat, is now extinct. The occurrence ratio has also decreased to 2.9/km^2 in some patches of Western Ghats – Tamhini, Mulashi and Mahabaleshwar. This is certainly a cause for alarm for the existence of Indian Giant Squirrel.

However, according to the Pune-based Wildlife Research and Conservation Society, the occurrence ratio is a healthy 15.9/km^2 in the Bhimashankar Wildlife Sanctuary. This ratio shows that there is certainly something special and unique to this area in terms of management, protection and conservation. My discussions with RFO and local people revealed a number of reasons for this. The area still largely inaccessible, thus there is less human interference. Also, there are some sacred grooves which are protected by local tribal people,this has maintained the canopy cover. The forest department too is effectively controlling the illegal felling and lopping in the area. Awareness has also been created among the local people not to cut fruit trees in the areas where viable populations of the squirrels reside. The forest department has also carried out plantation activity in the area between two source populations. In these plantations, fruit species preferred by the squirrels have been planted. This effort has increased the movement of Giant Squirrel and increased its population;ultimately increasing the gene pool. The forest

department also promotes the activities of JFMC by involving them in conservation programme and by providing them alternative livelihoods as guides,caterers,tollkeepers on check posts and as forest watchers. A NGO in the area also helps create awareness among the local people about the animal and its importance. These are some of the measures which have resulted in unique favourable environment for the species and have led to a sizable increase in the number of Indian Giant Squirrels in Bhimashankar Wild Life Sanctuary.

YEAR	NUMBER OF NESTS	ANIMAL POPULATION
2009	7787	719
2013	10179	1700-1800
2014	11340	1800-1900
2015	11915	1489-1985

*(*Times of India and Indian Express News sources)*

Since before 2015, census was carried out only in Bhimashankar WLS, the number of Indian Giant Squirrels only related to this WLS is known. In 2015, for the first time, a state-wide census was carried out. Generally counting of Indian Giant Squirrel is done on the basis the number of nests. Since one squirrel uses 6 to 8 nests, dividing the total number of nests by 6 or 8, gives an approximate total number of squirrels. In Bhimashankar WLS, this method of census is supported by modern techniques such as digital mapping with use of Global Positioning System (GPS) and Geographic Information System (GIS). These modern techniques help to know whether the canopy area has increased or shrunk. Also, it gives an idea of land patches where the breeding populations exist. Armed with this information the forest department is now taking initiatives to connect these patches by plantation programmes to increase the connectivity between two source populations.

Like other protected areas, Bhimashankar WLS is facing problems which can in future have an impact on this fragile ecosystem of the Indian Giant Squirrel. Bhimashankar is both, a holy place and a tourist destination. Each year lakhs of pilgrims and tourists visit this place. This creates noise pollution and litter which disturbs this shy animal and its habitat. Lots of litter creates the unhygienic condition. The windmill project which was banned in 2011, has caused removal of large trees, resulting in restriction on movement of the animal. The WLS is also facing the problem of encroachment by people of surrounding areas. Local people clear the forest for agriculture and settlement, this has shrunk the habitat of the Giant Squirrel. Illegal lopping and felling has also increased the severity of the problem. Proposals of widening of the approach-road to the temple; construction of the newly proposed highway passing through the sanctuary have the potential to spoil the Indian Giant Squirrel's habitat. The Indian Giant Squirrel is the pride of Western Ghats and also the state animal of Maharashtra. This beautiful animal needs protection in its habitat like Bhimashankar Wildlife Sanctuary. Though the forest department is making efforts to conserve it, it's now the duty of each and every citizen to protect it.

CONSERVATION / HIMACHAL PRADESH

Community-based livestock insurance programme to the aid of snow leopard

As a result of the programme in the Spiti Valley, the attitude of people towards wildlife has changed and has resulted in a decrease in man-animal conflict

Pradip E. Patil

The least known cat in the renowned cat family is Snow Leopard because of its secretive and challenging habitat. It has been listed as Endangered on the IUCN Red List. Less than 4,000 wild Snow Leopards are present in world and India ranks third in their population. A rough estimate of the Snow Leopard population in the Indian landscape is 400-700 (Snow Leopard Survival Strategy 2014.1), and it is mainly restricted to the Himalayan and Trans-Himalayan areas of five states, namely Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and Arunachal Pradesh. The total range is estimated to cover 126,842 square kilometres. Snow Leopards are found in the hilly, snow-blanketed, inaccessible, sub-alpine and alpine zones, above 3,200 metres in the west and 4,200 metres in the eastern part of India.

As the snow leopard has a large home range, to sustain a viable population in the undisturbed landscape is a prime need. Therefore, the Snow Leopard is considered as an ideal flagship as well as umbrella species for the conservation of mountain ecosystems of India.

The adjoining areas of Ladakh and Spiti Valley in the Trans-Himalayan region are a home for healthy prey and good Snow Leopard population in India. Suryawanshi (2013) reported that the density of the Snow Leopard population ranges from 0.5 per 100 square km to 3.4 per 100 square kilometre for five different areas in the Spiti Valley of Himachal Pradesh. This represents Upper Spiti Valley's alpine habitat, one of the most critical habitat to the Snow Leopard.

Background of the problem

The upper Spiti Valley, situated in the north eastern part of Himachal Pradesh, is one of the least populated regions of India. The valley encompasses roughly 3,000 square km of relatively undeveloped alpine habitat, with an average altitude of 4000m above mean sea level, having only 25 villages. It is known for its green pastures, high-altitude lakes, and rare and endangered wildlife. Snow Leopards are found all over this valley. The unique and beautiful landscape of

ISFS 2014-16 Batch

the Spiti Valley is point of attraction for many nature lovers and currently about 10,000 tourists visit this place annually to experience the uniqueness of natural beauty and with hopes to see the Snow Leopard.

With passage of time, this remote area has become more accessible and connected to the rest of the world. This has caused excessive livestock grazing and unmanaged tourism and economic activities. This has increased pressure on natural resources and threats to the survival of Spiti Valley's wildlife and ecosystem.

As high quality grazing land reduces, wild and domestic animals overlap more and more. The number of mountain ungulates, like the Blue Sheep and Ibex, has decreased significantly due to competition with domestic livestock. This has resulted in an increase in attacks on livestock. This conflict has resulted into many instances of retaliatory killing of Snow Leopards by poisoning, snaring or by other means.

Studies by Mishra et al. in 2003 report about 3-12 per cent annual loss of livestock holdings in high conflict areas because of snow leopards and wolves. Damage to domestic animals causes great economic loss to poor families as they are totally dependent on their livestock for livelihood. In addition, the difficult landscape allows limited alternate livelihood opportunities to local communities.

Compensation schemes in the Spiti Valley were facing problems of low compensation rates (6–20 per cent of market value), time and costs involved for claiming compensations and corruption which discouraged people from applying for compensation schemes. One cannot claim compensation for livestock loss in protected area and it was the technical problem. Instead of mitigating, the conflict had led to greater aggression towards wildlife. This has made Spiti Valley a high-conflict area between pastorals and wild predators.

Other challenges

Though Kibber Wildlife Sanctuary and Pin Valley National Park are notified protected areas in and around the Spiti Valley, conservation in these high altitudes is relatively neglected. In addition, the protected area management in these high altitudes has lack of resources and trained manpower and absence of clear boundary demarcation. Thus, it is nearly impossible to maintain a large National Park and Sanctuary without community participation.

Interventions

The Snow Leopard Trust started its work in India in the beginning of 1998 with Nature Conservation Foundation (NCF) to conserve the Snow Leopard. An objective of the programme was to protect the unique ecosystem of the Upper Spiti Valley with the help of local people, without changing their traditional way of life.

During the early phase of the programme in 1998, the NCF signed a contractual agreement with the Kibber village council for not harming or killing snow leopards or its prey species and

also keeping 1500 ha of nearby areas free of livestock grazing for a period of five years for benefit of wild animals. Compensation was given to villagers for not using the area. Council itself assured that animals will not enter into grazing-free area.

In 2002, a community based, locally managed livestock insurance programme was started by NCF in Kibber village. The main aim of the programme was to reduce economic losses due to livestock predation by wild carnivores by sharing the risk. Villager needed to deposit premium amount to secure their livestock. Provision was also made to give financial rewards to the better performing herder. By seeing good response to the livestock insurance programme, it was expanded to four more villages in 2006. The programme then spread to four village clusters covering 10 settlements and 250 households in Spiti and Ladakh, insuring over 500 animals. Villagers have learned to maintain all records needed for running of the insurance scheme.

Now, after every kill by carnivores, herder needs to inform the village community members, who then confirm a thumbnail-sized numbered metal tag on ear as proof of insurance on the preyed animal. The insurance body then granted them between Rs 2,500 and Rs 10,000 as compensation amount, as per norms.

The administration and responsibility of programme is now totally with the villagers. And, because of this, there are no fake claims. The SLT-NCF contribution for premium in early stage of programme and judicious use of funds by villagers has made livestock insurance programme of Kibber village self-sustaining within five years.

In addition, the trust also managed to set aside a 20 square km reserve near the villages for the endangered Snow Leopard and its prey. In 2012, awareness programmes like eco camps were held in school for 132 children and 13 teachers, where they learned about food chains in their local habitats. Similarly, in 2014, about 20 schools in the Spiti Valley participated in multiple educational events.

This project has focused on participatory processes for planning and implementation of innovative conservation programmes, which is not only confined to wildlife protected areas but to the entire landscape.

Results of interventions

The Snow Leopard Trust report (2010) states that Kibber livestock insurance programme has become self-sustaining because insurance fund had built surplus year-by-year. Initially, SLT and NCF were paying 60 per cent of the premium, but now it is wholly paid and run by villagers. Five villages from Spiti Valley have collected a fund of Rs 24 lakh.

In 2014, livestock insurance programmes areas running successfully in 7 villages with 115 households and three villages have established grazing-free reserves for Snow Leopards and its wild prey.

In 1500 ha area kept free from grazing, within five years — 1998 to 2003 — Bharal (Himalayan Blue Sheep) population increased four-fold

and stabilised to approximately 300 individuals. In 2009, roughly 100 ibex were observed actively using another reserve area round the year. NGOs, using 40 research cameras to estimate Snow Leopard abundance and its prey populations, found that the Spiti Valley area was being actively used by Snow Leopards.

As a result of livestock insurance and awareness programme in the Spiti Valley, the attitude of people towards wildlife has changed. It has resulted in end of retaliatory killings of carnivores. Villagers are thus actively participating in conservation.

The Indian government and NGOs active for conservation launched 'Project Snow Leopard' in 2009 to help this high altitude's flagship species with its highly endangered populations. The community-managed livestock insurance programme has become a unique role model for planning and implementation of conservation strategies in other Snow Leopard areas of country.

The Snow Leopard Trust's long-time India Director, Dr. Yash Veer Bhatnagar, has been honoured with the 'Wildlife Service Award' by Sanctuary Asia, India's largest wildlife magazine, for his exceptional conservation work in the Spiti Valley and other Himalayan regions.

The first landscape-level Management Plan for the Upper Spiti Landscape, including Kibber Wildlife Sanctuary, has been made by the NCF team for the Himachal Pradesh Forest Department. The management plan was prepared and officially accepted in October 2011, and it is based on NCF's long-term research in the Spiti Valley landscape.

Conclusion

A key factor that brings success to community-based conservation efforts like livestock insurance scheme is dependent on active community involvement. We can assure active participation of local people in a conservation programme by creating affinity toward wildlife unique to their land. Sympathy of people towards wildlife can be maintained by taking care of their economic loss in the case of man-animal conflict. This experiment is worth replicating in other parts of India where similar kinds of man-animal conflict is present.

CONSERVATION / WEST BENGAL

Red Panda conservation: A captive breeding initiative by Darjeeling zoo

The Padmaja Naidu Himalayan Zoological Park has shown that red panda can survive in a zoo with appropriate maintenance and conservation steps

Trupti A. Nikhate

Padmaja Naidu Himalayan Zoological Park also known as Darjeeling zoo, is occurred in the area of 67.56 acre (23.3 Ha) of land in the beautiful landscape of Darjeeling city of west Bengal state. This zoo established in the year 14th August 1958,earlier it is known as Himalayan zoo later smt. Indira Gandhiji gave the name it as Padmaja Naidu Himalayan zoological park by the governor of West Bengal state in the year 1975. Appreciable work done in the field of captive breeding of the snow leopard, Red panda, and Tibetan wolves (Himalayan species). This is only zoo in the country to release captive breed red panda in the wild in the south East Asia. It is the main centre for the central zoo Authority of India's red panda programme and also member of the world association of zoos and aquariums. Ex-situ conservation in zoo and release of red panda in wild is renoved work done by the Darjeeling zoo.

