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FIELD FORESTER

Voices from the Field

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Directorate of Forest Education
Ministry of Environment, Forest and Climate Change
P.O. New Forest, Dehradun

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Voices from the Field

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From the Chief Editor's Desk

It is a matter of honour for the Directorate of Forest Education that over a period of time, the outreach and appreciation of Field Forester has increased manifold. More and more case studies, experiences, best practices and thoughts of forestry professionals are being disseminated effectively through Field Forester. Documentation of such forestry success stories into one volume has made access to information and sharing of knowledge and experiences easy. The journal has now evolved into a wholesome reference material for those who are teaching and practicing forestry as well as allied natural resource management in India.

As always, the present issue is a compilation of diverse stories and experiences from the field that includes Biodiversity Conservation, Wildlife Management and People and Forests. Write-up on contribution of wild buffaloes in improvement of domestic buffalo breed in Assam makes for a good reading, while conservation of medicinal plants in the Great Himalayan National Park of Himachal Pradesh is highly informative. The story of revival of traditional millets and crops cultivated by the tribes of remote Chinnar Wildlife Sanctuary in Kerala arouses one's interest while the article on livelihood issues of community living in the vicinity of Protected Areas in Central India is an eye opener to the issues that need to be addressed. The emerging challenge of managing man-animal conflicts has also been flagged in an article. The conservation efforts of ten illiterate women in a rustic village of Himachal Pradesh sets an inspirational tone to the issue while a field study on understanding people-forest interface in a forest fringe village Madhya Pradesh elucidates the intricacies of people-centric forest management.

I am sure that this issue of Field Forester will serve as a source of information as well as inspiration to the forestry professionals and academicians across the country. It's certain that the readers will not only get enlightened but also will enjoy while reading Field Forester!

Best Wishes!



(R.P. Singh, IFS)



Photo : *Holarrhena pubescens*

Credit : Abhilash Damodaran, IFS, Lecturer, CASFoS, Dehradun, Uttarakhand

BIODIVERSITY CONSERVATION

BIODIVERSITY CONSERVATION

Recovery of Elephant Tusk

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It is an example how the animal article was recovered only through goodwill and bringing the local villagers into confidence

Two tuskers fought fatal battle for supremacy in the forest of Hermadih, Basadera and Lukai canal forests under Ghatsila forest Range of Jamshedpur Forest Division, Jharkhand. The battle ended with the death of one tusker. The dead tusker was having two gigantic tusks. The place was very remote and was highly infested with leftwing extremism. Few days before the local MP was shot dead by the extremists. After getting the information that one elephant died the local staff after lots of IFS and buts went to the site. When they approached the elephant body, they found that one tusk is missing. The local staff communicated to me (I was posted as DFO, Jamshedpur) about the matter in the evening of 26.02.2010. In the next day

morning I went to the site alongwith the Staff. Some of the members of the village forest protection committees were also with us. We discussed about the incidence in large and chalked out plan how to get the lost tusks.

The areas in and around village Basadera, Hermadih and Lukai canal are highly infested with Naxal activities. I was very sure that the tusk is somewhere in and around this village. At the same time it was very difficult to organize raids in these villages to recover the tusk. It came to my mind that this could only be possible with the help of the villagers.

I was apprehending one thing that once the innocent villagers come across the smugglers involved in the trade of elephant



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tusk, will be attracted to such illegal thing. Once such easy money come to them, may instigate even to kill the elephant to fetch the tusk. So I thought by hook or crook the tusk is to be recovered.

I told the villagers that I don't know, whether that tusk has been taken by somebody or it is lost in the forest during the fight. I doubt anybody will take the tusk. There is every possibility that the tusk is broken during the fight and the tusk is lost during the fight in the forest.

I announced them that from now they should go in group of five in the forest and try to search the tusk in the bushes of the forest. One who finds the tusk will be awarded. Initially there was a pin drop silence. After sometime some innocent villager asked me that what is the guarantee that you will not arrest the person who will give you the tusk. I was very happy to get such response from the villagers. I announced that no forest case will be booked against the person who finds the tusk. Rather



TELEGRAPH - 7/3/10

OLD JUMBO DIES FIGHTING IN FOREST

Villagers return broken tusk

JAYESH THAKER

Jamshedpur, March 6: Forest officials heaved a sigh of relief after the broken tusk of an elephant was found near the Dalma Wildlife Sanctuary today.

Villagers of Harmadi and Suknara handed over the 9kg tusk of an old jumbo — who had been killed in a battle with its younger counterpart inside the sanctuary last month — to A.T. Mishra, the divisional forest officer (Dalbhum), at his office in Jamshedpur.

The gory fight between the tuskers lasted for three days after a herd was heading towards the sanctuary from Bengal recently. Two tuskers, who were part of the herd, fought for supremacy after reaching the sanctuary last month.

The foresters kept the death of the 55-year-old tusker

Dalbhum divisional forest officer AT Mishra with the tusks in Jamshedpur on Saturday. Picture by Bhoja Prasad

under wraps, but they came in the open after recovery of the tusk — market value of which is pegged at Rs 10,000 per kg. Mishra said the tusker was badly injured after the fight and ultimately succumbed to its injuries.

“The fight lasted for three days (between February 24 to 26). We came to know about it on the night of February 26 but by that time things were over. We found the body of the elephant near Dalbhumgarh

under Ghatshila sub-division,” he added.

“The abdomen of the elephant was found slit open with intestines popping out. One of the tusks was found intact but the other one was missing,” he added.

“We announced reward for those who would hand over the tusk to us. We had also announced that no case would be lodged or suo moto action taken against anyone who found the tusk,” Mishra said.

the villager who finds the tusk will be rewarded and if the tusk will not be recovered the we will have no option but to book cases and with the help of police we will organize search to every house hold and where ever traces of such tusk will be found

will be punished heavily. The villagers started seeing their faces and after a while promised to start search operation from the next day morning.

Two days later the incidence i.e. on 06.03.2010 early morning I got the

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telephonic message from a villager that the tusk was found in the jungle. I immediately directed the local Forester to receive the tusk. The villagers told to the Forester that they will only hand over the tusk to the Divisional Forest Officer. I arranged one vehicle, the five villagers alongwith the local Forester came to my residence early in the morning and handed over the tusk to me.

I promised to reward the villagers.

The died tusker was a huge full grown tusker from whose body total 22 kg of tusk (two tusks) recovered.

In this way the lost tusk was recovered. It is an example how the animal article was recovered only through goodwill and bringing the local villagers into confidence.

□□□

BIODIVERSITY CONSERVATION

Eco-tourism an Important Tool for Forestry Management: Madhya Pradesh Experience

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Imparting unique experience of wilderness and nature based activities to the eco-sensitive people, 'Conservation' of the natural resources in and around forests, and to create 'Sustainable Livelihood' opportunities for the local forest dwelling communities through various 'Capacity Building Initiatives', are the key thrust areas of 'Eco-tourism management'

The National Working Plan code, 2014 has set objectives of Forest Management planning as under:

Forest Management Planning must provide for sustainable management of forests and its bio-diversity as enshrined in the National Forest Policy, encompassing the ecological (environmental), economic (production) and social (including cultural) dimensions. The objectives for attaining this goal include conservation of forests and reducing forest degradation, maintenance and enhancement of ecosystem services including Eco-tourism,

Madhya Pradesh is bestowed with luxuriant forest which covers more than 30% of its geographical area. The forests of Madhya Pradesh have six Tiger Reserves, many National Parks and Sanctuaries, inhabiting large variety of flora and fauna along with picturesque landscape and water bodies etc.

The above scenario makes Madhya Pradesh a potential world class Eco-tourism destination. The development of Eco-tourism destinations will not only help in better conservation of nature but will also be an effective tool for providing employment opportunities to local population. Incidentally these potential areas are in such locations, where other important opportunities are comparatively less, which again calls for

taking up eco-tourism in these employment opportunities deficient areas.

Madhya Pradesh Eco-tourism Development Board (MPEDB), the first of its kind in the country, was created on 12th July 2005, under the Madhya Pradesh Society Registration Act 1973. In line with of objective set in the National Working Plan Code, 2014 and Potential available in the Madhya Pradesh. Madhya Pradesh Eco-tourism Development Board is working with philosophy that enjoyment and recreation of the people can deliver ecological benefits. The vision of the board is to institutionalize the concept of Ecotourism and implement it in the forests and other natural areas of Madhya Pradesh in a manner, so that Eco-tourism becomes an integral part of forest management and other major sustainable development options for



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remotely located and marginalized forest dependent communities of the state.

Along with imparting unique experience of wilderness and nature based activities to the eco-sensitive people, 'Conservation' of the natural resources in and around forests, and to create 'Sustainable Livelihood' opportunities for the local forest dwelling communities through various 'Capacity Building Initiatives', are the key thrust areas of 'Eco-tourism management'. Broadly following four areas of thrust are catered by MPEDB:

1. Destinations Development

Madhya Pradesh has vast and diverse forest, which is the largest forest area among all the States of the Country comprising of teak, sal, miscellaneous and bamboo forests. Fauna wise also State has large number of Wildlife in its 11 National Parks and 24 wildlife sanctuaries, covering almost more than 12% of the forest area. The forest area of the State is gifted with picturesque landscape and large number of water bodies. Thus there are numerous destinations which can be developed as eco-tourism destination.

Madhya Pradesh has notified Madhya Pradesh Forest (Recreational and Wildlife Experience) Rules, 2015 which has given impetus to promote eco-tourism in the state, as it facilitates and empower to create low impact basic infrastructures for eco-tourism such as Camping facilities, Machan, Pagoda, Sitouts, Parking, Toilets, Fencing etc. These Rules cover all the Reserve Forest area, except which falls under any sanctuary

or National Park notified under Wildlife (Protection) Act, 1972. The rules provide provisions for recreational facilities, entry regulations and fee etc.

Under the above rules till date 106 Recreational areas and 13 Wildlife experience areas have been notified. Madhya Pradesh Eco-tourism Development Board has taken up development of 53 recreational areas and 3 Wildlife experience areas. Slowly and studiously these destinations are becoming popular among eco-tourist.

2. Promoting Responsible Tourism in Buffer area of National Parks

The State has been known for its Scientific management of Protected Areas and has been in the for font of Wildlife tourism for a long time. In the light of the increasing pressure on core areas and guidelines issue by NTCA, the State Government has taken initiatives through Madhya Pradesh Eco-tourism Development Board to promote eco-tourism activities in the buffer areas. This initiative has given breathing space within tourism zone of core



areas and some of these destinations are now equally popular as those in core tourism areas. This initiative has been helping to mitigate pressure of tourism in core areas.

MPEDB has initiated buffer area development in all the Tiger Reserves of the State and 44 such places have been developed. The visitations in these areas are 54821 and 65347 in the year 2016-17 and 2017-18, respectively. The trend shows likely increase in the coming years.



The prominent buffer areas undertaken in the State are as under:-

S.No.	Name of Tiger Reserve	Buffer area destinations
1	Panna Tiger Reserve	Hinota, Panna buffer, Raneh fall
2	Satpura Tiger Reserve	Bagra, Churna, Panchmari
3	Kanha Tiger Reserve	Sijhora, Khapa, Khatiya, Sarahi, Phen Sanctuary
4	Sanjay Tiger Reserve	Keolari, Badkadol, Madwas
5	Pench Tiger Reserve	Rukhad, Khawasa, Karmajhiri Sakata Ari
6	Bandhavgarh Tiger Reserve	Dhamokhar, Manpur, Panpatha

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3. Awareness / Outreach Programs

With possession of huge natural resources there is equally large responsibility of conserving the forest and wildlife of the State. One of the means to achieve conservation is education and awareness program. The people living within and in the periphery of forest area are major stakeholders in conservation of natural wealth. Students of the school in and around forest areas are a great asset if they can be motivated for conservation and protection of forest and wildlife. Based on this principal Madhya Pradesh Forest Department has taken up a major education and awareness program known as “Anubhuti”. Madhya Pradesh Eco-tourism Development Board is nodal agency for organizing Eco-camps for nature education and conservation.

These Camps are organized every year between 15 December to 15 January. All territorial Wildlife and Forest Development Corporation's ranges are covered in the program and in each range depending upon the financial resources one or two camps are organized. These day long camps are catered through Master Trainers, who are experienced retired Forest officers and environmentalists. Before the camps, two days Master Trainers training workshop are organized to enable them for better interpretation. The local officers are given full freedom within given frame work to incorporate innovation and local initiatives.

The day long camps starts early in the morning and the students are transported to the camp sites. Selection of these camp sites are based on their diversity and distance not more than 20 to 30 km from the schools.



There are large diversities in camp sites e.g. National Parks, Sanctuaries, Historical, anthropological, eco-tourism destinations, nurseries, depots, water bodies etc. the camp starts with early wildlife/bird watching trails and followed by breakfast. After the breakfast students are taken to “*Prakati ki sair*”, where Master trainers and department officials interpret about trees, medicinal plants, wildlife, wildlife signage's, various forestry operations, soil moisture conservation etc. The students are exposed to various department activities like plant preparation, plantation, logging and felling operations, depot, fire protection, silvicultural operation, wildlife rescue operation etc. and the introduction and responsibility

of forest officials. After this round lunch is provided in natural environment and then various quiz, lectures and activities are carried out. The last session is feedback and validictory and then students are safely transported back to their homes.

The Madhya Pradesh Forest Department organizes these camps with lot of zeal and devotion and undertakes lot of local innovations like special camps for “*Divyang Students*”, Pink camps, wildlife safaris, logos, rallies, health camps, yoga camps, treasure hunt etc. All the camps are plastic free and cleanliness during and after the camp are focused upon. All the participant students is provided with quality reading material, caps and participation certificates.



The participation in last 3 year is as under:-

Year	Number of Camps per Range	Total Number of Camps	Number of education institutes	Number of Students
2016-17	1	393	1938	53935
2017-18	2	903	2735	111068
2018-19	1	477	1744	61181
Total	1773	6417	226184	

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The highly motivated and willing participants are selected as Nature Volunteer Force, with the aim of developing them as Ambassador for Forest and Wildlife Conservation. Large number of people's representatives and officials of other departments also do participate in these camps. Print and electronic media is actively involved and through them the message of camp is dispersed to larger masses.

In the year 2018-19 the famous cine actor and environmentalist Ms Diya Mirza has agreed to be the Brand Ambassador of *Anubhuti* program and actively participated in some of the camps and encouraged students.

4. Skill and Capacity building programs

There are multiple stakeholders in eco-tourism such as local community, forest officials and tourists etc. Especially local community and forest officials are key stakeholders, who are responsible for providing quality services and ensure responsible tourism. These persons require capacity building on continuous basis for effective performance of their roles in eco-tourism. Madhya Pradesh Eco-tourism Development Board is working on capacity building training aspect of community as well as forest officials.

Following are major fields in which capacity building programs are undertaken by the Board taking help of expert institutions of the field.



Hospitality Training

Hospitality is the key to any successful venture dealing with eco-tourist visiting the destinations. It is amalgamation of various skills such as Soft Skills, Table etiquettes, house-keeping, cooking, presentation and services etc. Board have been organizing this training with the help of Madhya Pradesh Institute of Hospitality Travel and Tourism Studies and the results are wonderful and has enhanced experience of eco-tourist visiting the destinations.

Guide/Naturalist Training

Guides or naturalist are interface between nature and eco-tourist. Guide /



Naturalist have to knowledge of flora, fauna, geology, history of the area etc. and also should have good oral communication skills, to perform his job in a proper manner. In protected areas and eco-tourism destinations of Madhya Pradesh, more than 700 guides/naturalists are registered with the department. Their knowledge has to be upgraded and updated. Board every year undertakes 1 week refresher course for all the guides registered with the department. For these courses services of experienced and professional naturalist, biologist and foresters are taken up. Every year training venues are rotated so as to gain better exposure and learning from experience sharing.

Boats-man Training

Many eco-tourism destinations in the State are situated near water bodies and at such destinations water based activities are major attractions among the tourists of all age group. Carrying out these activities

require high skills as they involve human life risk.

Keeping this in mind Madhya Pradesh Eco-tourism Board has started a 12 days training program in collaboration with National Institute of Water Sports (NIWS), Goa, Ministry of Tourism. During this training, skills such as Basics of Motor boat, Operations techniques, Rescue Techniques, First-Aid Technique with CPR training, Maneuver Techniques etc. are imparted to the trainees.

Camp Management / Adventure Training

Camping is most desired an asked activity in eco-tourism. Board has developed many places with camping infrastructures and promoting the same in large scale. The persons involved in camping has to have various skills as types of tents, how to pitch a tent, how to prepare a camp site, how to create sanitation facility, safety measures and safety equipment and their maintenance, team building games, group activities, tour guiding skills etc.

Madhya Pradesh Eco-tourism Board has structured a one week training program to understand the various aspects of camping and low risk adventure activities to keep the guest engaged at any eco-tourism destination.

Eco-tourism Exposure Training

Madhya Pradesh Eco-tourism



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Development Board runs all its activities through field officials of the Madhya Pradesh Forest Department, which are designated as ex-officio Managers of the Board. On the field it is the Forest officials who conducts eco-tourism activities and manages destinations, therefore it is needed that their capacity building is also taken up for better understanding and management of eco-tourism. Regular courses of forest officials are organized by the Board at RCVP Narohana Administration Academy, Bhopal. A two days course specially designed to impart the core values of eco-tourism, activities, Do's and Don'ts, various operations models, current scenario of eco-tourism in India / World, is conducted for various ranks of forest officials.

Way Forward

Tourism is a important service sector

and is one of the largest growing industry, witnessing overall increase in tourists visiting various domestic destinations. Tourism market is growing into several sectors and sub sectors and there are an array of types of tourism catering to tourist with various inclination and requirements. Some of the types are – Adventure tourism, Nature tourism, Nature based tourism, Wildlife tourism, Green tourism, Rural tourism, Community based tourism, Cultural tourism, Heritage tourism, Health tourism, Herbal tourism and so on. Many of these types can be catered through eco-tourism and therefore Board is exploring other verticals too, to promote eco-tourism in the state to engage more and more local community for their economic strengthening and in turn develop motivation and awareness among them to protect and conserve the natural resources.



BIODIVERSITY CONSERVATION

“Punarjeevanam” - The Final Step of Existence

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Chinnar Wildlife Sanctuary has ventured a project named ‘Punarjeevanam’ for conserving traditional varieties of Millets and other traditional crop varieties cultivated by the Tribes

Chinnar Wildlife Sanctuary with an extent of 90 sq km has 11 tribal colonies in its jurisdiction having 1800 tribal members. Muthuva and Hill Pulaya are the two indigenous tribes inhabiting in the Sanctuary. About 30-40%

of the extent of the sanctuary is under Rain shadow region. This region belongs to Eastern side of the Southern Western Ghats where the availability of rain from south west monsoon is very feeble. Though North East monsoon has more influence over this



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area, Chinnar is known to have lowest rainfall in the State of Kerala. Hence cultivation in the plains of Chinnar Wildlife Sanctuary by the tribal communities is very limited. Climate change for the last 10-15 years was one of the main reasons for the withdrawal of extensive cultivation in the plains.

As per the govt. policies in the state of Kerala, the tribes have been supplied enough rice (35 kg/month for a family) as the main food for the last 15-20 years. This resulted in loss of interest in millet cultivation over a period of time. Gradually, the traditional cultivators have lost many varieties of millets during the last 20-25 years. That also gradually influenced their health adversely in the form of malnutrition, under weight, diabetes, anemia, goitre etc.

Earlier, the tribal people ate various types of millets like *Ragi* and *Thina* (foxtail millets), *Cheera* (Amaranthus), *Cholam* (sorghum), *Poosani* (Pumpkin), Turmeric and Beans. These nutritious “super-foods”, as christened by the modern wellness industry, used to be a part of their everyday diet. At that time food was their medicine and medicine was their food. The protein-rich kodo millet, little millet, barnyard millet, pearl millet, sorghum and various types of beans largely helped them maintain their health. The millets are high in minerals like iron, magnesium, phosphorous and potassium. Ragi had rich calcium content; about ten times that of rice and wheat. And all of these foods were being cultivated on these very lands by the people, but the cultivation was lost over the years.



Nutrition composition of various food grains (In 100 gm)

	Proteins (g)	Fibre (g)	Minerals (g)	Iron (mg)	Calcium (mg)
Pearl millet	10.6	1.3	2.3	16.9	38
Finger millet	7.3	3.6	2.7	3.9	344
Foxtail millet	12.3	8.0	3.3	2.8	31
Proso millet	12.5	2.2	1.9	0.8	14
Kodo millet	8.3	9.0	2.6	0.5	27
Little millet	7.7	7.6	1.5	9.3	17
Barnyard millet	11.2	10.1	4.4	15.2	11
Rice	6.8	0.2	0.6	0.7	10
Wheat	11.8	1.2	1.5	5.3	41

Courtesy : Millet network of India (www.milletindia.org)



Understanding these facts, Chinnar Wildlife sanctuary has designed and implemented a project named '*Punarjeevanam*' for conserving traditional varieties of Millets and other Traditional agriculture varieties of the tribes. The First phase of the project established its root during 2015-2016.

Thayannankudy is one of the Muthuva Tribal settlements in Chinnar Wildlife Sanctuary, where Traditional agriculture practices have been followed successfully. Hence Chinnar wildlife sanctuary selected Thayannankudy Eco-development Committee (EDC) to launch the project. The EDC started to collect several rare and endangered millet varieties from different tribal colonies which they didn't use for cultivation for the last few years due to many

reasons. Fifteen percent land has been taken by the EDC on lease from the farmers of that colony to initiate this endeavor. With the aim to conserve maximum number of traditional millet varieties, we prepared mother beds in the leased agriculture field and commenced regeneration of the rare millet seeds. By cultivation we enhanced the seed stock during 2016-17. During the first year, 8 Nos. of Ethnic Ragi (finger millet) varieties were restored. Then we distributed various seeds to all the tribal colonies in and around Chinnar Wildlife Sanctuary to ensure its further restoration and expansion. During the second year, we could restore 15 varieties and by the end of 2017-2018 (Third phase), the varieties of millets vs restored stock at became 21 nos. From 2nd year onwards (2017), we have also stepped up

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restoration efforts of ethnic varieties of Beans, Pumpkin, Amaranthus, Maize and many other traditional agriculture varieties.

During 2017, the efforts for the same was noted by the Agriculture department and recommended for State Agriculture award. Eventually Thayannankudy Tribal Eco-development Committee was awarded as the best tribal community in the state considering the remarkable efforts for conserving traditional agricultural practices in collaboration with forest department.

The main objective of the project named '*Punarjeevanam*' was to multiply the quantity of the rare and endemic millet varieties in maximum number of Tribal colonies in Marayoor - Anchunadu area in which Chinnar was is located. The conservation efforts were effective and for the last few years we have retrieved and conserved more than 21 Millet, 15 nos. of Beans and other ethnic agriculture varieties through strict organic cultivation.

During 2017, '*Punarjeevanam*' project



Protection of Plant Varieties and Farmers Rights Authority under Ministry of Agriculture, Government of India. The team of Scientists including the Registrar General inspected the *Punarjeevanam* project field during 2018. Eventually, this project became one among the five communities in India bagging the “Plant Genome Savior Award” worth ₹ 10 Lakhs - one of the most prestigious National level Agriculture Awards.

With the raving success of the project, running its third phase, *‘Punarjeevanam’* envisages the restoration and wide expansion of ethnic agriculture practices in more than 25 tribal colonies in and around Marayoor - Kanthalloor areas. A separate Agriculture based Eco-development committee is all set to form ensuring the participation of farmers from all tribal colonies. In future, Marayoor - Kanthalloor areas will become a hub of Ethnic millet production.

was proposed by the Intellectual property Rights cell under Kerala Agriculture University for “*Plant Genome Savior Community Award*” instituted by the

BIODIVERSITY CONSERVATION

Genetic Improvement of Indigenous Buffalo through (Cattle camps) and Chances of Genetic Pollution

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Genetic swamping is the main problem in maintaining the genetic purity of wild buffalo in India. The interbreeding between wild and domestic buffalo can cause problems for wild buffalo.