Red panda scientific name: *Ailurus fulgens*, also known as lesser panda, red bear cat and red cat bear. It is a small arboreal mammal. native from

SFS Batch 2014-16, CASFOS, Dehradun

Himalayas to south western china, generally feeds on bamboo species but can also eat insects, eggs (omnivorous). It is under endangered category of the IUCN red list. In wild near about mature 10,000 individual survive in world. Main threat to the red panda are habitat loss, fragmentation, poaching, & inbreeding depression. Two species of red panda found in the world one is *Ailurus fulgens,* And another is *Ailurus stylani. Ailurus fulgens* lives in the western part of Nepal, Assam, Sikkim, and Bhutan. *Ailurus stylani* lives in the north eastern part of southern china and northen burma

Fallowing data shows about the details of the founder population in Darjeeling zoo

House Name	Stud Book Number	Sex	Date of Acquisitions
Anita	8221	F	Wild
Basant	8649	M	Wild
Chanda	8222	F	Wild
Divya	8648	F	Wild
Gora	9305	M	10.11.94
Hari	9302	M	10.11.94
Indira	9330	F	10.11.94
Omin	9404	M	25.12.96
Prity	9430	F	25.12.96

Red panda births in PNHZP, Darjeeling

Year	No. of Born	No. of Litters (a no. of young animals born to an animal)	No. of Deaths
1994	2	1	1
1995	5	3	3
1996	6	3	2
1997	5	3	0
1998	6	2	0
1999	7	3	0
2000	2	1	0
2001	5	2	1
2002	1	1	0
2003	3	2	0
2004	3	2	0
2005	0	0	0
2006	1	1	0
2007	1	1	0
2008	2	1	0

Discussion

Any breeding programme should depend upon various things like their nature, feeding, breeding season & behaviour also. Ex-situ Conservation of red panda in Darjeeling zoo is a planned conservation Breeding project as a part of global captive breeding master plan which was initiated in 1990's in that zoo. Initially the zoo has four red panda from the wild then they added another five more red pandas in the breeding programme from the European zoo to augument the four wild red panda.

For this conservation breeding programme the Padmaja Naidu Zoo done the unique record keeping activity which includes

1) **Stud book Maintenance:** It includes the information like Taxon name, number, current status, in vital statistics sex, age and origin information are incorporated ,birth type, birth location, birth date all this detailed information are included in it for future management it became very fruitful.
2) **Animal history card:** In animal history card they include information of the red panda like name, sex, scientific name, distinguishing mark, habitat, parentage, vernacular name,

in acquisition category they include information like how and from where acquired, when acquired and birth date, age on arrival, size and weight on arrival,

3) Veterinary treatment card
4) Individual treatment file
5) Animal deworming card
6) Animal vaccination card
7) Animal tranquilization card
8) Animal operation card
9) Animal feeding card
10) Beat(daily) report

Conclusion

The greatest achievement is in the year 20/6/1994 when the two red panda mainly named Ekta and friend born two the Basant and Amita those two are from the wild origin (in zoo) and when the another red panda female which was released in the wild she mate with wild male and gave birth to an cub in 2003-2004 in Singalila National park. From this achievements we can say that this type of conservation activity in modern era helpful for the conservation and reintroduction of the endangered species in its natural habitat and zoo like PNHZP play crucial role in that programme.

Another zoo also adopt this technique for their local species conservation E.g. from this success gangtok zoo also initiate the conservation breeding programme for the red pandas with the help of central government

National exchange of the red panda from zoo to zoo and zoo to national park or in their natural habitat increases.

Will the red panda survive in zoo? and the answer shows by the PNHZP yes they survive with appropriate maintenance and conservation.

FORESTRY / MAHARASHTRA

Successful wildlife management practices

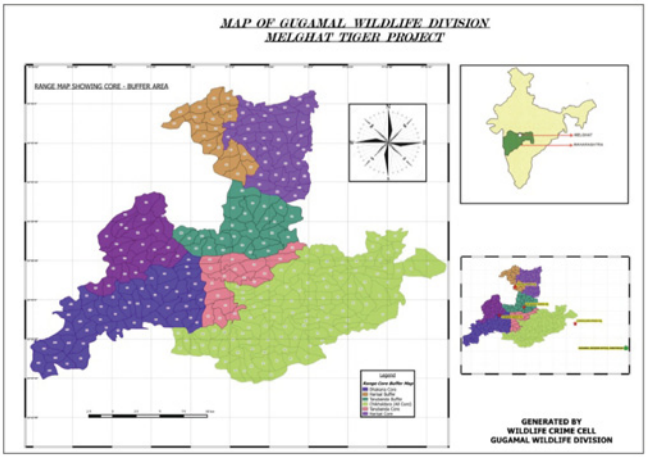
Given the improved availability of food and water, the floral and faunal biodiversity is totally changed in Gugamal National Park

Vidhya P. Vasav

Wildlife management is a science that relates to the art of making decisions and taking actions to balance the needs of wildlife with the structure, dynamics and relations of population, habitats, and people. There are essentially two kinds of management approaches– active and passive. Active management implies taking positive measures, increasing herbivore populations by creating grassland, ensuring distribution of herbivores in summers by creating waterholes, and so on. Passive management entails prevention of certain actions or letting the natural process take its own course, promoting natural succession of vegetation and not interfering with the natural occurrence of fire. The present case study discusses the successful practices taken by the forest department to achieve goals of wildlife management in Gugamal National Park.

Gugamal National Park with an area of 361.28 sq.km is a core area of Melghat

Map of Gugamal National park



SFS batch 2014-16

Tiger Reserve in Maharashtra. The park area is comes under Gugamal Wildlife Forest Division Paratwada. This park comprises four ranges, i.e. Chikhaldara, Dhakana, Tarubanda and Harisal.

In active wildlife management, the first step taken by the forest department was the rehabilitation of villages. The villages situated in the core areas of Gugamal National Park are Kund, Koha, Virat and Churni. The main populations in these villages are Koraku and Gavali communities and they mainly depend on forest for their bonafide and domestic needs. In order to reduce the dependency of these inhabitants on the forest, the villages in the core areas of the park were rehabilitated phase wise.

After there habilitation work, meadow development was done for the replacement of invasive species by palatable grasses in rehabilitated areas. The five sites were selected for meadow development such as Vairat (50 ha.), Kund (30 ha), Koha (45 ha), Belkund (20 ha) and Churni (50 ha). The seed plot was established at Vairat to serve as a seed bank for meadow development. In this seed plot, 18-20 types of grasses were planted such as *Themedatriandra*, *Apludamutica*, *Hetropogoncontortus*, etc. The seeds of grasses collected from this seed plot were spread in natural meadow areas. The various operations carried out by department for the grassland development in the above mentioned sites are detailed in Table 1.

Another important activity undertaken was soil and moisture conservation work, including creation of artificial waterholes and salt licks. The soil and moisture conservation work was done from March to May and included construction of Gabion structures, artificial waterholes, earthen dam and so on. (Table 2). The department carried out soil and moisture conservation work at each meadow development site. This helped to increase availability of food, water and space for wild animal.

One of the other most important activities undertaken by the forest

Table 1: **Month-wise operations to be carried out for grassland development**

S.No.	Month	Work detail
1	May	Earth work and barbed wire fencing to seed plot was done
2	June	After first shower, seeds of palatable grasses collected from seed plot were spread in the natural meadow areas
3	July & August	First weeding was carried out. The shoots were collected from seed plot and planted in natural meadow areas.
4	September & October	Second weeding was done and seeds collection from seed plot was carried out.
5	November &December	Third weeding and seeds collection from seed plot was done
6	October, November & December	Lantana eradication by manual uprooting method was done.
7	June to July	Seeds collected from seed plot were stored in gunny bags.

Planting of new shoots of grasses in natural meadow area

Grassland development area

department for wildlife management was silage-making. The silage operation was done in the month of November when the grasses have 20-30 percent moisture content. First, a pit of 5m depth, 5m wide was dug. It was then covered with the help of polythene sheet. The grasses were bunched and placed in the pit to make a layer of about 1 feet. A jaggery solution was spread above the layer of grass. Another layer of grasses is added followed by the jaggery solution. This procedure is repeated till the pit is full.

The pit is covered in an air tight manner with another polythene sheet. The jaggery solution act as a preservative and increases the nutrient value of grass. In the summer season, when herbivores face a scarcity of grass, these grass bunches can be taken out of the pit and spread along the waterholes.

In terms of passive wildlife management, the department undertook the creation of firelines in February and March. A 40 m fire line for division boundary, 30 m fire line for range boundary, 12m fire line for round boundary and 6m fire line for beat boundary were created.

The forest division has prepared a patrolling schedule for the forest staff

Table 2: **Detail of soil and moisture conservation work.**

Sr. No	Soil and Moisture conservation Structures	Location of structure	Number of Structures constructed
1	Gabion structures	Belkund	10
		Vairat	24
2	Artificial waterholes & creation of salt licks	Belkund	1
		Vairat	2
		Kund	2
		Koha	1
3	Earthen dam	Kund	2
		Vairat	1

Pit of size 5mX 5m

Spreading of polythene sheets

Spreading of jaggary solution

Prepared silage

and establishment of 10 permanent patrolling protection camps in the park. Each protection camp has one forest guard and 3 forest labours on daily duty who halt at the camp for the night. These 10 patrolling camps are Chatiburda, Bandarkau, Banam, SipanaKhandi, Gugaamal, Rajdevbaba, Vairat, Chikhaldara, Gobara and Sadhukundi. The forest staff in these camps undertook daily camp patrolling as per scheduled routes, pug impressions and pad creation for wildlife count, waterholes' desiltation

The results of this successful wildlife management practice is reflected in the increase in wildlife population (see table).

year	Name of animal										
	Sloth bear	Tiger	sambar	Barking deer	Wild boar	langur	Bison	Peacock	Jungle fowl	Wild dog	Total
2012-13	23	-	94	44	79	208	90	50	29	4	621
2013-14	18	-	166	81	108	217	143	63	40	9	845
2014-15	28	39	168	79	67	218	194	78	41	18	930
2015-16	34	45	190	89	82	269	350	91	57	22	1229

and increasing capacity of waterholes, and collection and recording of data on direct and indirect signs of wildlife.

For preventing wildlife poaching, they carry out litmus test of waterholes every day and use magnetic detector during patrolling to detect poaching traps by magnetic detector. On a monthly basis, local peoples' interaction and information about poachers is sought through EDCs.

The success of this work has been the significant increase in the number of herbivores. Now the movement of carnivores is easily ascertained in the park and remain inside the park because of greater prey availability and reduced man-animal conflict. Invasive weed species have reduced as has soil erosion. The percolation of drain water has improved following the soil and moisture conservation work. Given the improved availability of food and water, the floral and faunal biodiversity is totally changed thanks to the effective wildlife management practices.

WILDLIFE / ASSAM

Saving the whole genus from extinction

The successful re-introduction of Pygmy Hog into the wild can become a model that can be replicated in various parts of the country

Shinde Kondiba Baburao

Recently, while awarding the Harry Messel award to Dr Goutam Narayan, IUCN's Species Survival Commission acknowledged his dedicated research of two decades on Pygmy Hog and for saving the whole genus from extinction through conservation breeding.

Till 1995, when Dr Narayan became interested in Pygmy Hog, all efforts of conservation of this rare species were futile. The accidental re-discovery in 1971 of Pygmy Hog by a tea planter, J Tessier-Yadell, in the tea garden market near Barnandi Reserve Forest of North Assam, led to the first attempt of captive breeding of this species in a tea estate and Guwahati Zoo. Subsequently, in 1985, IUCN's Pigs and Peccaries Specialist Group (PPSG), at the invitation of Ministry of Environment and Forests (MoEF) formulated a conservation action plan for Pygmy Hog. But, it remained unapproved due to political unrest in the region and motivational problems till 1995.