As agriculture started to grow, domestication of animal became an integral part of it. Dairy business stood up as backbone of agriculture based economy. As population increased, man started directed selection in animals. More efficient selection programmes accelerated genetic improvement in a number of breeds. Milk quantity and body structure were main traits under selection programme. Selection for desirable traits resulted into a shift of cattle population distribution into one direction. Where only desirable genetic characters could be selected and some inferior, disease resistant genes were lost in due course of time and existing diversity was harvested. Further genetic diversity was utilized by hybridization programme which developed many high milk producing animals. Artificial insemination and embryo transfer have facilitated the dissemination of genetic material. As a result, highly productive breeds have replaced local ones across the world. Now genetic diversity is completely lost in domesticated animal. The main source of the diversity is mutation, random breeding, adaptation, isolation and genetic drift. This development has led to growing concerns about the erosion of genetic resources. As the genetic diversity of low-production breeds is likely to contribute to current or future traits of interest.

Wild buffalo *Bubalus bubalis* is restricted



Plate 1: Wild buffalo (*Bubalus bubalis*)



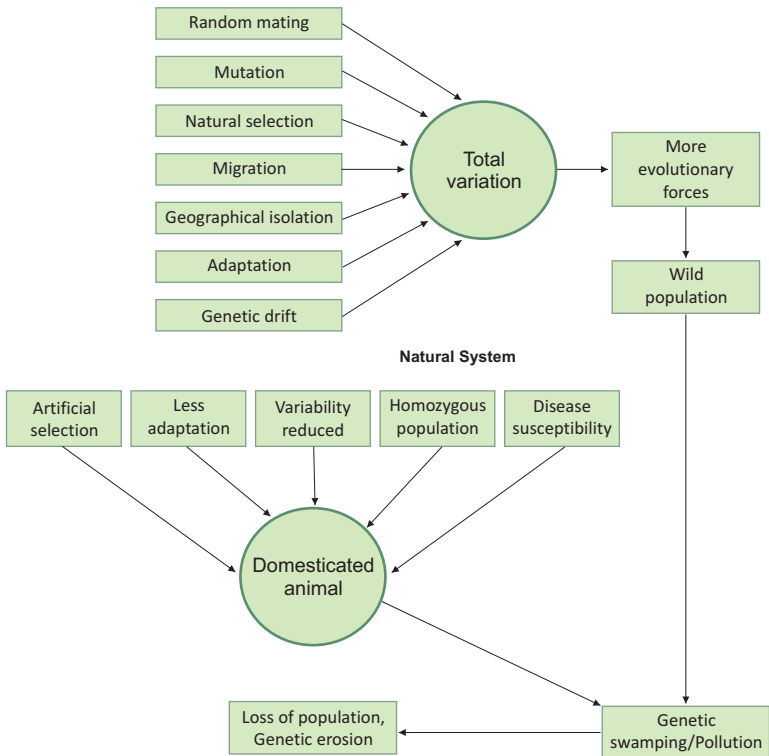
Plate 2: Distribution of Wild buffalo

in small isolated forest patches in Assam and parts of Chhattisgarh state (Bastar and Raipur districts). Kaziranga, Manas, Pabha and Dibru in Assam while Indravati National Park, Bhairamgarh and Udanti wildlife sanctuaries in Chhattisgarh State.

The wild relatives of the animals have got wild genes which are disease resistant, adaptation genes and also high milk producing so Government of Assam started programme under which cattle camps were established in fringe of many wild buffalo inhabitation areas. Few examples of cattle camps are Manas National Park, Kaziranga National Park and Dibru Sikhowa wild life sanctuary. The programme was framed in such way that wild bull can mate with domesticated buffalo and the wild gene can be brought in indigenous buffalo. This has resulted into the improvement of the buffalo

and the generation produced by such breeding possessing wild traits.

A population reduction by at least 50% over the last three generations seems likely given the severity of the threats, especially hybridization this population trend is projected to continue into the future. Interbreeding with feral and domestic buffalo in and around protected areas, may lead undesirable gene flow. Due to selection syndrome the domesticated population has some inferior genes which are less adaptive and susceptible for disease and whole population may be eradicated. Todesco *et al.*, 2016 has predicted in his research that anthropogenic hybridization is increasing worldwide and is a threat to the conservation of species. Changes in the abundance and distribution of species may be due to human-mediated hybridization. There are also



FIELD FORESTER

chances of removal of barriers that cause isolated or restricted species to expand, and/or the uncontrolled diffusion with domestic species. Allendorf *et al.*, 2001; Allendorf and Aitken, 2013 and Judith and Daniel, 1996 also supported this facts.

CONCLUSIONS

The genetic swamping is the main problem in maintaining the genetic purity of wild buffalo in India. The interbreeding between wild and domestic buffalo can cause problems for wild buffalo. Brander (1923) and Prater (1971) also agree to genetic swamping between domestic and wild buffalo. So there should be control in mating between wild and domesticated animals. The effect which may occur due to mixing is unpredictable but more chances of harmful effect due to cattle camps.

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BIODIVERSITY CONSERVATION

Conservation of Medicinal Plants and Livelihood Development of Locals in Great Himalayan National Park

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One hand the medicinal wealth will be conserved in the wild as a gene bank, and the other hand the local community could be benefited from its cultivation. The locals can be assisted in medicinal plant cultivation by linking them to various National and State level schemes

The Great Himalayan National Park (GHNP) is located in the Banjar sub-division of Kullu district of Himachal Pradesh, India, in the Western Himalaya. Initially constituted in 1984, and formally notified as a national park in 1999. The Himalaya as a whole is listed as one of Conservation International's 34 major biodiversity hotspots. The Himalaya Hotspot contains not only the world's highest

mountains and associated alpine ecosystems but also large expanses of lower-elevation temperate and subtropical forests and grasslands. It spans 3,000 km east to west, and 300-500 km north to south. The Great Himalayan National Park Conservation Area (GHNPCA) as a Natural Site was inscribed into the UNESCO World Heritage List on 23rd June 2014 for the most important and significant natural habitats for *in-situ*



Fig. 1. Great Himalayan National Park



Fig. 2. Trek route to Tirthan valley, GHP medicinal plants in GHPN

conservation of Western Himalayan biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

GHPN covers an area of 754.4 sq km. In 1994, two major changes were made in land use around the Park. A buffer zone of 5 km from the Park's western boundary, covering 265.6 sq km, and including 2,300 households in 160 villages, was delineated as an Eco-zone. Most of the population (about 15,000 to 16,000 people) in the Eco-zone are poor and dependent on natural resources for their livelihoods.

In 1994, two major changes were made to land use around GHPN, which covers an area of 754.4 km². A buffer zone extending 5km from the park's western boundary was reclassified as an eco-zone. 265.6 km² in area, this zone includes approximately 2,300 households in about 160 villages. Most of the eco-zone's population (between 15,000 and 16,000 residents) are poor and depend on natural resources for their livelihoods. Having moved away from exploiting the park's resources, they now work in areas as diverse as basking making, vermi-composting, organic farming, medicinal plant cultivation,

eco-tourism and many other income generation activities.

The second change was the creation of the Sainj Wildlife Sanctuary (90 km²) to surround the three villages of Shagwar, Shakti and Maror. Another protected area, known as Tirthan Wildlife Sanctuary, was also established on the southern edge of GHPN. This is uninhabited and covers 61 km². In 2010, 710 km² of the Parvati river catchment, contiguous to the northern boundary of GHPN, was instated as Khirganga National Park – adding further biological diversity, conservation value and physical protection to GHPN.

The boundaries of GHPN are also contiguous with the Pin Valley National Park in the Trans-Himalaya range (675 km²); the Rupi Bhabha Wildlife Sanctuary in the Sutlej watershed (503km²); and the Kanawar Wildlife Sanctuary in Parvati valley (107.29 km²).

Vegetation in the Park

The FROs from FTI&RC, Sundernagar, HP visited the GHPN from 1st – 7th May, 2018 as a part of their Introductory Tour. We got down at Sai Ropa (1400 meter amsl) the center for GHPN. The center housed Range

*Podophyllum hexandrum**Podophyllum hexandrum* flowering*Trilidium govani**Bergenia straychi*

office, Interpretation center, loading facility and sale outlet run by NGO Bio-diversity Tourism and Community Advancement (BTCA). The next day we went by road till Gusaini (1500 meter amsl) and after which trekked towards the park. On the way, in Eco-zone we came across the village Ropa. Like any hill village the community lived in houses built of wood, practiced agriculture mainly potato, wheat, vegetables etc. The males move out of villages due to lack of employment opportunities. Some of them are engaged in tourism in the GHNP by BTCA. We reached Rolla camp (2100 meter amsl) within the GHNP in the evening. In

the morning we proceeded for Chordwar (2955 meter amsl) from where we reached Rakhundi top (3700 meter amsl approx.) the next day. The vegetation from Gusaini along the river Tirthan had vegetation of *Pinus wallichiana* (Blue Pine), *Cedrus deodara* (Deodar), *Aesculus indica* (Chestnut), *Rhododendron arboreum* (Rhododendron), *Quercus leucotrichophora* (Ban oak), *Zanthoxylum armatum* (Timur), *Alnus nepalensis* (Alnus) and shrubs *Prinsepia utilis*, *Berberis asiatica*, medicinal plants as *Bergenia ciliata*, *Valeriana grandiflora*, *Viola serpens* etc. After the Rolla camp and till Chordwar there was forests of *Cedrus*

FIELD FORESTER

deodara (Deodar), *Quercus leucotrichophora* (oak), *Acer caesium* (Maple), *Rhododendron campanulatum* (White Rhododendron), *Taxus wallichina* (Thuner), *Abies pindrow* (fir) and *Picea smithiana* (spruce) with occasional shrub species of *Berberis spp.*, and herbs as *Potentilla spp.*, *Polygonatum spp.*, *Podophylum hexandrum* etc. along with hill bamboo. The vegetation after Chordwar till Rakhundi Top was of sub alpine mainly comprising of *Q. leucotrichophora* (Kharshu oak), *Betula utilis* (Birch), *R. anthopogon* (Rhododendron) along with hill bamboo (*Arundinaria spp.*) and herbs like *Bergenia stracheyi*, *Malaxis muscifera*, *Paris polyphylla*, *Polygonatum verticillatum*, *Angelica glauca*, *Potentilla spp.*, *Hypericum perforatum*, *Trillidium govanium* etc.

Potential of medicinal plants for livelihood

In the present world the value of alternative medicine is immense for health of people. The herbal medicines have been in use since the humans came into existing and even today they are curing those who cannot afford expensive allopathic medicine or are away from modern civilization. According to National Medicinal Plants Board, New Delhi the domestic demand of medicinal plants had been estimated 1,95,000 MT for the year of 2014-2015 and export demand of medicinal plants had been estimated 1,34,500 MT during 2014-2015. Total consumption of herbal raw drug in the country for the year 2014-15 had been estimated at 5,12,000 MT with corresponding trade value of ₹ 5,500 Crore. The major increase has been recorded in export value which has increased from ₹ 345.80 Crore in 2005-06 to ₹ 3211 Crore in 2014-15, registering a nine fold increase in during last decade, leading to pressure for collection from wild. This can be of opportunity for the people residing in the vicinity of the GHNP

for improving their livelihood and socio-economic status. In recent times there have been instances of unsustainable collection of medicinal plants from the fragile ecosystem of the Himalayas. It is not only depleting the precious gene bank of medicinal plants but also disturbing the overall ecosystem of the region. Few measures have been suggested to conserve this wealth.

In-situ conservation

- a) The medicinal plant wealth of the GHNP needs to be qualitatively evaluated.
- b) All efforts made to conserve this wealth from illicit collection and damage.

Ex-situ conservation

- a) Establishment of nursery and demonstration sites for the medicinal plants occurring within GHNP.
- b) The nursery can cater to the demand for cultivation or plantation of medicinal plants.
- c) The NGO, BTCA can be involved in it along with community residing in Eco-zone.
- d) Large scale cultivation of medicinal plants in demand such as *Podophylum hexandrum*, *Trillidium govanium*, *Paris polyphylla*, *Aconitum spp.*, *Angelica glauca*, *Picrorhiza kurrooa* etc.
- e) Develop market linkage of producers with traders through BTCA.

Thus on one hand the medicinal wealth will be conserved in the wild as a gene bank, and on the other hand the local community could be benefitted from its cultivation. The locals can be assisted in medicinal plant cultivation by linking them to various National and State level schemes. The conservation of this medicinal wealth with local support could go a long way in protecting these plants in wild.



BIODIVERSITY CONSERVATION

Rohtang Pass: Courting Sustainable Tourism

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Rather than viewing orders of the Hon'ble National Green Tribunal as a bane, every responsible citizen and managers should take it as an opportunity to exhibit a balanced tourism and livelihood development based on sustainable ecological principles

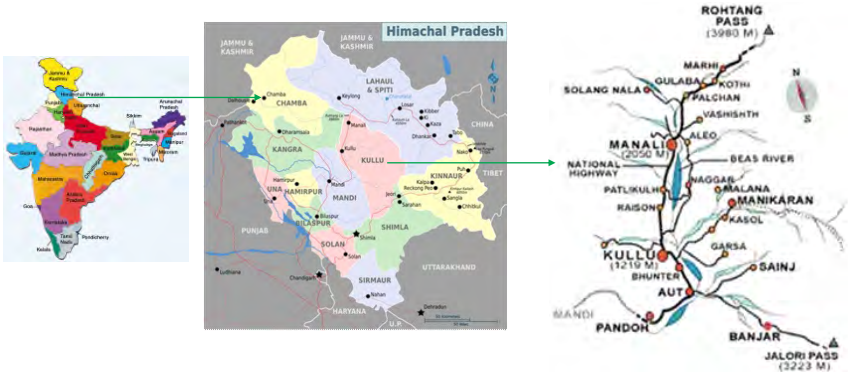
Rohtang Pass is a high mountain pass on the eastern Pir Panjal Range of the Himalayas around 51 km from Manali. It connects the Kullu Valley with the Lahaul and Spiti Valleys of Himachal Pradesh, India. The pass lies on the watershed between the Chenab and Beasbasins. On the southern side of this pass, the Beas River emerges from underground and flows southward and on its northern side, the Chandra River (flows from the eastern Himalayas), a source stream of the river Chenab, flows westward.

The pass is open from May to November. It is not particularly high or difficult to cross on foot by Himalayan standards, but it has a well-deserved reputation for being dangerous because of unpredictable snowstorms and blizzards. Endowed with breathtaking natural beauty

comprising of snow clad peaks, vast alpine meadows and high altitude forest ecosystems, Rohtang Pass and its vicinity witnesses footfall of thousands of tourists from across the country and globe every day during summers.

The former National Highway 21 (now NH 3), the road through the Kullu Valley, terminates at Manali. The road northwards over the Rohtang Pass to Keylong, and Lahul and on to Leh in Ladakh is not a national highway. Traffic jams are common as military vehicles, trucks, and goods carriers try to navigate the tight roads and rough terrain, compounded by snow and ice at certain points and the large number of tourist vehicles.

With increase in Traffic at Rohtang Valley, environmentalists fear its impact on the fragile mountain ecology. A rise in



Road maps of Rohtang Pass

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average temperature, and the consequent melting of glaciers, are also issues of severe concern.

Tourism activities in Rohtang

Rohtang is one of the favourite tourist destinations in India. Influx of around 11 lakh visitors annually. 87.3% vehicles plying on Rohtang belong to tourists. Snowmobiles, ATVs, Horseman activities, Para Gliding are the main activities going on there. All these activities resulted in following issues:

- Devastating impacts - heavy tourism, over crowding, misuse of natural resources, construction of buildings and infrastructure, littering of waste, Artificial traffic and other activities.
- Overgrazing, cattle movement causes soil erosion and destroys regeneration.

- Illicit and unplanned felling causes baldness of hill tops and this badly affects the regeneration of conifer species.
- Direct impacts are caused by presence of tourists and indirect impacts are by infrastructure created and services required in connection with tourism activities.
- All these cumulative effects resulted in considerable fall in the amount of snowfall and degradation of environment and ecosystem.

Context and background of involment of National Green Tribunal (NGT) in Rohtang issue

The Hon'ble High Court of Himachal Pradesh in CWP no. 15/2010 titled Court on its Own Motion vs. State of Himachal Pradesh earlier and Hon'ble National Green



Snow cladded Rohtang Pass

Tribunal later on its Own Motion vs. State of Himachal Pradesh and Ors. have passed direction to the state of Himachal Pradesh for taking specific steps relating to the environmental conservation of Rohtang Pass and its surrounding areas on 06/02/2014 (Comprising area from Vashishta to Rohtang Pass and Solang area).

National Green Tribunal (NGT)

The NGT has been established on 18.10.2010 under the National Green Tribunal Act 2010 for effective and expeditious disposal of cases relating to environmental protection and conservation of forests and other natural resources including enforcement of any legal right relating to environment and giving relief and compensation for damages to persons and property and for matters connected therewith or incidental thereto. It is a specialized body equipped with the necessary expertise to handle environmental disputes involving multi-disciplinary

issues. The Tribunal shall not be bound by the procedure laid down under the Code of Civil Procedure, 1908, but shall be guided by principles of natural justice.

The Tribunal's dedicated jurisdiction in environmental matters shall provide speedy environmental justice and help reduce the burden of litigation in the higher courts. The Tribunal is mandated to make and endeavour for disposal of applications or appeals finally within 6 months of filing of the same. Initially, the NGT is proposed to be set up at five places of sittings and will follow circuit procedure for making itself more accessible. New Delhi is the Principal Place of Sitting of the Tribunal and Bhopal, Pune, Kolkata and Chennai shall be the other four place of sitting of the Tribunal.

Table 1: Entry tax (Green Tax) and Congestion fee

Vehicle class	Permit fee	Congestion charges
Car and Jeep	500	50
MUVs	500	50
Buses and HMV	500	100



Panoramic view of Rohtang Pass

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NGT's decision on Rohtang issue

NGT put ban on uncontrolled tourism and fixed daily limit for vehicles that can ply to Rohtang. Intervention of NGT resulted into regulations being put on tourist and vehicular movement for tourism in Rohtang area. Daily number of vehicles permitted in the area was capped at a maximum of 800 petrol vehicles and 200 diesel vehicles, keeping in view higher pollution caused by the latter. Further, each vehicle can obtain only two permits in a week. Vehicles shall not be allowed on Tuesdays as the day is marked for maintenance of the road. Levying of charges and taxes has been a time tested method of controlling certain activities and the use of financial resources generated in such a way also provides

support for mitigation and management of impacts. Similarly, entry tax and congestion fee was also ordered to be imposed on tourist vehicles going to Rohtang Pass. Details of the charges and fees levied are given in Table 1.

Check post at Vashishta should be developed which shall be jointly run by BRO (Border Road Organization), Police Department, Tourism Department and Pollution Control Board. Installation of computerized weigh-in-motion systems has also been put in place to control entry of overloaded vehicles. Keeping in view the higher emissions by old vehicles, Hon'ble NGT has ordered the ban on entry of vehicles that are more than 10 years old in Rohtang Pass. Giving a boost to cleaner



Endless que of Vehicles carrying tourists as seen near Gulaba
(Photo Courtesy: Mr. Neeraj, Forest Guard, Gulaba, Kullu Forest Division)

fuels, the Tribunal also cleared way for adoption of environment friendly fuel run vehicles like CNG or electricity.

Facilities for the tourists shall also be ensured that includes eco-friendly market, parking place and toilets at Marhi and Rohtang Pass. Plastic bags, packaging material and littering of any kind has been strictly prohibited in the area. The directions of NGT also sets pace for examining the possibility of installing aerial ropeway from Kothi to Marhi, which will reduce congestion and vehicular pollution in serene vicinity of Rohtang Pass. Establishment of Green tax barrier at Gulaba shall be ensured. Joint patrolling by officers of Forest Department, Police, Tourism, and Pollution Control Board shall be done regularly to ensure zero violations. The Tribunal also envisaged formation of a Joint monitoring committee including Secretary, Environment, Conservator of Forest, Kullu, Director Tourism, Environmental Engineer HPPCB and an eminent environmentalist from G.B. Pant Institute of Himalayan Ecology and Development, Almora.

Forest Department: Playing a pivotal role

The Hon'ble National Green Tribunal recognised the role Forest Department can play in ensuring sustainable and eco-friendly tourism in Rohtang Pass area in light of the delicate alpine ecosystem the area harbours. Forest Department was entrusted with the following important tasks for ensuring ecological security in the area:

- Immediate and effective measures for reforestation of the degraded forest areas of Kothi, Gulaba and Marhi. Such sites for reforestation shall be selected through advanced techniques like use of RS and GIS. Species like Chir pine, *Toona ciliata*, *Morus alba* etc. shall be planted in areas up to 1000 m elevation. From 1000 to 2000 m altitude, species like blue pine, deodar, willow, *Prunus cerasoides*, walnut and ban oak shall be preferred. Beyond 2000 m upto 3000 m

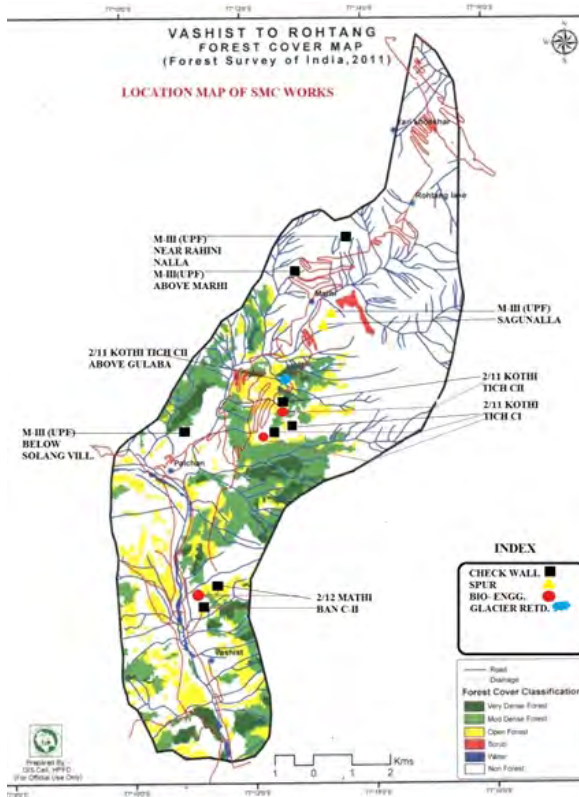
high altitude species like Spruce, Fir, *Taxus wallichiana*, Maple, Ash, *Aesculus indicus*, *Betula utilis* shall be planted. Plantation programme must include at least 50% broad leaved sp.

- Soil and moisture conservation works including bioengineering measures in steep hills.
- Planting high conservation value medicinal plants like *Aconitum heterophyllum* (Atish), *Gentiana kurroo* (Kutki), *Picrorrhiza kurroo* (kadu), *Angelica glauca* (Chora) through JFM.
- No remnants of crops in agricultural fields shall be burnt.
- Prevention and control of forest fire.
- Development of nature park at Gulabaso that the recreation activities could be restricted within the park.

Swinging into action, Kullu Forest Division has established forest nursery at Kothion 0.6 ha for raising seedlings required for plantation activities in compliance to the orders of NGT. Another nursery is also under development at Marhi.

Reforestation was planned using time line images available on Google Earth and other Remote Sensing and GIS platforms for identifying and prioritizing degraded areas. Accordingly, reforestation in 26 ha been done as per approved for the year 2014-15. Further, as per suggestions of the visiting NGT committee to the area, planting activities in 35 ha have been undertaken during year 2015-16 itself by advancing the date for planting by two year. In addition to this, avenue plantation on road side was also taken up between Kothi to Gulaba and enroute Solang Nallah wherein 200 tall avenue plants have been planted by Hotel Organizations, Manali.