The Pygmy Hog Conservation Programme (PHCP) was started in 1995 under a formal International Conservation Management and Research Agreement – first of its kind in India – between the Assam State Forest Department, the Durrell Wildlife Conservation Trust (DWCT), PPSG and the MoEF. The main objective of this consortium was to conserve Pygmy Hog through captive breeding and grassland ecosystem management.

Pygmy Hog is rarest and one of the two critically endangered suids in the world. It is an evolutionary relic and the only representative of the Porcula genus. The body size, ears, short medial false hooves, absence of characteristic tail, tusk and construction of nest and its year-round use by both sexes, distinguish it from the related genus Sus.

The historical distribution of Pygmy Hog was a narrow strip of tall alluvial grasslands from North Uttar Pradesh to Assam, through terai region of Himalayan foothills both in India and Nepal and the Bengal duars. Presently, it has lost most of its range to human migration and its only viable wild population is surviving in the Manas National Park and two re-introduced populations in Sonai Rupai Wildlife Sanctuary and Orang National Park.

Though omnivorous, it mainly feed on grasses and its very survival

SFS Batch 2014-16, CASFOS, Dehradun

is depend on grasslands which provide it place to hide, build a nest, water and protection from flood. The decline in population of Pygmy Hog is attributed to loss and degradation of grasslands due to human habitations, agriculture expansion, indiscriminate fire, contagious disease spread from livestock and faulty wildlife habitat management practices such as tree plantations in grasslands and dry grass burning in summer coinciding with the farrowing season. Therefore, the Pygmy Hog is a sensitive indicator species which highlights the threatened habitat of the region on which other species such as Rhino, Swamp Deer, Wild Buffaloes, Hispid Hare and Bengal Florican also depend for their survival.

Captive Breeding

The first custom-built research and captive breeding centre for the Pygmy Hog was constructed at Basistha, near Guwahati, the Capital of Assam, in 1995. The following year, six wild hogs (2 males, 4 females) were captured from the Manas National Park and kept in this centre for captive breeding. The care was taken to capture pregnant sows, so that the heterogeneous population could be built for future breeding programme without going for capture from the wild, which was time-consuming and a daunting task. Simultaneously, five more wild hogs were captured for radio telemetry study and released back at capture site.

The three sows, out of four, produced 13 piglets (7 males, 6 females) in the same year, out of which 12 survived. In 1997, seven more litters were born, raising the total number to 35, an increase of 580 per cent from the founder population. However, seven sub-adults and adults succumbed to death, out of which six to multiple bacterial infections. Another 22 piglets were added from five litters in 1998. The year 1999 witnessed another disease outbreak at the centre, claiming several young ones due to piglet diarrhea, and added 11 piglets from five litters. With the addition of 14 piglets in 2000, the total population of the centre rose to 65. This was the unprecedented success of the Pygmy Hog captive breeding programme so far. But, owing to short gestation period and large litter size, population had increased rapidly and created an accommodation problem in the centre. Later, more extension enclosures were added to accommodate the growing population and quarantine facility had been constructed to take care of possible disease outbreaks.

Till 2001, the captive population had risen to 77, a 13-fold increase in six years of the programme. From 2001 to 2007, the rigorous measures were taken to stabilise the population and to maintain the genetic heterozygosity in the population through DNA studies at CCMB, Hyderabad. Around 70 adult hogs were maintained in the captivity till 2007 and, in 2008, decision was taken to re-introduce about 12 hogs every year into the wild.

Re-introduction

With successful captive breeding, the next step to achieve the ultimate goal of the programme was to re-introduce captive bred hogs into the wild. For re-

introduction, extensive studies were carried out to locate probable sites in Assam and three sites, namely Sonai Rupai Wildlife Sanctuary, Nameri National Park and Orang National Park, were finalised. Efforts were taken to restore the grasslands at these sites before the release by site-specific management interventions, such as controlling indiscriminate grass burning and livestock grazing. Besides, the pre-release centre with a holding pen and three pre-release enclosures with simulated grassland were established at Potasali, in Nameri Tiger Reserve, as part of the soft-release process. The hogs to be released were encouraged to feed naturally and their supplementary diet reduced to one-fourth of their daily requirement gradually.

The first batch of three social groups – 16 captive bred hogs (7 males, 9 females) were released in Galgeli grassland of Sonai Rupai Wildlife Sanctuary in May 2008. Two more batches, consisting of 9 and 10 captive-bred hogs, were released in the same grassland in 2009 and 2010, respectively. The reintroduced hogs were monitored using field signs (droppings, foraging marks, nests, etc.) and video camera traps. A total of 35 (18 males, 17 females) hogs were released in the Sonai Rupai Wildlife Sanctuary. All of them are surviving there. Another 8 social groups, consisting 39 hogs (18 males, 21 females) were released in grasslands of Orang National Park in 2011, 2012 and 2013. Thus, the PHCP has so far released 74 captive bred hogs into wild at two sites, 12 times the founder population. The next site decided for the release is Barnadi Wildlife Sactuary, where the Pygmy Hogs were re-discovered in 1971.

Wild capture

Maintaining heterozygosity is crucial for sustenance of any captive breeding programme and PHCP was no exception. As the founder population of PHCP was small (only 6 hogs) there was chance of in-breeding in the population, even though the management had taken due care to avoid it through DNA studies. So, 3 more wild hogs (1 male, 2 females) were captured from Bansbari Range of the Manas National Park and introduced in Potasali Centre for future breeding.

Conclusion

In India, focus of wildlife management so far is on conserving big animals with intent of ecosystem conservation. Thereby, conservation of small creatures has not yielded desired results. The PHCP is, therefore, a shift in our perception of importance of few flagship species to every species in ecosystem.

WILDLIFE / MADHYA PRADESH

Re-introduction of Swamp Deer

The resurrection of the Barasingha from near extinction is one of the most successful stories of wildlife conservation in the world

Bharat Solanki

The Hard-Ground Barasingha, a handsome swamp deer, was rescued from the brink of extinction within Kanha National Park, and is one of India's most successful conservation stories. In 1970, the population fell into decline and was reduced to just 66 animals as a result of habitat loss, infectious disease and over predation by tigers. As a result, a major conservation programme was launched in an effort to curb the rapid losses of this species.

The Hard-Ground Barasingha found in Madhya Pradesh are recognised as a sub-species of the nominate species of Swamp Deer (*Cervusduvaucelibranderi*). This species was systematically described for the first time by R.I. Pocock (the famous British mammologist, who also coined the species name *branderi* after A.A. Dunber Brander, a British forest officer).This majestic species belongs to the family *Cervidae. It is called Barasingha* because of its twelve antlers which are conspicuous in males only. Also the state animal of Madhya Pradesh, the Hard-Ground Barasingha is a vulnerable species as listed in the IUCN Category list.

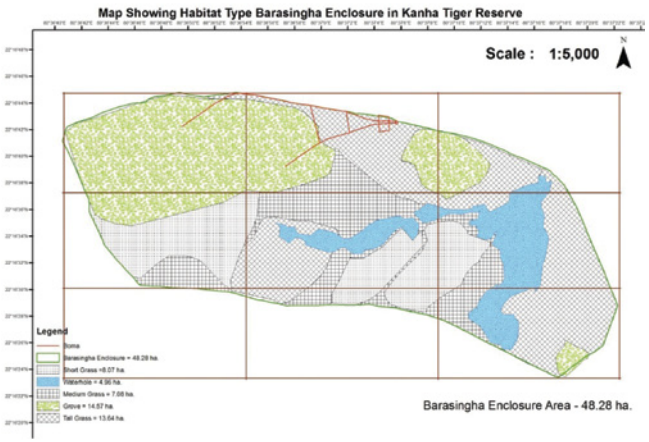
The species was earlier distributed throughout India, Nepal, Pakistan and Bangladesh (as shown in the map). Currently, the population of this species is restricted only to the Kanha Tiger Reserve because of alteration, fragmentation and degradation of its habitat. The Barasingha is a specialised feeder, consuming just a few grass species like *Themedatriandra*, *Saccharumspontaneum*, *Vetiveriazizanioides*, *Iseilimalaxum*, which are found in the meadows of Kanha. The population also dwindled due to illegal hunting on account of the medicinal value of its antlers.

The Hard-Ground Barasingha is one of three recognised species of Swamp Deer: The TaraiBarasingha (*Cervusduvauceliduvauceli*) is found in the foothills of the Himalyas (Gangetic plains), mainly in the DudhwaTiger Reserve while the Eastern Swamp Deer (*Cervusduvaucelirangitsinghi*) is found in the swampy grasslands of North-East India.

It is a totally graminivorous species and because of this grasslands are crucial for its survival. The species also prefers open areas of marshes, grasslands and woodland with understory. The hot season is a tough time for the Barasingha and that's why

SFS Batch 2014-16, CASFOS, Dehradun

The map shows the enclosures used in the KTR.



they need frequent access to swamps to dip its muzzle, drink water and wade several times in a day.

Barasingha were observed for the first time in January 1863 by Captain James Forsyth in Halon valley of Kanha and near Panchmarhi.

Kanha Tiger Reserve is situated in the Maikal Hills which constitute the eastern segments of the Satpura Hills inthe Narmada river basin in Central India. This park stretches from 22° 02' to 22° 27'Nlatitude and 80° 26' to 81° 03' E longitude. According to WII, this area comes under geographic zone, 6E-Deccan Peninsula of Central high lands. Kanha consists of a core zone (940 sq km.) and buffer zone (1009 sq. km.).

In 1938, the Forest Department estimated the population of the Barasingha to be 3038 in Kanha National Park. By 1970, the population drastically declined to 66 by 1970. The major reasons responsible for the dwindling Barasingha population were identified as follows:

- Inbreeding depression
- Degradation and fragmentation of habitat
- Natural calamities and epidemics
- Man-made changes like construction works, fire protection works, un-removal of invasive species, etc.

Experience has been shown that little food and relatively poor cover will be available for wild herbivores if the dense forest is cut down. Therefore, the Kanha management took the first step towards conservation of species through relocation of villages from the national park so that they could able to improve and manage grasslands to support for foraging, dispersal and multiplication of swamp deer.

Inside Kanha National Park

The Park management fenced an area of about 28 ha by making and erecting a chain-link enclosure. The area included habitats of grasslands, water bodies, wallows and small groves of sal

trees. There, they kept five Barasingha for multiplication, with the hope of increasing the population. By 1979,the population gradually increased up to 20. Motivated by this success, the Park management authority erected another fence in the Supkhar range and eight Barasingha were translocated to the range in 1981. Thereafter, in-situ enclosure areas of Kanha were expanded up to 50 ha. In this enclosure, deer respond very positively and the Barasingha numbers reached 84. by the end of October 2010.

In this way, unbelievable work was done by the management authority of the Kanha Tiger Reserve and this showed significant results (see Tables 1 & 2).

Translocation from Kanha

The population in the KTR was facing inbreeding depression due to the restriction on the gene flow. There was concern that due to natural calamities, epidemics, inbreeding depression this species may be extinct from the wild. Therefore,it was felt that the only way to ensure long-term survival was to translocate/re-introduce the species to a suitable habitat. The ensuing search found two suitable habitat, i.e. Satpura Tiger Reserve (STR) and Van Vihar National Park. The Field Director, KTR, was deputed to prepare and submit a detailed protocol for the pre-capture preparation, capture operation, transportation and release of the animals to Van Vihar National Park and STR. They decided three objectives for this operation:

1) To establish gene pool
2) To spread awareness about conservation
3) To establish a protocol for re-introduction of Swamp Deer

Inspired by the South African capture and translocation technique, the boma method was employed to capture the Barasingha (see box). Besides, a large transportation truck was customised to carry 15-20 animals comfortably. The truck was closely linked to a ramp camouflaged with plastered soil and grass to make it look natural to the animals. In this way, the transportation truck, the ramp and the chute of the

Table 1

YEAR	TOTAL INDIVIDUALS	REMARKS
1960-65	66	Banajar valley
1988	535	
1996	308	
2003	321	
2015	600	

Table 2: **Population of three Species**

S.N.	YEAR	TOTAL INDIVIDUALS	REMARKS
1	**1978** **1999-2000**	**700** **400-500**	Eastern swamp deer *R. d. ranjitsinhi*
2	**1988** **1999-2000**	**500** **300-350**	Southern swamp deer *R. d. branderi*
3	**1990** **2000-2003**	**1500-2000** **2170(with 350 springs)**	Western swamp deer *R. d. duvauceli*

boma became one composite structure at the capture site. This structure was installed several days before the actual capture operation in the field so that the animals could get habituated to its presence and could freely enter and exit it.