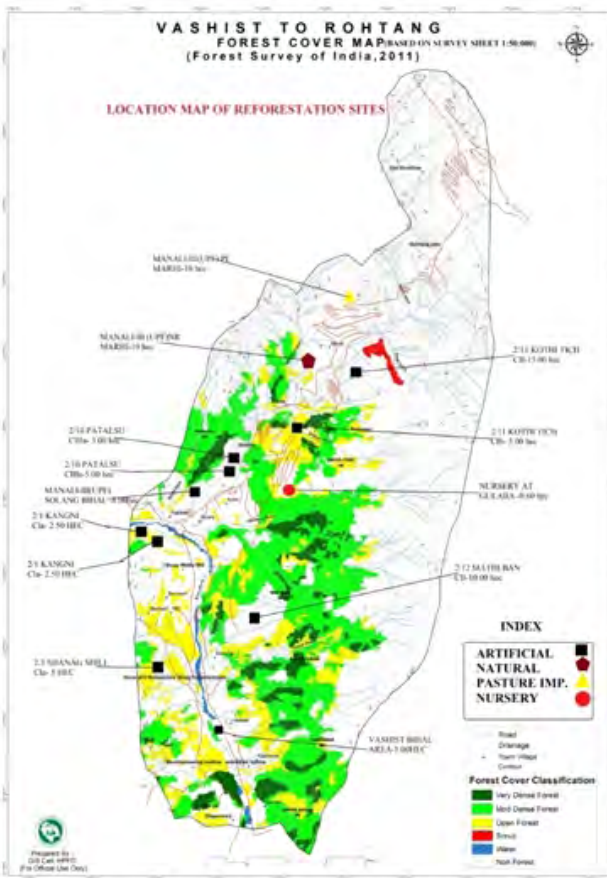
In some patches of the command area, conditions are conducive to natural regeneration provided some sort of assistance is provided. The tract has been depleted due to heavy biotic pressure on the



forest land for grazing, timber and fuel wood collection and mainly due to tourism. Such area will be taken up for assisted natural regeneration (ANR). Such areas shall be closed to reduce the biotic interference and cultural operations shall be done to promote natural regeneration. Wherever natural regeneration is deficient, ANR will be supplemented by artificial regeneration. Suitable species for ANR are *Asculus indica* (Khanor), *Juglans regia* (Wall nut), *Prunus padus* (bird cherry) and other local species. Patch sowing is preferred in this type of area. As per norm, 600 plants (300 Conifer and 300 Broad Leaved) will be planted in a hectare area. Plants will be made available from Gulaba and Kothi nurseries. Conservation plantation of high value rare

medicinal plants like Patish (*Aconitum heterophyllum*), Kadu (*Picrorhiza kurroo*), Chora (*Angelica glauca*), Rewandchini (*Rheum emodi*), Bankakri (*Podophyllum hexandrum*), jungle lahsun (*Alium sp.*), singlimingli (*Dioscorea deltoidea*), has been done at Marhi in 15 ha. For the reduction of grazing pressure alpine pasture land is being developed at Marhi and Rohtang for which tufts and seeds of fescue grass (*Festuca pratensis*) being planted during mansoon season. Pasture improvement programme in alpine area is also under process by control on grazing and graziers group, soil moisture conservation work and fencing.

Such plantation work has already been done on 15 ha area at Gulaba on degraded land during 2015-16.



Soil and moisture conservation activities have been given top priority, the area being catchment of important streams that originate from the area. Accordingly, as per Action Plan 101 check walls have been constructed at various points/locations against the total approved target of 267 No. structures. Rest of the proposed soil moisture conservation works are under progress. Regular monitoring of plantation, pasture land and encroachment in sensitive areas is being done.

Total ban on snowmobiles and limited activities of ATVs only in specified areas is allowed. The first electric bus service at

13000 ft altitude on Manali-Rohtang pass has been conducted on trial basis. Route allocation to horsemen and their registration is being done to restrict their activities to 4-5 different roots and droppings of horses removed by the staff deputed for it. Evacuation of all encroached areas and removal of all illegal permanent and temporary structures (more than 200) from the area has been done which is a remarkable achievement keeping in view the socio-political scenario. Forest fire management through the appointment of fire watchers and involvement of JFMCs is being implemented effectively. JFMCs have been

FIELD FORESTER

mobilized for sustainable use of forest and natural resources in the area.

Challenges

- Ensuring eco-friendly activities of tourists is big task because tourists don't care for the regeneration and they go for recreation without thinking that this area is under afforestation. Transforming ordinary fun loving tourists into “responsible” tourists is a big challenge ahead of the multiple stakeholder managers.
- Regeneration of conifer species through natural methods and planting has proven to be a big challenge because the area was subjected to heavy fellings and over wood openings in the past due to improper silvicultural practices.
- Managing the operations of horses and mules by local people is an uphill task as much as disposal of horse dung generated all along the roads and mule paths.
- Movement of grazier groups and grazing in alpine region is very intensive and has huge impact on alpine floral and faunal diversity.
- Food stalls and other stalls run by the local people during tourism season (Temporary structures) are raised at the green tax barrier and inside the barrier.

CONCLUSIONS

Judicial interventions in Rohtang Pass and its surrounding areas has given an opportunity to regulate the uncontrolled and destructive tourism activities and maintain the delicate eco-system services offered by the high altitude eco-system. Restoration of the lost balance in the delicate alpine grasslands and forests eco-system has gained much importance as various stakeholders have now come together to mitigate the drivers of deterioration in the area. Rather than viewing orders of the Hon'ble National Green Tribunal as a bane, every responsible citizen and managers should take it as an opportunity to exhibit a balanced tourism and livelihood development based on sustainable ecological principles.

ACKNOWLEDGEMENTS

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*Photo : Elephant at Hosur Forest Division, Tamil Nadu
Credit : Chandrashekhar Patil, SFS Trainee (Batch 2018-20), CASFoS, Dehradun, Uttarakhand*

WILDLIFE MANAGEMENT

WILDLIFE MANAGEMENT

Taking Palamau Tiger Reserve to its Recovery Path

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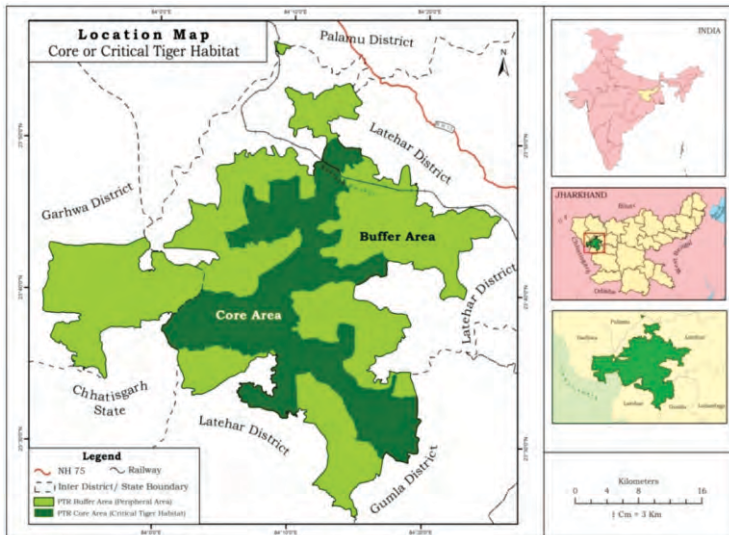
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Opening up of dialogue with all stakeholders, implementing the approved Tiger Conservation Plan encouraging all stakeholders to suggest solutions and association of wildlife experts have paved the path for recovery of Palamau Tiger Reserve

The Palamau Tiger Reserve is a large forest tract spread across the northern slopes of the Chhotanagpur plateau in Jharkhand extending lavishly up to Bandhavgarh (Madhya Pradesh) on one side, Orissa on another and connecting the forest of southern west Bengal! Not only does it flaunt its rich bio-diversity and house rare and endangered wildlife species, the tiger reserve also acts as an essential life line for the communities living in and around the reserve. Infact it is a catchment area of major rivers such as North Koel, Burha, Auranga,

Kohbarwa and other minor streams and tributaries contributing to the major rivers.

Interestingly, PTR, was one of the first out of nine to be declared as a tiger reserve during the year 1974 by the Central Government. It is undoubtedly one of the most suitable habitat for the top carnivores. PTR was known for its reputation of being the pioneer in the field of wildlife census, particularly tiger census. The forest eco-system here, even in today's time is best suited for the wide spread occurrence of the magnificent Royal Bengal Tiger, Elephants, Bison etc.



Location Map of Palamau Tiger Reserve

FIELD FORESTER

PTR has had a strong conservation history and sound management over many years. For instance, it was famously credited for the effective management of forest fire through well-established communication systems in place, *i.e.* presence of fire watch towers at strategic locations and exchange of different light signals for effective communication during the night.

However, unfortunately situation in the reserve has deteriorated over the years, major contributors to that being left wing extremism and management negligence. Certain facts state, the forest staff was confined to 7-8 places leaving large areas unattended. The security scenario for wildlife was precarious leading to local poaching of prey base. Project Tiger Scheme was not being utilized fully leading to nonpayment of wages of trekkers. A chaotic situation developed with neglect of existing grasslands and check dams.

Under above narrated circumstances I was posted as Field Director in the month of September 2016. As the first principle of management initiative, I opened dialogue with all stakeholders for understanding the problems and implementing the approved Tiger Conservation Plan (TCP). All stakeholders were encouraged to open their minds to suggest solutions pertaining to planning the road map for improvement of conditions in PTR. A Whatsapp group 'Palamau Tiger Friends' was created with the same above purpose to have regular exchange of views. Wildlife experts interested in the welfare of PTR were associated from all over the country for free and frank interactive suggestions. Annual Management Effectiveness Evaluation (MEE-2016) was done for the first time to understand depths of situation and needs. Further the Memorandum of Understanding (MoU) between the Field Director and NTCA and between the Government of Jharkhand and NTCA was taken into account while planning the recovery of

PTR. Vision-2022 for PTR was prepared as per international mission of TX2-2022 *i.e.* to double the number of wild tigers by 2022 in consultation with WWF-India. To achieve this, various plans in supporting dimensions were developed, for instance: Security, Water Availability, Grassland Development, Fire Protection, Ecotourism/Eco-development and Awareness Plan. Jal Sansads were organized for participatory planning to harvest rainwater at potential sites and prepared a Water Availability Management Plan for a period of 3 years which was later revised to 5 years. Security Plan was prepared keeping local manpower in focus as they can venture out even in Naxal affected areas and provide security to the wildlife in the adverse situations prevailing in PTR. Similarly, Fire Control Plan was prepared for the first time in the history of PTR by involving local youths through Eco-development Committees and latest tools and techniques. Annual work programs of the above were strategically incorporated under different schemes such as the Project Tiger scheme sanctioned by National Tiger Conservation Authority, the CAMPA scheme sanctioned by State CAMPA Authority and the state plan scheme sanctioned by the State Government. For example, the security requirements such as wages for manpower, intelligence gathering, communications, etc were incorporated in Project Tiger Scheme while infrastructure needs of constructing anti-poaching camps were undertaken under CAMPA scheme. However, Security Plan, Augmentation of water bodies, Development of grassland and Eco-development and Awareness to reduce biotic pressure were considered as four pillars of management interventions, which are described in brief below.

1. Security Plan: Effective protection of the Wildlife

It becomes imperative to establish the protection camps at every sub beat level to ensure area domination through suitably

placed anti-poaching camps. Due to large scale vacancy in the Frontline Staff, *i.e.* Forest Guard and Forester (to the extent of 90%) and the presence of left wing extremism in the area, the tiger reserve field staff protection activities were restricted to a very limited area of the Betla Park and the protection camps were restricted to the range headquarters only, *i.e.* only 7 to 8 places, hence it was very difficult to have the area under effective control of the tiger reserve authority.

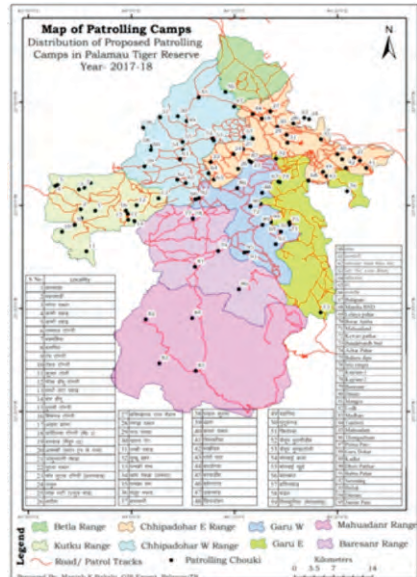
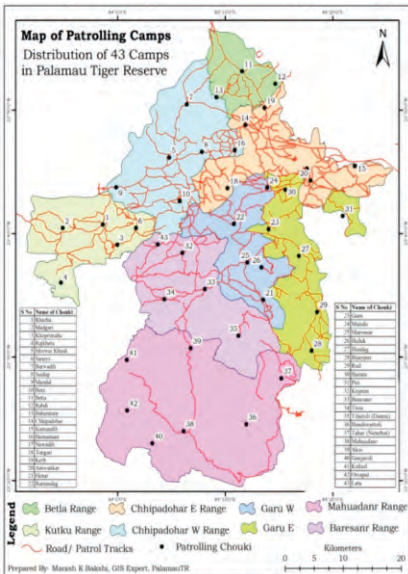
Looking into the seriousness of the problem we tried to establish patrolling camps at around 43 sensitive places with 4-5 persons at each camp in the financial year 2016-17. In the same year, the numbers of camps were increased to 131 against the target of 120 to cover the complete area by establishing or placing the patrolling camps at sub beat levels to ensure we have patrolling camps at every 10 km² areas for effective monitoring and protection. It was envisaged that the staff undertake the foot patrolling on daily basis while staying in the

camp during the night. We integrated GPS based patrolling to have virtual data access to the management authority on various issues such as illegal poaching, timber felling, quarrying, forest fire and any kill by the wild animal inside the forest so that the authorities can take remedial action on time.

Apart from the Trekker, Tiger Protection Force & Strike Force were engaged for long-range patrolling on every day basis and also act as quick response team to address the emergency situation in the park.

2. Augmentation of water bodies: Ensuring water availability

Our priority was to ensure water availability to wildlife throughout the year since PTR falls in drought prone area. We devised strategies to overcome the acute shortage of water in peak summer coupled with fire season. Jal-Sansad was conducted involving the local people to find out potential places where water harvesting structure can be constructed inside the Tiger Reserve Area.

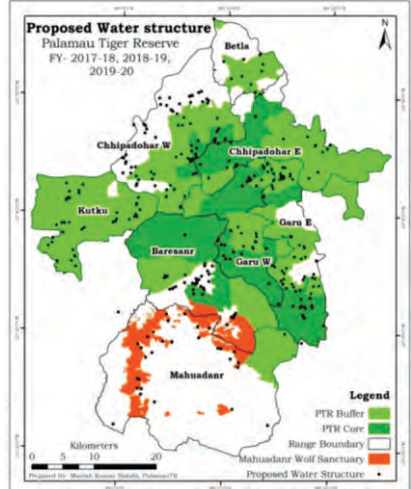
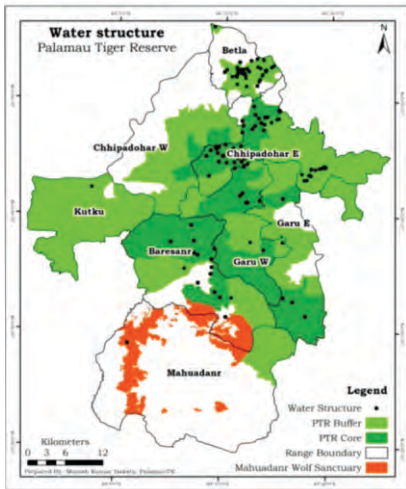


Map of existing and proposed Anti-poaching patrolling camps

FIELD FORESTER



Meeting with local community during Jal Sansad



Map of existing and proposed water structure

A comprehensive water harvesting plan has been prepared to construct 310 water harvesting structures and proposal has been submitted to the state Government. During 2016-17, distillation of 45 existing check dams and construction of 14 new check dams has been completed. During 2017-18 construction of 66 check dams was completed while construction of 75 check dams are proposed for 2018-19.

3. Scientific Management of the Grassland

Grasslands are the primary producers that play a very significant role in maintaining the efficient food chain and food web in the forest eco-system in general and national park and tiger reserve in particular. PTR has identified around 547 ha of forest land as a grassland but because of various reasons these grasslands were not maintained scientifically over a period of time. As a result of ecological succession they were gradually moving towards the woody nature leading to shortage of grassland habitat important for herbivores such as Bison, Chital, Sambar, Chowsingha, Barking Deer etc. These animals form the major prey species of the Tiger and Leopard in PTR.

To underline the significant contribution of grassland to the forest ecosystem and tiger reserves the PTR authority has taken effective steps to manage these grasslands scientifically as opposed to earlier. To realize the same, in the financial year 2016-17, a three-day Training program was organized at Betla for the field staff and Tiger reserve officials. Dr. Muratkar, Scientist, Melghat Tiger Reserve, Maharashtra, Grassland expert who is also advising the authorities of Kanha, Melghat and some other tiger reserves across the country had been invited to provide training on the scientific management of the grasslands. The training component included presentation and discussion and after having sufficient deliberation, brain storming

sessions in the classroom was followed by a two-day field visit.

The grasslands listed in the TCP amount to an area of 547 ha out of this, in 2016-17, an area of 200 ha was taken up for scientific management as per the guidelines made by grassland expert Dr. G.D. Muratkar, Besides, in 2016-17, 45 ha of new grasslands have been developed. In the financial year 2017-18, out of the total area of 547 ha covered by the listed grasslands, 362 ha were maintained and 115 ha were rehabilitated. Further, 270 ha of new grasslands were created in the same financial year.

4. Eco-development and Awareness

Community participation has been established as an effective tool in the management of forest and wildlife as recognized by the state govt. hence a provision has been made accordingly by the state government regarding the eco-development activities. That refers to, promoting the economic development of the local community, without destroying the structural and functional aspects of the forest and wild life, meanwhile maintaining the functional integrity of the eco-system. Eco-development by shaping a preparation of micro plan with the objective of sustainable development and promoting the service based economic activities such as eco-tourism, nature interpretation, tourist guides, eco-huts, home stay facility for the tourist and other small-scale industries which are based on minor forest produce.

This ensures minimization of direct dependency on the forest to a great possible extent, which in the long run helps control the man animal conflict, thus ensuring lack of purpose for revenge killing of wild animals.

During the last financial year 2016-17 the state government has sanctioned ₹ 94.0 lakhs to take up the eco-development activity among the community who are directly and indirectly dependent on PTR for their livelihoods.

FIELD FORESTER

Besides above four major initiatives, effective fire management was achieved in PTR for the first time in the history of PTR by involving local youths through Eco-development Committees and latest tools and techniques. Fire in PTR has always been a major concern. To involve local population in fire control, provision was made to give ₹ 75000 to each EDC for payment of honorarium of ₹ 5000 to 15 persons for the entire fire season from Feb-March to May-June. Satellite based fire alarm system was activated and made use to control the incidences of fire with the use of latest tools. Starting with the 2016-17 season, there was almost complete control achieved on fire breakouts in PTR.

As far as the road and railway track is concerned, Daltonganj - Mahuadanr - Netarhat - Ranchi State Highway break out from the Ranchi-Daltonganj NH-75 and pass through the Tiger Reserve, bisecting the core/CTR. Double line electrified railway line also transect through the tiger reserve. The frequency of these trains has increased on Barwadih-Barkakana section because of heavy transportation of coal and other minerals in this section. Approximately 90 trains cross this track in 24 hrs both Road and Railway issue divides the PTR into four parts lead to not only breakup of the tiger reserve habitat which itself has edge effect on the wild species such as Chital, Sambar, Tiger, Elephant, Bison, but also on various birds reptiles etc. It obstructs the free movement of both large and small animals/reptiles also leading to their accidental deaths. Looking at the unhappy situation as illustrated in the above discussion, it is necessary to take some of the steps in the wider interest of forest, wildlife and people at large.

- No more widening of existing state high-

way passing through the PTR starting from Dubiakhanr to Netarhat via Garu-Mahuadanr.

- Putting ban on movement of all commercial vehicles on the state highway from evening 06:00 pm. To morning 06:00 am.
- No more widening of the existing railway track and if possible, alternate new route should be found outside the Tiger Reserve so that no animals get killed due to accident.
- No addition of new trains in the existing track and its speed must be maintained as previously decided.
- Railways staff must not throw the railways garbage in the park area as it is strictly prohibited.

Such issues of importance were taken to the statutory steering Committee headed by the Chief Minister and meaningful progress is being made to mitigate the impacts due to the fragmentation of PTR habitat. To conclude: the existing framework for governance of tiger reserve in the country is excellent, what matters are that we only put this framework to correct implementation. The TCP for PTR was approved by NTCA but not being implemented on the ground. Schemes were designed and implemented even contrary to the provisions of TCP. The silvicultural operations were being taken up to enhance tree growth even though TCP provides for canopy opening by uprooting trees for growth of grasses and other shrubs. The meeting of Steering Committee was not held even once before. Similarly, provisions of voluntary relocation of villages from the core area were not implemented. The provisions of Memorandum of Understanding are very extensive and provide detailed framework for the governance of the tiger reserve. With the right spirit PTR should bounce back with atleast 12 tigers by 2022.



WILDLIFE MANAGEMENT

Protected Areas of Central India and Livelihood Issues of Nearby Community

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Livelihood issues of community living near five national parks and sanctuaries of Maharashtra state, mainly in the form of tangible benefits emanating from these cornerstones of regional biodiversity conservation

Generally, it is said that local communities are susceptible to the establishment of protected areas (PAs), particularly in developing countries since their livelihoods are lost (Rodgers, 1989; Gadgil, 1990; Mishra *et al.*, 1992). They pay indirectly not only by loss of access to resources - fuelwood, fodder and other non-timber forest products (NTFPs), but often by direct losses from crop and livestock raiding by wild animals coming out from PAs. The label of a protected area (PA) implies some restricted use of its resources (Hales, 1989). However, in the recent years it is being increasingly felt that PAs should play a role in sustaining local people's livelihoods (McNeely, 1995; Ghimire and Pimbert, 1997; Sekhar, 2003). It is increasingly recognized that PAs or natural areas are the cornerstone of global biodiversity conservation and prime destinations for nature-based tourism due to their unique biological, natural and cultural features (Ceballos-Lascurain, 1996; Whitelaw *et al.*, 2014). Keeping the theme of PAs supporting livelihoods of nearby community in view, five PAs of Central India namely Pench Tiger Reserve (PTR), Navegaon-Nagzira Tiger Reserve, Tadoba-Andhari Tiger Reserve (TATR), Bor Tiger Reserve (BTR) and Umred-Karhandla Wildlife Sanctuary (UKWLS) of Maharashtra state, were studied by the first two authors during the period April to June 2018 as part of their summer internship work. We have

estimated the annual income of local community from tourism activities, apart from agriculture during the year.

METHODOLOGY

We used surveys, using structured interviews and questionnaires; focused group discussions (FGDs), using semi-structured and un-structured interviews and finally we also gathered some information from various sources like reports, articles, websites, forest department and Satpuda foundation.

Surveys were conducted in and around various tourism gates of Pench, Tadoba-Andhari, Navegaon-Nagzira, Bor Tiger Reserves and Umred Karhandla Wildlife Sanctuary (Table 1).

Villages in which most households earn a majority of their living from participation in tourism activities, such as hospitality in nearby hotels/resorts, as gypsy drivers or guides were classified as tourism villages and non-tourism villages are those in which most households earn all of their income from agriculture only. Villages were classified at the time of field visits by having a discussion with the residents and the Sarpanch of the village. Random sampling as well as snowballing were used to form a sample size of 173 households from the 22 villages surveyed in the study area.