On January 8, 2015, seven animals were successfully captured, transported and released in the Van Vihar National Park, Bhopal.

The habitat in Satpura Tiger Reserve is similar to that found in Kanha and therefore suitable for Barasingha. STR was known to have had a Barasingha population in the past as well. The permission to capture and translocate 20 Barasingha was given by the technical committee of the Government of India in January 2015. The first eight animals were captured and transported on March 3, and another eight on March 15. Four other animals were translocated a little later. At that time, Kanha had a Barasingha population of around 600 animals. The "reintroduced" animals were kept in a specially designed enclosure in STR for future multiplication and gradual release into the wild.

Successful re-introduction of Barasingha has shown the way for all other endangered and vulnerable species. Steps for intensive protection and conservation should be taken immediately so that their extinction can stop.

The word "boma" is a South African term for capture-enclosures or large cages. It consisted of a wide funnel tapering into an animal selection-cum-loading chute. The main structure of the boma was made of steel sections (2.5 m height and 3 m long) but the wings of the funnel were extended with the help of chain-link fence supported with grass mats to make it opaque for animals.

Boma structure

Vehicle attached to Boma

Animals in the enclosure

WILDLIFE / WEST BENGAL

Managing human-tiger conflict in Sundarbans Tiger Reserve

Nylon net fencing has helped check instances of tiger straying into fringe villages, significantly reducing the conflict rate

Shrikant Subhash Pawar

Sundarbans, the estuarine phase of Ganga and Brahmaputra river systems, is known for its mangrove forest and tigers. This forest is the only such ecological habitat of the tiger. The typical littoral forest of the Sundarbans comprises tree species adapted to the peculiar estuarine condition of high salinity, lack of soil erosion and daily inundation by high tides.

Background

Ferocious and man-eating behaviour of the Sundarbans tiger has been a great problem. This happens as a result of either an attack on the villagers entering the forest or by the tiger straying into human habitation. Millions of people living in the vicinity of forest depend on the Sundarbans ecosystem for their livelihood because it has rich diversity of aquatic and terrestrial flora and fauna and millions get their livelihood through fishing, collection of honey and fuelwood/timber.

The man-eating behaviour of Sundarban's tiger does not have any intra-specific or intra-generic similarity with any of the Panthera species from anywhere in the world. The various groups of persons falling victim to the tiger includes fishermen, crab collectors,

-STR Created in 1973. -Total geographic area 2585 Km^2. -Forest Sub group 4B tidal swamp forest. • True Mangrove species = 26. • Mangrove associates = 29. • Back mangrove species= 29. • Fish species = 364, • Mammals species= 47. • Insect species= 114, • Birds species = 234.	Tigers - 400 • Famous for their amphibious life. • Both terrestrial as well as aquatic food web. • Swimming has led to changed food habits (fish, crabs, water monitor lizards). • Uniqueness of habitat causes certain behavioral trends, which are unique. • Their behaviour is highly individual specific.

SFS Batch 2014-16, CASFOS, Dehradun

honey collectors, tiger prawn seed collectors and even Forest Department staff.

Reasons behind the man-eating behaviour of Sundarban Tigers are:

Salinity: Human deaths by tiger in high salinity zone are higher than the zone of medium and low salinity – Siddiqi & Chowdhury (1987).

Ceriops & Phoneix vegetation: Dense vegetation of Ceriops & Phoneix forces the tiger to explore different preying strategy, which may be successful killing of human being after following them – Chakrabarty (1978).

Biotic interference & prey density: Biotic interference and prey density causes high human deaths – Deodatus & Ahmed (2002).

Straying of tiger into fringe villages: The major issue in managing human-tiger conflict in STR is the straying of tiger into fringe villages.

Control measures for human-tiger conflict

There is no village inside the Tiger Reserve. Outside the Reserve, there are more than 1,000 villages within the Sundarbans area, out of which around 100 villages are very close to the Reserve at its northern and north-western fringe, which are densely populated with people and cattle. Here, we can say that not only the excessive human interferences, but also the straying of tigers into these fringe villages is the reason of man-animal conflict in

Villagers wear face masks on the back of their heads to confuse the tigers, who prefer to attack from behind.

Nylon net fencing in Sundarban tiger

Sundarbans Tiger Reserve. The staff and local villagers use different ways to drive the tiger back to the forest, such as drums, crackers, fire, trap cage with live bait and tranquilisation. Sometimes no interventions are needed; tiger goes back to the forest on its own. However, the process of rescuing a strayed tiger is very difficult in STR because of difficulties in transportation and crowd management. As the capture and release is difficult to carry out, preventive measures have to be thought out so that can avoid the straying of tigers could be avoided.

Up to some extent, dependency of people over forest can be minimised by giving them alternate livelihood opportunities, but they can't be totally stopped from entering the forest. On the other hand, straying of tiger can be prevented by fencing the boundaries of vulnerable forest areas by nylon net. Using Avicennia posts along the forest fringe have been found to be very effective for the last ten years There are some psychological things which keeps away the tigers from the human and found to be very effective, such as electric human dummies and tiger masks. But the straying of tigers into nearby villages is successfully prevented through nylon net fencing. These fencings last about three years. Earlier, nylon net fencing with Avicennia posts was practiced. Now it is planned to be replaced by RCC posts and bamboo to reduce Avicennia cutting and recurring expenditure.

Recent observations reveal that tigers have started negotiating the 8-feet high fence by jumping over them. The use of RCC posts and bamboo pole can also help to erect the fencing at a height of 10-12 feet. The mesh size is 4"x4" to avoid any strangulation of wild animal like deer. Till 2012, more than 50 km of forest fringes had been fenced. To restrict entry inside the forest, patrolling activities are strengthened. No unauthorised persons are allowed inside the protected area. This reduces chances of possible conflicts and tiger attacks.

Nylon nets are checked for its height (8 feet minimum) and the height of Khal guard has be maintained at least 5 feet above the highest tidal level estimated for 'Kotal' period. If the net is found to be brittle or the posts of the fencing are found to be rotting at the base, they should be immediately changed after bringing it to the notice of the concerned authority.

Results

The data till 2010 clearly shows that the conflict has reduced considerably after 1990. Before the year 2000, every year human deaths used to touch double figures. After 2000, the efforts became more integrated and the situation has significantly improved. At the same time, it is seen that cases of tiger straying into the fringe villages has reduced considerably after 1998-99. This trend is continuing till now.

Conclusion

Sundarbans Tiger Reserve has been facing human disturbances, but it has one of the highly unique ecosystem with great biodiversity value. If we want to conserve this mangrove habitat, then the survival of the tiger is very

Abstract of tiger straying & human killing in Sundarbans Tiger Reserve

Year	Frequency of tiger straying
1998-99	37
1999-00	32
2000-01	27
2001-02	21
2002-03	15
2003-04	13
2004-05	14
2005-06	02
2006-07	11
2007-08	11
2008-09	12
2009-10	14

Person killed / Injured by Tiger					
(Report based on STR)			Report based on other sources-RCHP, Gosaba and NGOs		
Year	Died	Injured	Year	Died	Injured
1990-91	43	8	1990-91	53	10
1992-93	34	5	1992-93	40	05
1994-95	05	-	1994-95	16	02
1996-97	02	2	1996-97	06	03
1998-99	02	2	1998-99	21	02
2000-01	15	4	2000-01	40	03
2002-03	14	-	2002-03	02	-
2004-05	02	-	2004-05	-	-
2006-07	-	-	2006-07	-	-
2008-09	09	-	2008-09	01	-
2009-10	08	1	2009-10	04	02

(Source: Tiger conservation plan of Sundarbans Ttiger Reserve, 2012).

important. For achieving this objective, the management of the Sundarbans Tiger Reserve has to resolve the human-tiger conflict.

The high dependency of local people on forest is responsible for the man-eating behaviour among the tigers. There are limitations in reducing the dependency on forest. Enforcement of law and creation of alternative livelihood options for the fringe forest dwellers are some ways to reduce forest dependency and, ultimately, human and tiger deaths.

WILDLIFE / NAGALAND

Longleng: New capital for Amur Falcons

A village community in Nagaland shows how successful conservation is possible without sponsors from any source

D. Rameshwaran

Amur Falcon *(Falco amurensis)* is an annual migratory bird of the falcon family. During October-November, winter sets in the northern hemisphere. To avoid this extreme climate, Amur Falcons migrate to the southern hemisphere, particularly to the southern African countries where summer sets in that time. Life is more comfortable there due to availability of abundant food (insects). For this, Amur Falcons undertake long flight and cover a distance of around 22,000 km during their onward and backward migration.

During migration, they stop at several places in the north-eastern part of India, like Mizoram, Assam, Manipur and Nagaland. The primary roosting sites are found in Wokha, Longleng, Peren, Dimapur, Pheu, Zanheboto and Mokokchung areas in Nagaland.

In Nagaland, the majority of people (90 per cent) belong to the tribal community. In the past, they were dependent on hunting, gathering and subsistence agriculture for livelihood. After the 19th century, their main occupation has been agriculture. But, due to insurgency and disturbed conditions in recent times, low-level traditional hunting turned into a much more destructive practice. Due to poor socio-economic condition, they started harvesting Amur Falcons on a large-scale and sold them in the market.

In 2012, 'Conservation India', a Bangalore-based NGO, prepared a report about the mass-scale killing of Amur Falcons in the Doyang catchment area. This report invited attention of conservationist at the national as well as international level for protecting these migratory birds. India, being a signatory party to the "Convention on Migratory Species (CMS)", is bound to prevent this massacre and provide safe passage to this species. So, the Indian government took action by joining hands with the state forest department, NGOs and other stakeholders to protect these birds. Their efforts to create awareness alongwith timely enforcement of law and introduction of livelihood improvement programmes changed the attitude of people and they converted from hunters to conservationist. As a result, no killing of birds was reported in 2013. All these changes occurred within one year and improved the eco-tourism potential of that area.

Following the success of conservation

2014-16 Batch, CASFOS, Dehradun

in the Doyang catchment area, an area in the Longleng district of Nagaland, which is managed by a village community called 'Yaongyimchen Community Biological-Diversity Conservation Area (YCBDCA)', was in the news last year (2015) for three reasons. First, is the presence of new species named 'Snow White Amur Falcon', which resembles the "Gyr Falcon" living on the Arctic Ocean coast and had never earlier been reported in the area. Second, some Amur Falcons remain there throughout the year without undertaking return migration, and, third, Amur Falcons, which earlier roosted in Wokha district, particularly in the Pangti area, now selected this conservation area for roosting.

YCBDCA is wholly managed by the village community. This area covers hundreds of hectares of forest areas of Nyangchi, Awakung, Owa and Akchang. The initiative was taken by villagers of Yaongyimchen, Alayong and Sanglu community in 2010. The village community is working tirelessly without sponsors from the government or any other source for the protection of Amur Falcon. This has been successful mainly because of the efforts of Y Naklu Phom, Executive Secretary of the Phom Baptist Church Association and Convenor, Lensachenlok (name of the village committee).

Awareness and restrictions imposed by the district administration are the two main reasons for the successful conservation of Amur Falcons in the community conservation area. Awareness was created by the adoption of a resolution by the village community during the Citizen's General meeting in 2009, where they decided to make the conservation and preservation concept more relevant to the community. This sensitised the entire community and led to the establishment of YCBDCA. The village community is now also deploying five to seven volunteers everyday to roam around the conservation area for giving protection to the roosting site. For further protection, the district administration has issued an order to all the village councils to get involved in the conservation process as per the Wildlife Protection Act, 1972. The order also states that if any village failed to protect this migratory bird, strict action will be taken by withholding the Village Development Board (VDB) funds.

As a result of these efforts, the number of Amur Falcons visiting the area increased four to five times (not less than two lakh birds) in 2015, in comparison to previous years. These efforts are also attracting different wild species to this area due to the increased availability of food and protection. Above all, it has given a fillip to ecotourism in this area.

The community of Yaongyimchen has now taken initiative to construct a watch-tower near the roosting sites for the visitors to see the birds. The community is also providing accommodation facilities in the conservation area as well as in the village alongwith local food to guests with an aim to promote 'Eating Fresh and Living Fresh'.

Yaongyimchen community has now become the role model for the entire country. It has shown that sponsorship

or financial support is not the criteria for successful conservation. The only need is to understand the value of the environment and tireless efforts from the entire community to bring positive change.

It is very clear that conservation through village community is very effective and has proved that no alternative can match this. Now the role of the government is to give moral support to the community and take this success story to other parts of the country.

FORESTRY / KARNATAKA

Huli, a boon for wildlife, habitat and conflict management

An indigenous web-based application software in BTR has effectively helped in monitoring patrolling activities, wildlife, habitat and man-animal conflicts

Ganesh R Randive

Forest management deals with wildlife management, habitat management and conflict management. Issues of poaching, illicit felling, encroachment, habitat fragmentation, fire, mining, grazing, etc., are big concerns in protection and conservation today. However, the use of modern technology, like camera traps, hand held GPS, DGPS, etc., has helped monitor this.

Watchers, or foot-patrolling persons, are the basic backbone in any conservation effort. This anti-poaching camp gives the accurate picture on the ground of threats to the habitat. Anti-poaching camps, during their day monitoring, collect detailed information on sighting, pugmarks, scats and any other observation of habitat disturbance. But, they could not transfer this data to senior officials. For proper management, we need to get this information daily and accurately. The forest department of Karnataka, understanding this problem, came up with indigenous web-based application software, 'Huli'. Before Huli, there were no means for monitoring the patrolling carried out by anti-poaching camps.

The project Huli was started on March 1, 2011, on a pilot basis in BTR by the Karnataka Forest Department. Huli effectively monitors foot patrol staff of anti-poaching camp of the BTR tiger reserve and is useful in wildlife, habitat and conflict management. It gives complete information – date, time and geographical information. The recording system of the app helps in recording the sounds and video of wildlife on the field and also makes it own remarks. Huli is an innovative tool and an administrator sitting anywhere can log on and get complete day-to-day information. It has helped in real time monitoring and increased accountability of the staff. It identifies the location with geo-coordinate data where critical measures need to be taken for habitat management. The main motive of Huli was to effectively monitor patrolling of anti-poaching camps (APC), patrolling forces, wildlife habitat and illegal activities, and man-animal conflicts. Some other goals were to identify corridors for wildlife management and decision-making and

2014-16 Batch, SFS

to find direct and indirect evidences on repository of wildlife.

The field staff of APC of BTR carried GPS-uploaded PDAs during patrolling. They log the location of animal sighted, scratches on the trees, pug mark, scat, and indirect and direct evidences of wildlife they have seen. Their complete route is tracked and, at the end of the day, the watchers transfer the data from device to computer. Using cellphone boosters, they send the data to a centralised location where data from different APCs of BTR is collected. This develops a complete patrol map. The complete observation of the day can be seen remotely on the net. The BTR APC has been provided with the power back-up which lasts for 6 days and cellphone signal booster are provided to see that they have enough connectivity.

Huli has been very useful in tracking the movement of tigers, elephants and other animals. It has helped in coordinating the movements of APC, foresters, forest observers and guards with the help of GPS. The actual location of the field staff can now be monitored. The watchers log the location of each sighting of tiger, herds of prey, scat, encroachment, cooking fire, etc., and enter the data. This data is simultaneously entered in the Huli software. Simple graphic-user interface enables the forest watcher, tribal or any illiterate person to log his details. This is consolidated to derive monthly data, which helps in giving the picture of ecosystem dynamics, habitat, wildlife – sighting, movement of tigers, elephants or herbivores like deer, gaur – and helps in pinpointing any disturbance to the habitat by poachers or grazers. Once the data is generated, it helps to identify sensitive points where major patrolling measures need to be taken. It also helps in understanding the co-relation between the prey base and tiger population in BTR to take important and major steps to monitor it.

The Huli has also been found to be a boon in the management of man-animal conflict. The conflict management app system caters to online registration of complaints and their inspection in this regard. The public can download this application by using APK file. When a man-animal conflict occurs, they can report it directly to the department. This application facilitates real-time reporting and submission of complaints or grievances. The information is received in the form of videos, photos and geo-tags. The status of the request can be tracked and this helps in conflict management.

This app is user friendly and is available in English and local languages with pictorial information. It can be used as a diary. It tracks and records the events completely. This app has helped in using traditional and indigenous knowledge of tribes, and thus, in wildlife and habitat management. The offline mode of data collection is another advantage which overcomes the problem faced by foresters in remote localities. Login Id and password of this device protects the information from being stolen by illegal elements. The National Informatics Centre has tested its vulnerability.

There were many positive efforts taken by the department for the

extension of the project – the user is guided and addressed 24X7 by interactive voice response and calls; SMS-based help; trouble-shooting queries and frequently asked questions posted on the department sites; detailed procedure on using the system given; and, blog developed to solve any problems.

The impact of Huli in the forest management of BTR is that earlier details given by APC where confined to the circle but are now viewed by all officers with geo-tags locations and representation on maps; earlier, the data was noted in a diary which was submitted late and hampered the monitoring, but now complete information with location, date and time is given; earlier, decision-making was done on the output provided by the field staff, now it's based on real-time information. Now, each APC and staff is correctly monitored and guided, monitoring of the habitat is done on the basis of exact locations, the online registration of complaints and online disbursement of amount has solved many conflicts and the accountability of the staff has improved.

The Forest Department of Karnataka won the prestigious e-India 2013 award in G2G category for this application software and also the Brand is Award for revolutionary change in forest management by excellent use of the information and communication technology. Data collected by 11,800 km of patrolling has been recorded on this application. Nearly 2,580 sightings of wildlife have been recorded. This project has fulfilled the objective of getting accurate information on wildlife, habitat and conflict management. After the success of Huli in BTR, an improved version of Huli, called Hejje software, is being developed by the department.

CONSERVATION / KARNATAKA

Ban on night traffic, a boon for wildlife conservation

A case study on Bandipur National Park results in a pathbreaking decision regarding operation of roads inside protedted areas.

V Priyadarshini

The case study highlights the involvement of different stakeholders – conservationists, forest and allied departments, individuals, organisations and institutions together towards the protection of biodiversity. It also gives emphasis on the teamwork which emerged as the only viable option available so far to implement any measure that leads to the protection, conservation and management of wildlife and thus ensures the peaceful coexistence of all kinds of life in the earth.

The study focused on the impact of roads on the existence of different wildlife – small, medium or large mammals, insects and birds, etc. Roads led to habitat fragmentation and destruction and degradation of habitat quality. Development of roads in such protected areas led to increased poaching and illegal trade activities, pollution, invasive weed infestation, etc., which further decreased wildlife population. Road kills wipe out the breeding population and hence reduce the population and ultimately results in loss of biodiversity of the habitat.

The study was conducted in Bandipur National Park and Tiger Reserve, situated in Chamrajanagar district of Karnataka. The study was initiated in 2001 by the conservationists of Nature Conservation Foundation, based at Mysore, Karnataka, for carrying out the study on bird diversity of Bandipur. But, during the course of study, the team of conservationists was shocked to record the alarming incidence of road kills, especially along the State and National Highways laid through the wildlife habitat. The team started documentation of wildlife deaths (especially along NH 67 AND NH 212) from 2003 onwards. After years of relentless efforts by the team, a detailed report was prepared. The report showcased the ill-effect of roads and the impact of speeding vehicles which posed serious threat to the existence of wildlife as well as habitat destruction.

In 2006, the report was submitted to the forest department as well as the district administration, which were already working day and night in combating wildlife offences and illegal transportation of materials meant for

2014-16 Batch, SFS

public good. The forest department of Karnataka looked at the report as an important tool in formulating mitigation measures against the threat posed for wildlife (as envisaged in National Wildlife Action Plan, 2002-2016). Due to consistent efforts by the forest department and conservationists, the plight of wildlife was documented in detail and was submitted to the district administration. Initially, the authorities implemented ban on vehicular movements (from 9 pm to 6 am) along the two National Highways. The ban was withdrawn due to pressure from other stakeholders. But the genuine concerns on wildlife sparked the 'conservation responsibility' among the likeminded individuals, institutions, etc. A PIL was lodged in the High Court of Karnataka, demanding closure of highways at night, citing the potentiality of the road in wiping out valuable resources of India.

The detailed report, which consisted of well-documented scientific findings, supportive photographic evidences and presentations, RTI reply on trade-related affairs, etc., attracted the attention of judges in the High Court of Karnataka. The report had answered every plea of the stakeholders who stood for "infrastructure development" as well as personal deeds. Every argument that stood against the conservation efforts of the forest department and other conservationists were defeated through appropriate and alternative solutions. The proceedings were highlighted by the media extensively. They became instrumental in creating awareness among the people in every possible way and hence succeeded in bringing out the undisputed support from the public in preserving the habitat of wildlife.

As a result of the tireless efforts played by each and every stakeholder, a historic judgment was given by Karnataka High Court on March 9, 2010, which put the ban on vehicular traffic during dawn and dusk (9pm- 6 am) along the highways of Bandipur National Park.

Outcome of the case study

- Following the ban on night traffic along NH 67 and NH 212, Rapid Action Project was initiated in Bandipur National Park to create awareness among the public, tourists and, especially among truck drivers. The role and responsibilities of drivers towards the protection of wildlife in the park were highlighted. The people were educated about the speed limit, which was very crucial in preventing wildlife deaths along and across the highway. The speed of the vehicle was reduced to 40 km/ hr from 80-100 km/ hr.
- The ban in Bandipur led to the similar steps in other states as well. Following Karnataka, night traffic was banned in Mudhumalai Tiger Reserve of Tamil Nadu, Gir National Park and Velavedar Wildlife sanctuary of Gujarat, etc.
- Funds from various national and international organisations were arranged to divert road projects from eco-sensitive zones.
- The case study brought out the plight of wild animals and their behavior. Hence, the importance of protected

areas, animal corridors, habitat quality, etc., were increasingly in limelight recently.

- The role of media has grown tremendously and it has become a vital tool in creating awareness among the public in mass scale.
- By keeping in view the demands of other stakeholders as well, new roads were proposed and laid outside the protected areas.
- The case study resulted in meetings, conventions and seminars among the policymakers at every level. Inspite of pressure from powerful lobbies as well as greedy needs of the stakeholders, policymakers exhibited their solidarity and determination in conservation of wildlife by formulating policies and strategies which prioritise ecology and environment, protection of wildlife corridors, biodiversity, etc.
- Educational institutions were directed to create awareness among the children at a very young age, so as they look wildlife as a part of the ecosystem and not as creatures for entertainment.
- The ban on night traffic was further extended from 9 hours to 12 hours (6pm - 6am) in other tiger reserves of Karnataka from December 2015.

The study proves that proper and well-documented scientific findings, along with extensive studies on other related aspects, ends up in a positive note. Simple and good interpretation of scientific studies helped in better understanding of the subject, which resulted in bringing the stakeholders together. The integrity shown by every stakeholder resulted in quick decision by the judiciary.

WILDLIFE / MADHYA PRADESH

Successful tiger reintroduction project in Panna

Proper preparation, planning and execution created a reintroduction model for tigers to be replicated in the world.

Manisha Purwar

Panna National Park was declared in 1994 as the 22nd tiger reseve in India and the 5the in Madhya Pradesh. It is located in Panna and Chhatarpur districts of Madhya Pradesh. The area of the park is 542.67 square km. This forest division is the only large wildlife habitat remaining in North Madhya Pradesh. This area is the northern most tip of the natural teak forest and the easternmost tip of the natural kardhai forest. The forest of this park, alongwith Ken Gharial Wildlife Sanctuary and adjoining territorial division, form part of catchment area of the 406 km long Ken River which runs north-east for about 72 km through the park.

This park is home to more than 200 bird species, including the bar-headed goose and king vulture. Animals found here are the tiger, sloth bear, chital, chinkara, nilgai and sambhar.

Tiger Reserve

In Panna National Park, which was declared as a tiger reserve in 1994, a decrease in tiger population has been reported several times. In 2004, there were reports that no tigers were found in the reserve; there was no direct evidence of tiger presence like pugmarks, scratch marks on tree, etc. In 2009, it was said that entire population has been eliminated.