Tourism trend and corresponding effects

Tourism in the surveyed Tiger Reserves

FIELD FORESTER

is allowed in the form of safaris in the allowed tourism areas of the reserves, either on gypsies or other private vehicles. Higher the number of trips at a Reserve or Sanctuary, better the tourism. If the number of trips are higher, guides and gypsy drivers, who are paid on a per trip basis, get better income during a particular season. Fig. 1 indicates the comparative number of trips during the 2017-18 season, and hence, gives a fair idea of the comparative income of guides across the Tiger Reserves surveyed. Hence, in spite of every guide earning an amount of ₹ 300 per trip, the guides working at the Reserve with the highest number of trips earn the highest.

Tadoba-Andhari Tiger Reserve (TATR) received the highest number of tourists during the season, therefore the income to guides at TATR was the highest while it was the lowest to guides at Umred-Karhandla Wildlife Sanctuary (UKWLS) (Table 2).

The above income figures were calculated using data from the guides' FGDs, as well as data collected from the Forest Department regarding the revenue from tourism at the gates mentioned in Table 1. The number of trips were obtained from the total revenue at the gate and the amount given to the Department. The latter comprised of the fees for an average of three people, paying ₹ 180 each, the vehicle fees amounting to ₹ 440, and an average of camera and online fees amounting to ₹ 120 (Pench Tiger Conservation Foundation, Nagpur, 2018). Each guide receives ₹ 300 per trip, which is used to estimate the total income to guides at a Tiger Reserve or Wildlife Sanctuary. Apart from this official income, tourists also give generous tips to the guide on a favourable spotting. On an average, an amount of ₹ 250 to ₹ 300 is earned on the spotting of a tiger, while leopard spotting invites a slightly smaller tip

Table: 1
Gates along with type of villages

Sanctuary/Reserve	Gate	Tourism Villages	Non-Tourism Villages
Pench Tiger Reserve	Sillari, Khursapar, Kolitmara, Surewani, Khobala, Chorbauli	Sillari, Pipriya, Khursapar	Khapa, Usripur, Sawara
Tadoba-Andhari Tiger Reserve	Moharli	Moharli	Mudholi
Navegaon-Nagzira Tiger Reserve	Chorkhamara, Pitezari, Mangezari	Chorkhamara, Pitezari, Mangezari	Kotebarra, Bodalkasa, Balapur
Bor Tiger Reserve	Bordharan, Adegaon	Bori, Salaipevat, Adegaon, Gothangaon	Vihira, Dewli, Khappikhurad
Umred-Karhandla Wildlife Sanctuary	Karhandla	Karhandla, Thane	Tirkhura, Vanora

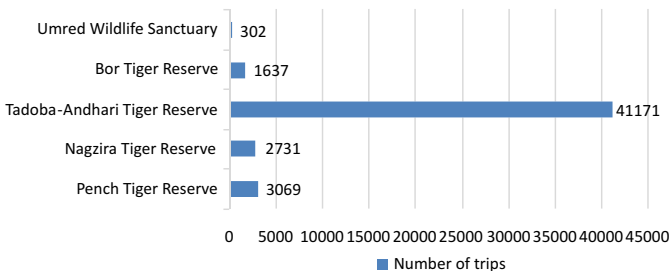


Fig. 1. Number of Trips at Reserves and Sanctuaries

Table: 2
Income of tourist-guides during the season

Tiger Reserve / Wildlife Sanctuary	Gates Surveyed	No. of Guides Surveyed	Number of Trips during Season	Total Income to Guides during Season (₹)
Pench Tiger Reserve	Sillari, Khursapar, Chorbauli, Khobala, Surewani	86	3069	9,20,783
Navegaon-Nagzira Tiger Reserve	Mangezari, Pitezari, Chorkhamara	39	2731	8,19,355
Tadoba-Andhari Tiger Reserve	Moharli	44	41171	1,23,51,254
Bor Tiger Reserve	Bordharan, Adegaon	45	1637	4,91,090
Umred-Karhandla Wildlife Sanctuary	Karhandla	28	302	90,740
Income of guides this season				14,673,222



of ₹ 150 to 200. On the higher side, guides at TATR have received tips amounting upto ₹ 2000, as compared to an amount of ₹ 500 at PTR (Personal communication with officials). Apart from monetary tips, the tourists sometimes also provide gifts such as cameras and books to the guides who greatly impress them.

The local community also finds a stable livelihood option in the hospitality sector. Employed as junior staff (such as cook, helper, waiter) and mid-management (like supervisor), the income of the employees

across various resorts around the tiger reserves of Maharashtra is shown in Table 3.

From Table 3, it is clear that about 283 people earn ₹ 2,08,92,300 (USD 310197) per year from being employed in the hospitality industry near these reserves, alongwith their income from agrarian activities. Agriculture on an annual basis provides the following structure of income to all villagers in the areas surveyed (Table 4).

DISCUSSION

PAs can generate substantial economic benefits through sustainable use of

FIELD FORESTER

Table: 3
Impact of Hospitality on Community

Tiger Reserve / Wildlife Sanctuary	Number of Resorts Surveyed	Number of people employed from community	Income to local community (₹)
Pench Tiger Reserve	8	106	93,22,500
Nagzira Tiger Reserve	7	35	27,94,800
Tadoba-Andhari Tiger Reserve	7	58	35,94,000
Bor Tiger Reserve	3	23	18,75,000
Umred Wildlife Sanctuary	5	61	33,06,000
Total income to community from hospitality			2,08,92,300

Table: 4
Agricultural income of non-tourism villages

Tiger Reserve/Wildlife Sanctuary Around the Villages	Crops cultivated	Income per annum (₹)
Pench Tiger Reserve	Tur Dal, Paddy, Cotton	2,90,36,146
Nagzira Tiger Reserve	Tur Dal, Paddy, Cotton	1,32,10,890
Tadoba-Andhari Tiger Reserve	Tur Dal, Paddy, Cotton	1,80,22,435



biodiversity to local communities in many ways. One such potential way is wildlife tourism. Tourism in PAs in India has changed from a few hundred visitors to several thousands in recent years (Sekhar, 2003; Panwar, 1996). The above information provides a true picture about the economic benefits accruing to local villagers engaged in tourism activities besides agriculture. Table 4 shows income per annum from crops

cultivated in the seven non-tourism villages, namely; Khapa, Usripur and Sawara (Pench Tiger Reserve), Mudholi (Tadoba-Andhari Tiger Reserve) and Kotebarra, Bodalkasa and Balapur (Navegaon-Nagzira Tiger Reserve). Market rates and average landholding of these villages were taken into account to calculate the income per annum. Therefore, in these non-tourism villages, the overall annual agricultural



income of around 815 households comes around ₹ 60,269,471.

In order to find out the relevance of tourism activities resulting in a better livelihood opportunity to villagers, we compare the annual income arising out of tourism in the villages around the same three tiger reserves, namely, Pench Tiger Reserve, Navegaon-Nagzira Tiger Reserve and Tadoba-Andhari Tiger Reserve with the annual agricultural income that has been estimated above. The tourism income is nothing but the income of the guides (Table 2) and from the hospitality income of the three reserves (Table 3), which amounts to ₹ 29,802,692. This figure is about half of the income arising from agriculture *i.e.* 49% of the agricultural income. The above results clearly show that with almost half the effort, and in lesser time, villagers earn a fairly handsome amount of income from tourism activities, while also earning from agriculture at the same time.

Several case studies have suggested that the relationship between tourism and livelihood issues (Croes and Vanegas, 2008; Hall, 2007; Harrison, 2008) are dynamic, complex and no single framework can be

constructed to examine these two aspects (Nyeupane and Poudel, 2011). In present case study, we have found that if tourism activities are further invested in and more community people are trained for the same, then the people of the Vidarbha landscape in Maharashtra state cannot only benefit from another comparatively more stable source of income, but may also overcome uncertainty in agricultural field arising out due to any natural calamity like drought.

ACKNOWLEDGEMENTS

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WILDLIFE MANAGEMENT

Sarus Crane (*Grus antigone*) Habitat Restoration at Nawegaon National Park

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The article narrates restoration of degraded lake ecosystem in Nawegaon National Park, Maharashtra

Nawegaon National Park declared in the year 1975 having an area of 133.88 sq km, is a part of Nawegaon Nagzira Tiger Reserve (NNTR) located in Gondia and Bhandara District of Maharashtra. Nawegaon National Park got its name from the famous Nawegaon bandh lake which was constructed some 500 year

ago by two brothers Kolhu and Chimna Patil, providing water to 5 villages and serving as home for various aquatic resident as well as migratory bird species and fish species. 3.5 km bank of lake is included in National Park area. Nawegaon lake was once a feeding and breeding ground for the giant Sarus crane (*Grus antigone*). Once



Before removal



Manual removal



Removal with tractor



Removal with bush cutter

FIELD FORESTER



Area after clearing of Ipomoea



Plantation of aquatic flora

Shri Madhavrao Patil Dongarwar sighted 32 pairs of Sarus crane at Nawegaon bandh.

Over the years, the preservation maintenance of water bodies lost its importance as not enough attention has been given. Because of negligence, various weed species specially Ipomoea encroached bank of Nawegaon bandh lake destroying aquatic ecosystem resulting in disappearance of Sarus crane (*Grus antigone*) and various species of fishes.

Conservator of Forest and Field Director, NNTR Shri R.M. Ramanujam and his team have decided to take the challenge and restore habitat of Sarus crane (*Grus antigone*). On World Forestry Day the restoration operation was started at

Ranjhicha Tok Camp of Nawegaon National Park. First attempt was done to remove weeds manually with the help of volunteer of NGO, Students, Staff, Labour but it was not successful as the roots of Ipomoea were coiled and deep in soil. Then grass cutter / bush cutters were used to remove the Ipomoea. It was also cumbersome and time consuming. Then Ipomoea was removed by using tractor with plough and total 90 acre area was cleared of Ipomoea within a time period of two months.

On the cleared soil, aquatic flora was planted by doing ecological studies with the help of specialist in botany Dr Kahalkar and water bodies restoration expert Shri Manish Ranjankar and Shri Patiram Tumsare. Planting was done in three zones, 1st zone near the water level Chaura (*Nymphaea cristata*), Gadh (*Eleocharis dulcis*) species were planted after that Devdhan (Wild rice) was planted and at third level near the road Khus grass (*Vetiver zizanoides*) was planted. Soil mounds with *Acacia nilotica* plants were constructed for nesting and snag trees were erected for perching of birds.

Some plots were left undisturbed to study the natural regeneration process. With this effort, the whole area has grown into a beautiful aquatic habitat. Animals started



Birds perching on Snag trees

using water body which was earlier inaccessible for them due to thick root growth of *Ipomoea*, birds both resident and migratory visited the lake and hope one day Sarus crane (*Grus antigone*) will also visit and nest in Nawegaon bandh.

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- Shri L.S. Chole, Forest guard, Nawegaon National Park.
- Shri Manish Ranjankar and Shri Patiram Tumsare.



WILDLIFE MANAGEMENT

Pygmy Hog Breeding and Research Centre – A Tale of Dramatic Comeback

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Pygmy hogs are very sensitive animals and habitat loss has affected them more than anything else

Pygmy hog is a critically endangered species of Suidae family, which in the earlier period was spread across Bhutan, India and Nepal. Now it is found only in India, being endemic to the state of Assam. It was thought to have become extinct in the 1960s. However in 1971 it was re-discovered with a small population in the Barnadi Wildlife Sanctuary of Assam. Prior data analysis did put the current world population at approx less than 500 individuals only in the wild.

However, on a positive note, we can say that recent conservation measures has improved the depleted situation and also the prospects of survival is raised, thereby restraining a check on the gloomy state of these critically endangered species.



Let's meet them

The scientific name is *Sus salvanius*, commonly known as Pygmy Hog, belonging to family Suidae. They are listed under IUCN as critically endangered species. It is the smallest among wild pig species, much smaller than a wild boar with 60-65 cm in length, 25 cm in height and 8-9 kg in weight; females being even smaller. It gives births to 4-5 babies a year and weight at the time of birth merely 150 grams. They breed only once a year with babies generally born between April and June. They tend to live in small groups and are omnivorous in nature.

Conservation Program

Once it was a pity to acclaim the fact that these shy creatures are extinct. It got a new lease of life when the 100th captive breed of pygmy hog was re-introduced into the wild in 2016. The credit for such a turnaround is attributed to conservationists Mr Goutam Narayan and Mr Parag Deka.