Threats

Poaching: Poaching is the number one threat to the tiger's existence. Every single tiger organ is sold on the black market. Tiger parts are used for traditional medicines to cure ailments. China has a great market for tiger part. Tiger skin is also used for décor, it indicates status and wealth across Asia.

Habitat loss: The tiger is increasingly under threat from deforestation for agricultural developments, especially monocultures.

Panna Tiger Reintroduction Project

The MP forest Department initiated the Panna Reintroduction Project in March 2009. This project had two phases and involved translocation of six tigers. The phase I and phase II were adopted protocol of All India Tiger

SFS Batch 2014-16, CASFOS, Dehradun

Population Estimation and Monitoring for sampling design and data collection.

Phase 1

Earlier it was thought it was impossible to relocate tiger in a new area. But, the Panna Tiger Reserve made history in the world; it has completed six years of tiger relocation. The number of tigers in the reserve has gone up from 0 to 28.

T1 and T3: The Ministry of Environment and Forests approved a proposal to translocate two tigers to the Panna Tiger Reserve. One female tiger from Bandhavgarh National Park (T1) and one female tiger from Kanha National Park (T2) was translocated to Panna Tiger Reserve.

T3: This tiger was first tranquilised on November 2009 at Pench and was brought to the Panna Tiger Reserve, where it was keep in an enclosure at Badagarhi inside the Park area. Due to technical and logistical reasons, the tiger was brought to Panna without a radio collar. The tiger was under watch for 7 days and a team of expert veterinarians had decided to tranquilise the tiger for the second time on November 13. The next day, the tiger was released in the Reserve. T3 started moving in the south direction towards its original habitat. T3 was tracked continuously for over a month and brought back to the Reserve. This was a huge task of Panna forest department. This massive search operation was supported by 70 members and four elephants were also deployed.

T4 and T5: Two female day-old cubs, T4 and T5, were brought Kanha Tiger Reserve. Their mother was killed by territorial male and the cubs were hand reared by Panna Tiger Reserve for 18 months. They were successfully reintroduced in the Panna Tiger Reserve, which deployed the urine test to encourage them to mate.

Phase 2

T6: T6 is part of the second phase in the relocation of tigers to Panna. T6 was relocated from Pench Tiger Reserve. She was let free in the Balaiya Ghat area of the Panna Tiger Reserve, However, she had to be re-tranquillised and re-released as she had wandered into the peripheral area of the park.

Tigers Monitoring

Panna had lost all its tigers in the span of four years, from 2006 to 2009-10. This put the spotlight on obvious dangers to their lives, making it essential to radio collar the tigers.

Method: Muscle relaxant is used for tranquilising the tiger. The effect of the tranquiliser lasts for about an hour. The tiger's eyes are covered with a black cloth, so that it can't see anything. When the tiger is tranquilised, the radio collar is attached to its neck and after that the tiger is ready to be monitored. A team manually tracks the tiger with an antenna and transmitter, which indicate the tiger's GPS location. Continuous locations are tracked and reading of the transmitter is noted down in a register issued by the forest department. Tiger trackers work 24x7 and give hourly updates about the tiger. A checking party is assigned to inspect the activities of

the tracking party. The information gathered by the tracking party is collected by the RFO.

Working of transmitter: The ideal reading of the transmitter is 60 beats per minute. It indicates that the tiger is absolutely healthy. If the beats are more than 80, the tiger's life may be in danger – it's either ill or injured and needs immediate attention. If the reading falls to 30 or 20 beats per minute, it indicates some problem in battery.

Tracking by drone: Drones will track tiger movement across the Panna Tiger Reserve. This is the first time that a park will use them. Panna has the permission to use two drones until June 2014 to see how they work. The miniature antenna and receiver attached on each of the drones will help in monitoring and managing the security of the tigers.

Result

T1 gave birth to four cubs in April 2010, of which 2 survived. T2 gave birth to four cubs and all four survived. The third tigress, T4 (orphaned cub), was found dead on September 19, 2014, due to infection caused by its radio. T5 was released in the wild in November 2011.

Solution

- Mitigating the most pressing threats facing the species by training and outfitting law enforcement patrols.
- Investigative teams to secure protected areas utilising informant networks to apprehend poachers.
- Identifying and protecting tiger habitats.
- Using advanced technology to prevent poaching, including hand-held Thermal Imagers
- Training the government and NGO staff to use the best scientific methods to monitor tiger and its prey populations.
- Relocation of 16 villages at the edge of Panna forest. There are two ways to relocate villagers; the NTCA gives Rs 10 lakh per family to go elsewhere and the second is to take part of money and get settled on a piece of land.

Special attention was paid to the buffer zone on the periphery of the forest, which is used by both cattle and wild animals. The forest department ensured immediate compensation to a villager if his cattle were killed by a tiger.

Conclusion

The reintroduction programme of tigers in Panna has proved to be successful and can be replicated in the world. In Panna, proper preparation, planning and execution created a reintroduction model for tigers to be replicated in the world.

CONSERVATION / MAHARASHTRA

Mangrove cell succeeds in rehabilitation in Mumbai

Mangrove Cell was established in 2012 to create awareness about importance of mangroves and to train staff for effective conservation of mangrove areas

Amol Pandurang Thorat

Mumbai, the capital city of Maharashtra with an estimated population of about 22 million, is the 6th populous agglomeration in the world. There are seven islands which make Mumbai and a home to communities of fishing colonies. With increase in population, Mumbai was reshaped by Hornby Vellard project in the 18th century, which, by reclamation work, connected these seven islands. With the construction of major roads and railways, the reclamation project changed Mumbai into a major seaport on the Arabian Sea.

Mumbai has a long history of land reclamation. Present day Mumbai is a part of a two major groups of islands that were connected through the process of land filling over past many years. This led to a change in the floral and faunal diversity of this region. The process of land filling is still continuing for solid waste disposal and expansion of urban and industrial campuses in Mumbai. The rapid rate of urbanisation in Mumbai changed land use pattern drastically e.g. reduction in forest and agriculture land, reduction in mangrove forests and at the same time increase in built-up area. Most mangroves in and around Mumbai are being destroyed rapidly and are being turned into landfill sites.

These sites have heavy accumulation of non-biodegradable solid waste materials accumulated in mangroves areas. Mumbai creeks are major sinks for discharge of sewage and industrial waste which is generated in the city. Considering it is a city of more than 27,000 people per square km, huge amount of sewage is generated which is poorly treated and dumped in the creeks. Also, industrial effluents are also discharged into creeks which changes characteristics of water and also biology of mangrove ecosystem. In 2005, the Bombay High Court directed the state government to declare mangroves as reserved forest. This has resulted in more protection to the mangroves area and has also shown increase in its cover.

Mangrove and its importance

Mangroves are salt tolerant trees and shrubs that grow in the inter-tidal regions of tropics and subtropics.

SFS 2014-16 batch, CASFOS, Dehradun

They come up better in places where freshwater mixes with seawater and where sediment contains accumulated deposits of mud. Mangroves have the ability to survive in an adverse environment. They sustain in high salt content area and developed adaptation to thrive in this environment. Mangroves have been proved to have tremendous biological resources, which confer various benefits to mankind. It plays an important role in enriching coastal biodiversity, in climate change mitigation, protection from tsunamis, cyclones and storms surges.

Today, mangroves face constant threat from urbanisation, agriculture, aquaculture, sewage and industrial effluent, oil pollution, cutting of mangroves, reduction of ecosystem health, overfishing, sand and iron ore mining and natural threats like flooding, grazing, poor natural regeneration, bio-fouling, cyclones and effect of climate change. Mangrove habitat has lost many animal species that were restricted to mangroves habitat at an elevated risk of extinction under IUCN categories and criteria. However, none of the mangrove plant species are in IUCN Red list.

Mangrove distribution

The total area of mangroves in India is about 4,628 sq km, which is about 7 per cent of the world's total area of mangroves. According to Mangrove Cell, 19 species of mangroves are found on the Maharashtra coast and 12 of these species are found in Mumbai. Mangrove cover in Maharashtra is 186 sq km (*State of Forests Report – 2013''*) which includes mangroves standing on private as well as public land. The distribution of mangrove cover across the six coastal districts of Maharashtra is as follows:

S.NO.	NAME OF DISTRICT	MANGROVE COVER IN SQ. KM.
1	Mumbai	02
2	Mumbai Suburban	43
3	Thane	53
4	Raigad	62
5	Ratnagiri	23
6	Sindhudurg	03
TOTAL		**186**

Mangrove Cell

To protect, conserve and manage the mangroves of the state, a cell was established on January 6, 2012, in Mumbai and headed by Dr N Vasudevan (IFoS), a Chief Conservator of Forests. The objective behind the conservation of coastal biodiversity is to create awareness about importance of mangroves and to train staff for effective conservation of mangrove areas. To increase the mangrove cover in the degraded areas, the Mangrove Cell has initiated mangrove afforestation programmes since 2012-13. Mangrove nurseries were established at Bhandup, Godbunder and Manoriin Mumbai, Guhaghar in Raigad district, Mithbao and Achra in Sindhudurg districts. Lakhs of mangrove saplings will be available in nurseries in 2013-14. Largescale afforestation programme were carried out with the involvement of local people. The objective behind afforestation is to improve the species diversity on the Maharashtra coast. Efforts were

Activities of Mangrove Cell in Mumbai

1. Mangroves plantation by Mangrove Cell

Place	Year of Plantation	Area (Ha)	Spacing (m)	Species	Number of seedlings
Bhandup	2013-14	10	1.5 * 1.5	*Avicennia marina Ceriopstagal*	44,440
Kanjur	2013-14	5	1.5 * 1.5	*Avicennia marina Ceriopstagal*	22,220
Mandale	2013-14	10	1.5 * 1.5	*Avicennia marina Ceriopstagal*	44,440
Kanjur	2014-15	4	1.5 * 1.5	*Avicennia marina Ceriopstagal*	17,776
Mandale	2014-15	10	1.5 * 1.5	*Avicennia marina Ceriopstagal*	44,440

2. Afforestation Works Carried Out In Mumbai 2012-13

Sr.No	Location	Area (ha)	Nature of work
1	Manori	21.00	Plantation
2	Charkop	19.12	Plantation
3	Airoli	5.62	Plantation
4	Koparkhairane	2.70	Plantation
5	Bhandup	7.87	Plantation
	Total Plantation	**56.31**	
7	Bhandup	10.00	Assisted Natural Regeneration
8	Mahul	8.00	Assisted Natural Regeneration
9	Gorai	4.00	Assisted Natural Regeneration
	Total ANR	**22.00**	

3. Plantation activity region wise

Region	Area Planted in hectare
Central Mumbai	50
Western Mumbai	40
New Mumbai	90
Total Area	**180**

taken to revive the mangrove cover by facilitating better tidal inundation (Assisted Natural Regeneration).

4. Protection: Demolition of illegal huts was carried out in mangrove areas and around 850 huts have been removed since 2012. Each hut's average size was 4mx5m, which means 17,000 sq m areas was cleared. Mumbai Mangrove

Conservation Society was established for protection and mangroves were planted on these areas.

5. Awareness programme: Mangrove Cell is creating awareness in various schools, colleges, institutions and corporate companies. They celebrate various days, like Wetland Day, World Environment Day, International Biological Diversity Day, etc., with the help of various NGOs and civil societies.

Results

The biennial survey conducted by the Forest Survey of India, Dehradun, shows that during 2013 to 2015, mangrove areas have gone up from 186 sq km to 222 sq km. Between 2005 and 2013, it was static at 186 sq km, but after the establishment of the Mangrove Cell, it increased by 36 sq km. This is the highest increase in cover recorded by any state in the country during 2013 to 2015. Total mangrove cover of country has gone up by 112 sq km, from 4,628 sq km in 2013 to 4,740 sq km in 2015. Despite heavy pressure on Mumbai and suburbs, it has shown an increase of 5 sq km, which means 43 sq km to 48 sq km. this means nearly 12 per cent increase in the area. The Cells have created awareness in many schools, colleges and institutions.

Conclusion

The Mangrove Cell is working efficiently for the conservation and protection of mangroves in Mumbai and in the state. It carried out various restoration works in these areas. Today, mangroves have become a global concern because of their continuous destruction worldwide. Therefore, we must primarily create awareness to educate the public and must avoid dumping of waste and releasing hazardous effluents in mangrove areas. In each state such a Cell should be established to undertake rehabilitation initiatives, nursery establishment and afforestation as well as replanting in degraded areas. Many international agreements and various regional agreements are directly relevant to conservation of mangroves. Still, largescale mangrove restoration and rehabilitation programmes are needed to be taken up to save the last surviving oceanic rainforest with national and international integrated efforts.

CONSERVATION / MAHARASHTRA

Kaas flower plateau: Steps taken to battle tourists' rush

Formation of Joint Forest Committees and strict monitoring of number of tourists per day has helped in checking the threats caused by increase in tourism

Girija N. Desai

The Kass Flower Plateau is a pristine site of endemic flower species with large carpets of flowers. It is situated 30 km from Satara (Maharashtra) in the Kaas Wildlife Sanctuary in the Sahyadris, in the Western Ghats. The Kass is a volcanic plateau, basically formed of basalt and laterite rock rich in bauxite. It is a biodiversity hotspot with about 6 per cent of flower species in the red data book.

In 2012, this plateau was listed as the World Natural Heritage Site by Unesco. The Kaas plateau region comprises of about 1,400 plant species with 15 botanical families and more than 400-500 species of wildflowers. As Satara is a small district of Maharashtra, the Kaas plateau was totally untouched till the last decade. Due to its high degree of endemism, it became famous following studies by various researchers and scientists, which ultimately led to visits by tourists. The flowering season in Kaas plateau is from July to October and, on an average, about 1.5 lakh tourists visit Kaas every year.

The name Kaas has originated from the presence of Kaas tree (*Eleocarpus glandulosus*) in the region. The region is under protection of the Satara Forest Division.

Geographical Details

Latitude	17°42′ to 17°45′N′
Longitude	73°47′ to 73°56′E′
Area	approx 1972 ha RF
Avg. Annual Rainfall	1,800 to 2,300 mm
Forest type	3B/C-2 Southern Moist mixed deciduous forest

SFS Batch 2014-16, CASFOS, Dehradun

The impact of tourism

The basic motto of world heritage convention is to preserve the natural world heritage sites in sustainable manner for future generation and its conservation. The great influx of visitors in the recent years has the potential to affect plants which are sensitive to trampling as most of the species found in the plateau are on the lower surface with a very small soil layer. Overcrowding of the place results in trampling of floor plants with less resistance. Vehicles are a source of chemical pollution, causing threat to flower species at the lower surface of the plateau. Cattle-grazing is also a major threat to this world heritage site. Disturbance by tourists include water pollution at the Kaas lake area and plastic waste. Various activities, as trekking, hiking, rock climbing, are a major cause of soil disturbance. Moreover, windmills are installed here in large numbers and are causing disturbance to the ecosystem.

The Kaas plateau is a pristine natural site and needs efforts from all ends of the society for its conservation. This tourism is expanding day by day and there is an increase in littering by tourists. The large number of tourists is a major concern in decreasing the aesthetic value of the site and adding to the pressure on local communities and nearby lakes by Kaas village population.

Due to fast increasing popularity of Kaas plateau, the land prices in the nearby surroundings have gone up drastically, making it difficult for farmers and villagers.

ENDEMIC FLORA OF KAAS

Botanical Name	Local Name
Alysicarpus belguamenses	Gulabi shewra
Cassia auriculata	Tarwad
Murdania lanuginose	Abolina
Exacum pumlum	Chirayat
Impatiens	Pandhara terada
Hitchenia Caulina	Charvar
Hypoxis aurea	Sontara
Utriculateria purpurensis	Sitchi Aasure
Drosera indica flower	Gavti davbindu
Senecio graham	Sonki
Drosera burmanni	Davbindu
Neanotis lancifolia	Taragucha
Impatients lawii	Jambhala terad
Eriocaulon tuberferum	Panged
Vigna vexillata	Halunda
Pentanema cernumn	Sonsari
Pogostemon Deccanensis	Jambhali Manhiri
Smithia hirsute	Kawla
Pinda	Pand
Tridax procumbens	Dagdi pali

Major threats

The loss of biodiversity and aesthetic value of Kaas is a major concern. Also, economic benefits from tourism are not sufficient for conservation activities. Also a cause of concern is less concentration on conservation and high trend towards tourism management. According to Unesco, only 2,000 visitors per day are allowed, but this number increases to about 50,000 per day during peak tourist season.

Conservation measure taken

The forest department of Maharashtra has framed Joint Forest Management (JFM) committees with villages in Kaas plateau. The primary objective of JFM

committees is to check pollution and do waste management. This includes removal of plastics, bottles, garbage and food materials on a frequent basis. Mass public awareness programmes on protecting biodiversity of Kaas are organised by various educational institutes every year and these include, conservation sensitisation on social networking sites, poster presentations and tourists' awareness campaigns.

The forest department of Maharashtra has initiated five-year plans for conservation. The department has built fences bordering roads to avoid trampling of plants and herbs. Temporary, mobile latrines have been encouraged by the forest department; as the Kaas plateau area is under a reserve forest, no permanent structure can be formed. The JFM committees are promoted for conservation activities, security, ticket counters and guide facilities.

A project plan of the interpretation centre is in pipeline for approval in the forest ministry. The online booking system for tourists is maintained by the forest department. As per rules, only 2000 tourists per day are allowed. Rs 10 per tourist is being charged, which goes into the accounts of JFM committees for protection and conservation. Information and signages with slogans of ecosystem conservation are installed by the Maharashtra forest department. Vehicle parking is restricted in the 3 km periphery around the Kaas plateau. Driving beyond the 20 km/hr speed is restricted by the forest department. The number of forest guards in the Kaas plateau region is increased during June to September.

The Kaas forest area is divided into A, B, C1, C2 blocks. Fire lines, fire-fighting kits, check nakas and firewatchers are provided by the Satara Forest Department. Fencing of about 10 kilometres is done by the forest department with gaps every 1 km.

Various fees and taxes levied by the Satara Forest Department

Fees per individual	Rs 10
Mini buses	Rs 100
Bus	Rs 150
Commercial photographers	Rs 50
Deposit to carry plastic (refundable)	Rs 50
Fine for plucking flowers	Rs 100
Plucking of plants	Rs 200

No of tourist

2009	50,000
2010	175,000
2011	300,000

Result of conservation effects

Nearly 3,000 plus plastic bottles were collected per day in the years 2010, 2011 and 2012. Today, the number has reduced to less the 500. Tourist monitoring online booking system has reduced the rush. Fencing and barriers act as protection from grazing activities. With active participation of JFM committees, conservation efforts are fruitful.

COMMUNITY / MAHARASHTRA

Concerted action in Coimbatore

NGOs like Siruthuli have played a key role in conservation of the Western Ghats, signifying the importance of peoples' participation

R. Rajmohan

People's participation is one of the biggest weapons to achieve any goal. After Independence, the public is increasingly contributing towards rural development through participation in rural projects, campaigns and social services. Another remarkable level of participation is seen in environment. The past few years have witnessed a lot of change in the attitudes, approaches and policies of non-government organizations (NGOs) and their participation in environmental conservation activities. NGOs are playing an important role in raising environmental concerns, environmental education, promoting sustainable development and conservation of environment.

There are many examples one can take. One such is the contribution of Shri Jadav "Molai" Payeng of Assam to forest development forest in Jorhat. Another example is that of Abdul Kareem of Puliyamkulam, who created 32 acres of forest in Kadarkod while Rajendra Singh of Alwar district in Rajasthan is working for water harvesting and water management.

In the Western Ghats region, the Keystone Foundation has been working in the Nilgiri Biosphere Reserve (NBR) with indigenous communities on eco-development and wildlife conservation. OSAI, an NGO for student environmental groups, is also focused on the Western Ghats, their water resources and their conservation. It has been organising seminars and exhibitions. Another success story is that of an NGO in Tamil Nadu is Siruthuli. This case study details and analyses the activities and achievements of Siruthuli and its collaboration with the Forest Department.

Siruthuli is a non-profit movement formed by a few socially conscious corporates in 2003. Siruthuli means 'a little drop' (in Tamil). The idea was to motivate the people of Coimbatore to come together to save the city. It envisioned creating a public movement to address the environmental issues facing the city, especially the water problem. Industries and corporates joined hands with the Residents Awareness Association of Coimbatore (RAAC).

The ultimate aim of this organisation is to improve the level of underground water table through desiltation, creation of new water bodies, river restoration, restoration of the green cover through

ACF Trainee, CASFOS, Dehradun

massive afforestation, solid waste management and creating awareness about environment conservation. Over the past decade, it has grown into a mass movement and continues to do exceptional work for the city's well being.

Coimbatore is the second largest city in the state of Tamil Nadu. It is located in the southern part of the Western Ghats. The Coimbatore forest range is surrounded by eight major water bodies – Singanallur Lake, Valankulam Lake, Ukkadam Periyakulam, Selvampathy Lake, Narasampathi Lake, Krishnampathi Lake, Selvachinthamani Lake and Kumaraswami Lake. These wetlands are a major life-supporting component of the area with high concentrations of birds, mammals, reptiles, amphibians, fish, invertebrate species and also contributing to the livelihoods of the human population.

But all that changed in the early 2000s.The lakes were drying up; the river had run down to a trickle; and groundwater was depleting fast. Things went from bad to worse in 2003 when the city faced a severe drought-like condition. And sadly, all this was man-made.

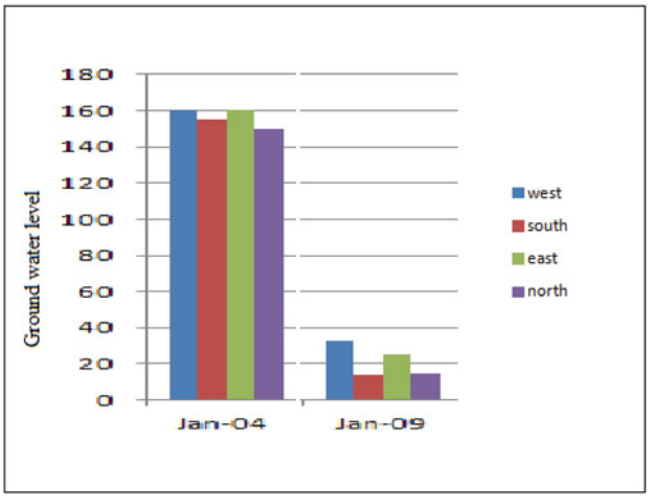
The major reasons for the environmental degradation in Coimbatore were water pollution due to industrial waste, encroachment of the elephant corridor, lack of proper waste management in the urban areas. Degradation of water bodies by development activities and largescale conversion of agricultural land to real estate are leading to fragmentation and degradation of natural habitats. The tanks were shrinking in size, clogged with all sorts of urban garbage and construction of concrete roads on the bunds. In many cases, water hyacinth covered the entire water surface of the tanks. The unavailability of water was increasingly leading to human-animal conflict.

Then in 2003, Coimbatore district was declared as a drought hit area by the State Government. The ground water table levels of Coimbatore went to as low as 1,000 feet deep. The River Noyyal and all lakes were completely dried out. This critical situation led to the birth of Siruthuli. A series of activities were undertaken under the aegis of the NGO.

Save the Lake (Kulam Kaappom): With the mass participation of residents and volunteers in Coimbatore, the channels of Singanallur Lake, Valankulam Lake, Ukkadam Periyakulam, Selvampathy Lake, Narasampathi Lake, Krishnampathi Lake, Selvachinthamani Lake and Kumaraswami Lake were cleaned. Also, construction of rainwater harvesting structures in and around Coimbatore city were undertaken.

Construction of check dam: A check dam was constructed in association with the District Rural Development Agency (DRDA) and Forest Department on the Nandangarai perennial stream flowing near Kalkothi Tribal Hamlet. With a water holding capacity of 100 million litres, the check dam helped to recharge ground water resources in Coimbatore area and provided drinking water to wild animals in the surrounding forest.

Rain water harvesting structure: Siruthuli constructed artificial ground water recharge harvesting structures



Source: Tamil Nadu Water and Drainage Board

on road side and in open spaces in Coimbatore. This structure consisted of a deep bore well, percolation pit, filter chamber filled with filter materials and concrete slabs.

By 2005, a visible difference was apparent. The river was returning to life, a few lakes were brimming with water and ground water levels were getting back to normal. Siruthuli's commitment ensured that the pace did not slacken.

It is not surprising then that Coimbatore was given the Best City Award in 2014 for efficient management of water through restoration of tanks. Another great achievement is the renewed sighting of rare birds in the rejuvenated water bodies. The Salim Ali Center for Ornithology and Natural History reported more than 116 species of birds in the Coimbatore water bodies and surrounding area in 2014. The Spot Billed Pelican (*Pelecanus philippensis*), a globally threatened species, was reported from Ukadam Lake. Oriental White Ibis (*Threskiornis melanocephalus*), Gadwall (*Anas strepera*), Pallid Harrier (*Circus macrourus*) were also reported during the bird survey. The Environment Conservation Group (ECG) reported sighting the migratory bird, Great Flamingo (*Phoenicopterus roseus*) in Coimbatore Lake; normally, this bird is seen in Gujarat.

The ground water table level drastically increased from more than 150 metres deep to less than 30 metres during the last 10 years. The graph shows the comparison between different zones in Coimbatore from January 2004 to January 2009. In June 2015, the average ground water level of Coimbatore increased up to 13 metres!

The Western Ghats is the one of the major biodiversity hotspots in India. For development and conservation of the Western Ghats, the Tamil Nadu government has initiated the Western Ghat Development Programme

(WGDP). This programme includes fire protection, anti-poaching and soil moisture conservation. In the Nilgris district, the state government has initiated the Hill Area Development Program (HADP) for conservation of Shola forest, improving wildlife habitat and fire prevention works. Outside the forest area, the Tamil Nadu Forest Department in collaboration with the Japan International Cooperation Agency is implementing a Biodiversity Conservation and Greening Project to increase forest cover. As the case study of Siruthuli has shown, increased participation of various stakeholders such as environmentalists, NGOS, corporate and the public will go a long way in strengthening the conservation activities of the State Forest Department.

WILDLIFE / TAMIL NADU

Reducing human–elephant conflict

The early morning system instituted in the Valparai plateau is an innovation that has had effective results and must be sustained

P Arunkumar

Valparai plateau is a 220 sq.km area, which was once a pristine rain forest before the British in the late 19th century clear felled these pristine forests and raised tea, coffee and cardamom plantations. This has resulted in fragmented rain forest patches in between these estates. Valparai is also surrounded by various sanctuaries and national parks both from the Tamil Nadu and Kerala side that includes the Anamalai Tiger reserve and Parambikulam Tiger reserve, both of which are contiguous with the area. These areas had historically been the migratory corridor of elephants. Today, elephants often cross through these estates to reach from one forest patch to another as it is known that elephants have a very good memory and the migratory routes almost remains the same over generations together. Thus, it is obvious that very often there is interface between the people and elephants resulting in property damage mainly buildings where grains are stored like ration shops and noon meal centres. The worse consequence of this interaction is the death of people. All this is slowly leading to a situation

Valparai Plateau with details of protected areas surrounding it

SFS Batch 2014-16, CASFOS, Dehradun

where people started turning hostile against elephants when their dear ones are lost. This is not a good sign for conservation as in a landscape like this conservation of these pachyderms is difficult without the cooperation and goodwill of the people.

It is under these circumstances of increasing unrest due to loss of property and life that the NGO Nature Conservation Foundation (NCF) intervened. After working on elephant conservation for over a decade in the Valparai plateau, Anand Kumar, working for NCF, came up with the innovative idea of a elephant early warning system and together with the cooperation and support of the Forest Department and the local people were able to implement it.

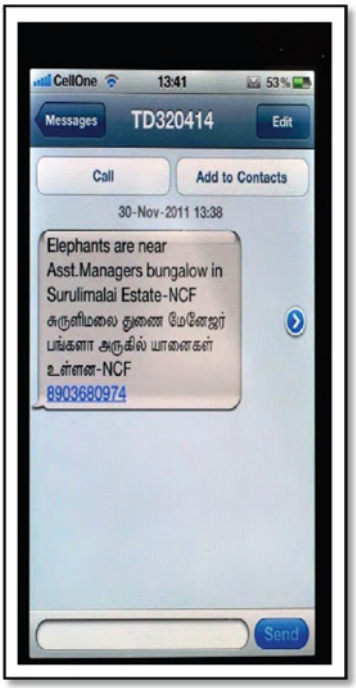
The Early Warning System

The early warning system is based on the premises that majority of human deaths occur in conflict zone when both human and elephants are caught unaware of each other's presence leading to attack. So the early warning system is basically making the presence of elephants aware among the people living there.

It includes tracking and locating elephant movement through the Rapid Response Force comprising local people, using Forest Department staff and information from local people and dissemination of the same through various channels.

Local Cable TV: Initially the information about presence of elephants was disseminated in the form of messages that were relayed in the local cable channels when mobile phones were not popular among the people. The cable TV has a reach of about 5,000 households in the area. This was one of the earliest methods of elephant information system used by the NCF team starting from the year 2006.

SMS alerts: As the reach of mobile technology increased and the people also started switching to satellite television, the SMS based alert system was introduced. For this a database of mobile numbers of plantation workers, students, drivers and pastors in local churches and other people interested to receive the message was created. As and



SMS alert sent giving the location of the elephants with emergency contact number.

when the information about the location of elephants is received from the team tracking them, bulk SMS is sent to all the mobile numbers within 2 km radius of the location of the elephants. The 2 km area was fixed based on the long-term study done by NCF that elephants within a period of 24 hours would move around a 2 km radius. The message is bilingual in both English and Tamil, the local language.

Initially when the project was launched, people were reluctant to share their mobile numbers. As the initiative caught up, the response from the people was great and they started to give information even about the location of elephants. The SMS service acts as a timely alert to the local people and they avoid the route where the elephants are present and also seek the help of the Forest Department or Rapid Response Force. The Forest Department personnel deployed for this operation in the conflict zone are in a closed user group for instant sharing of information and immediately respond for any emergency call reaching the spot to save life and property.

Visual alert system: Apart from the above mentioned alert systems, a visual alert system consisting of a red LED flashing light fitted over a 10 m long pole (Figure 3) at 24 strategic locations was put in places of high probability of elephant movement locations. This is visible for about 1 km.

These lights are fitted to a SIM card and can be operated from a mobile number. A maximum of three numbers can be registered for activation of this light. For turning on this system, locals were involved with a minimum of two mobile number registered and as soon as the message is received by them, they turn on the light system. It was found that in 98 per cent of the cases, the lights were operated by local

Red flash light visible for a long distance giving the location of elephants, so that people can avoid going to the area.

people themselves from the registered numbers.

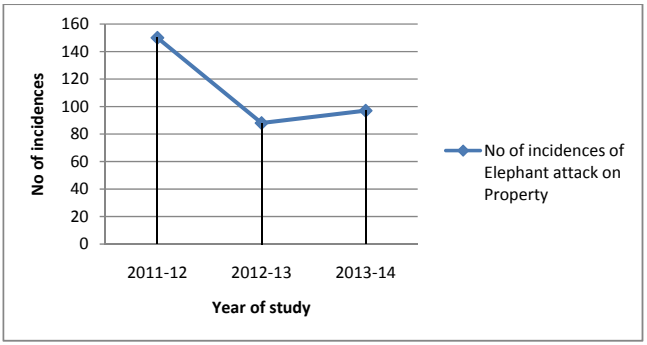
Effect of the Early Warning System

The effect of these early warning system and other interventions of forest department was studied by the NCF team in terms of incidences of human attack and loss of life and property over a three-year period (2011-12 to 2013-14).

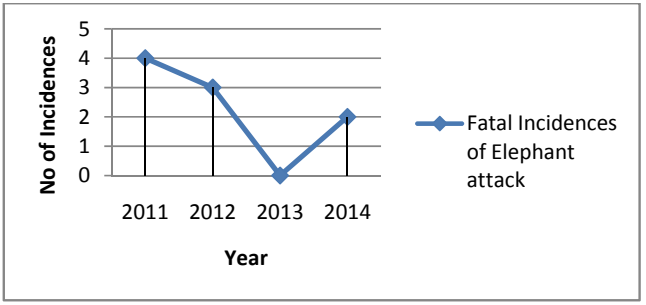
Reduction in the incidences of loss to property: It was found at the end of the study period that there has been a gradual reduction in the loss of property. The number of incidences of loss of property during the study period has showed a marked reducing trend. When compared to the first year, there was a 41 per cent reduction of incidences of elephant attack on property. The success is greatly attributed to timely dissemination of information, rapid response of forest department staff to protect the property and the cooperation of the local people.

Reduction in fatal encounters: The effect of this timely information provided through bulk SMS has helped people to avoid the elephants which have in fact resulted in gradually reducing the fatal incidences which became zero during 2013 as can be seen from the figure below, but unfortunately in February 2014 there were two fatal incidences.

On analysis of the incidences, it was found that one incidence was due to the ignorance of the warning provided



Trend in incidences of elephant attack on property after the introduction of early warning system



Trend in incidences of fatal elephant attack

by the alert system and the other was due to the fatal injury caused while running away in panic to escape from the elephant and not the actual attack by the elephant.

The success of the alert mechanism can be attributed to

- Long-term research done on the human elephant interface in the landscape to understand the genesis of the problem.
- Designing suitable multipronged need based solution to suit the site specific problems.
- Creation of awareness among the people about the problem and the need for restraint.
- Cooperation of all the stakeholders involved.

For his effort in the reduction of elephant and human conflict when other parts of the country has seen a rise in such incidences, NCF's Ananda Kumar was awarded the Whitley Award, dubbed as the Green Oscar.

In order to sustain the system so created, there should be a long-term plan of self sustaining the mechanism by involving people and also institutionalising it. These measures are still short-term mitigation measures to reduce the interaction of people and elephants, to have a long-term solutions one should be thinking of creation of corridors along the plantations especially along the Nadu Ar-Sholayar river system passing through the middle of the Valparai plateau along which the elephants migrate. If a corridor is created by planting along the width of the river system, local tree and grass species that exists in the rain forest patches concentrating on some fodder species of elephants, then the elephants will have peaceful movement from one forest patch to other without any disturbance to both human and elephants. Efforts should be taken to think of ways of storage of food grains that would not attract elephants and that could not be damaged by elephants such as underground storages and use of suppressant or maskers for masking the smell of grains so that the animals cannot detect the foodgrains.

Note: Articles may be sent at the following email ID:
fieldforester@gmail.com

Evaluation and Review System

There will be two layers of review of the contributions; Faculty and the Directorate review. Evaluation and review at the faculty level in the training institutes/academies will be undertaken under the guidance of Director/Principal/Head of the institutions. Even very specialized and technical topics shall be presented in simplified format so that frontline staff and forest community are able to appreciate and understand the topics. Articles shall be written in a popular style, easily understandable and in simple English.

However depending on the response to this programme, arrangements can be made for translation of the magazine into the vernacular. A short note about the contributor and the reviewer shall accompany the article. The note shall contain name, age, postal and e-mail address, course, academic accomplishments, and important assignments held. The evaluation would be done on following criteria:

a. **Style**: The article should be interesting and informative. The introduction should draw the reader in and convince them that the remainder is worth reading. The remaining should be written in a lively and concise style, and should leave the reader convinced of the importance of the topic.
b. **Structure**: The article should be within 1000 words, and formatted in 1.5 line spacing in Times New Roman 12 point font.
c. **Organization**:
    - Instead of an abstract the article will give information on the location, the period when the field work was carried out
    - Integration - the article organized in a coherent form and all ideas are clearly leading to a single main argument.

The review at the Directorate level will be done through an editorial board constituted by the DFE, which will be responsible for the content, design and review of the journal articles. The editorial board shall consist of expert/experts constituted by DFE and reconstituted every year, which would screen contributions and recommend their publication. Articles previously published elsewhere, or simultaneously sent for publication elsewhere, may be accepted with modifications. Article submitted shall carry a declaration that the article is original. The Editor would reserve the right to reject articles without assigning any reason and articles not found suitable will be sent back.

Directorate of Forest Education
Ministry of Environment, Forest and Climate Change
P.O. New Forest, Dehradun
Tel: +91 135-2750127, Fax: +91 135-2750125
Website: www.dfe.gov.in