What is PHCP?

The Pygmy Hog Conservation Program (PHCP) is a collaborative project of Durrell Wildlife Conservation Trust, Assam Forest Department, MoEF&CC, International Union for Conservation of Nature (IUCN) / Species Survival Commission (SSC), Wild Pigs Specialist Group (WPSG) and Aaranyak (A Guwahati based Institute as local partner). While efforts, in the form of a conservation survey began in the late 1970s, the PHCP took off in 1995.

Objectives of Conservation Action Plan (under PHCP)

- Re-introduction of species in sites from where they disappeared.
- Upgrading protection status of such selected sites.
- Re-introduction of viable number of pygmy hogs for long time survival in wild.
- Monitoring of re-introduced species as well as habitat management practices.

The story so far

The project began with six wild hogs which were captured from Manas National Park, Assam for captive breeding. Among the six, there were three adult females who were in the mid-term of their pregnancy. The hogs were taken to a custom-built research and breeding centre in Guwahati, Assam, where the females gave birth to 13 young in 1996. The next year it grew by another 24, by the year 2001 steadily to 77, with 2016 releasing the 100th from pre-release facility. As the entire global population of the pygmy hog was in one site, and also because of the

steady increase in their numbers, it was inevitable for another breeding centre to take the stage which took the form of the breeding centre in Potasali Range, near Nameri National Park.

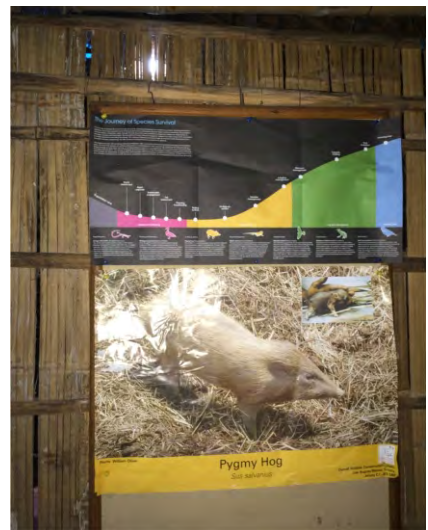
Thereafter, three re-introduction sites were selected viz., Barnadi Wildlife Sanctuary, Orang National Park, and Sonai Rupai Wildlife Sanctuary.

Breeding centre at Nameri NP

- It is a pre release facility
- A total number of 36 pygmy hogs are stationed
- Previously managed by Durrel Foundation but now under supervision of Aranyak NGO
- Department of forest is not managing directly

How can we save them?

Pygmy hogs are very sensitive animals and habitat loss has affected them more than anything else. Due to their selectiveness of high degree as far as habitat is concerned, they are not able to survive if it is jeopardised or degraded. So it is extremely



A frontal view of the breeding centre situated in Nameri NP

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essential to protect tall grasslands, which is their habitat. Only after restoration of their habitats can one think of releasing these captive bred animals.

Where do we stand now?

The conservation program directed to protect the elusive species that started way back in 1995 with the incorporation of PHCP has indeed come a long way. These animals are very much confined to limited area, purely endemic to the State of Assam and hence it was vital to protect an indicator species like them.

The efforts of many pioneer conservationists, international organisations, NGOs as well the State Forest Department of Assam has definitely brought some ray of hope for these elusive species who were pushed to the

brink of extinction. A lot of work still remains in terms of preserving the habitat that triggered the oblivion. But it will not take away the credit from those who were involved and who acted promptly after gauging the pathetic nature of a species that may go extinct in the wild. The release of 100th pygmy hog in the year 2016 will go as a landmark event as those tiny steps will culminate into a giant step for conservationists.

We can say that all hope is not lost. The progress has been steady, no doubt with varying degree of success. But the brighter side is that once a species which was assumed to be extinct in the wild has been revived. This is a dramatic turn around and can be regarded as one of the best success stories in the history of Assam.



WILDLIFE MANAGEMENT

Management of Hard Ground Barasingha in Kanha National Park: A Famous Eco-tourism Spot of India

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Article deals with the problems and consequences of overgrazing on the population of Hard Ground Barasingha in Kanha National Park and the measures taken by the administration of KNP to improve its habitat

Kanha National Park (KNP) was created on 1st June 1955 as the largest National Park of Madhya Pradesh, spread across 1945 sq km. It is also known as Kanha Tiger Reserve (19% of India's and 10% of world's tigers reside over here). It is one of the best managed parks in Asia and is respected for saving and conserving Barasingha from extinction. It is the most recent home to Hard Ground Barasingha (HGB).

Barasingha (Swamp Deer) is the state animal of Madhya Pradesh. It is extinct in

neighbouring countries like Bangladesh and Pakistan. In KNP, its population drastically decreased to 66 in 1970 from 3,000 in 1938 due to excessive overgrazing by its competitors (mainly Spotted deer and Sambar) which led to loss of food and habitat of HGB. Various conservation methods like habitat improvement and captive breeding have helped to increase the number of individuals of HGB to around 700 in 2018.

The present article is based on the personal observations in Kanha National



Fig. 1. Deer antlers' Arch at KNP

FIELD FORESTER

Park during Safari followed by personal communication with Mr M. Krishnamoorthy (Director, KNP), Mr S.K. Khare (Assistant Director, KNP) along with literature review.

Barasingha

Barasingha (*Rucervus duvaucelii*) means twelve-tines (Fig. 2). It is a large deer with shoulder height reaching up to 1.2 m. Average length of antlers is 76 cm and girth is around 13 cm at mid of the beam. Females are paler and lighter as compared to males. In the IUCN red list, it is categorised as an endangered species. At present, they are found in Madhya Pradesh, Assam, Uttar Pradesh and Utrakhand states of India.



Fig. 2. Hard Ground Barasingha



Fig. 3. Spotted Deer

Barasingha and its Competitors

HGB shares its habitat with *Chital* (Spotted deer) and *Sambar* (Fig's. 3 and 4). However, the pattern of utilization differs, reducing their competition for food. Barasingha shows a preference for aquatic plants and often wades into water, frequently dipping its muzzle to feed on water plants. Males very often wallow in shallow muddy pools during the rutting period in winter. Table 1 compares HGB with its competitors (Spotted deer and Sambar).

Problems and Issues

1. Encroachment of woody species (mostly *Butea Monosperma*, *Shorea Robusta*, *Lagerstroemia parviflora* and *Diospyros melanoxylon*) in grassland led to decrease in the grazing area of HGB and its competitors. HGB, being food selective animal, suffered more due to lack of distinctive grass species.
2. After birth, fawns of HGB take 24-48 hours to stand and walk. Tall grasses provide protection to fawns from their potential predators (tigers, leopards and jackals). Overgrazing led to decrease in area of tall grasses which made HGB



Fig. 4. Sambar

Table: 2

Parameters	Barasingha	Competitors
Food habits	<ul style="list-style-type: none"> Grasses, aquatic plants and leaves Drink at least twice a day during the summer season (Choudhary, 2018) Prefer grasses and leaves above neck height 	<ul style="list-style-type: none"> Feed on short, sprouting grasses Consume grasses less than 4 tall (Axis Deer or Chital Deer, n.d.)
Habitat	<ul style="list-style-type: none"> Swampy grassland and flood plains (Rawat, 2013) Prefer tall grasses and open habitats 	<ul style="list-style-type: none"> Open deciduous forests and grass lands (Discover the ungulates around the world, n.d.)
Movement of Fawn	<ul style="list-style-type: none"> Takes 24 to 48 hours to walk Need care and protection 	<ul style="list-style-type: none"> Starts walking within 1 hour

difficult to protect their young ones, which made them susceptible to their predators.

- Overgrazing led to loosening of soil. During heavy rain, loose soil got transported as silt to nearby water bodies, which decreased their depth. Concomitantly led to drying up of water bodies, which in turn decreased their food availability of aquatic plants.
- HGB is basically graminivorous and feed on few selected grasses, leaves and aquatic plants. Launch of Project Tiger also facilitated elevation in population of Spotted Deer and Sambar as prey of tiger. The expansion in population created heavy competition for grazing among them. (Shukla, 2011).
- Overgrazing by domestic cattle of local community also increased competition for food.

Management and Improvement Techniques

- Eradication of non-palatable grasses / shrubs (mainly *Casia tora*, *Lantana camara*) and prevention of woody species (*Butea Monosperma*, *Shorea Robusta*, *Lagerstroemia parviflora* and *Diospyros melanoxylon*) from growing in the grassland.
- Plantation and maintenance of tall grasses by sowing seeds of palatable and perennial grasses. It acts as fawning cover for the HGB.

- Creation of artificial ponds for providing swampy and marshy habitat. It serves as an advantage for HGB because its competitors do not feed on aquatic plants.
- Grasslands are monitored with the help of space inputs and series data from Landsat-MSS, ETM, IRS-LISS-III of tree species. (J. S. Parihar, 2013)
- Grazing of cattle was restricted only to Buffer zones.

A small area of the park is fenced with barbed wire where indigenous and fast-growing varieties of grasses are grown artificially. HGB were kept in this area for feeding and fawning. The area also protects the fawns from predators as no other animals were allowed to enter the area. This technique is known as *Enclosure Technique*. It helped in revival of grasslands and HGB.

CONCLUSIONS

Grassland is one of the most important primary producers which helps in regulating the food web. It also provides habitat to wild life. The continuous effort of the administration of KNP in implementing different scientific techniques like captive breeding, enclosure technique, etc. have helped in maintaining the food web of KNP. It has also helped in maintaining the population of all indigenous species of the park. Till December 2018, the number of individuals of HGB has increased to 700 from 66 in 1970.



Fig. 5. Barasingha Enclosure

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WILDLIFE MANAGEMENT

Rhino on the Highway

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It becomes apparent from the results of the study that National Highway - 37 and associated impacts of vehicular traffic, ancillary developments and their related influences have resulted in the direct and indirect impacts on habitat use and movement of Rhinos within Kaziranga and Karbi Anglong landscape

Kaziranga is located between latitudes 26°30'N and 26°45'N, and longitudes 93°08'E to 93°36'E within two districts in the Indian state of Assam the Kaliabor subdivision of Nagaon district and the Bokakhat subdivision of Golaghat district. The park is approximately 40 km in length from east to west, and 13 km in breadth from north to south. Kaziranga covers an area of 378 km² with approximately 51.14 km² lost to erosion (ID, 2003). A total addition of 429 km² along the present boundary of the park has been made to provide extended habitat for increasing the population of wildlife or, to serve as a corridor for safe movement of animals to Karbi Anglong Hills. The elevation of the KNP ranges from 40 m to 80 m. The average humidity ranges 65% and 95%. Average temperature ranges from 5 to 37°C. The park area is circumscribed by the Brahmaputra River, which forms the northern and eastern

boundaries, and the Mora Diphlu, which forms the southern boundary. Other notable rivers within the park are the Diphlu and Mora Dhansiri.

The Park is a home to about 60% of world's population of the India one-horned rhinoceros (*Rhinoceros unicornis*); about 50% of the world's population of the endangered Asiatic wild water buffalo (*Bubalus arnee*) and has only viable population (about 400 animal) of Eastern swamp deer (*Rucervus duvaucelii*) in the North Indian region. Its major conservation success has been the increase in numbers of Rhino. A few were recorded when the park was first established, with population counts recovering to 366 in the first survey in 1966, 1,552 in 1999 and recent census recorded 2505 in 2012 (Forest Department, 2012).

National Highway - 37

The 54 km length of the National



FIELD FORESTER



Highway (NH) 37 runs parallel on the southern boundary of Kaziranga National Park (26°34' to 26°46'N and 93°08' to 93° 36'E), between Bokakhat to Ghorakhoti range divides the landscape between the low-lying grasslands in the north and the elevated Karbi Anglong hills in the south.

The highway is 7.5 m wide paved road and has a range from 60 to 90 m above sea level.

During rainy season because of flood inside the Kaziranga National Park forces the wild animal to move southwards to elevated grounds, many wild animals are killed by vehicles while attempting to cross



NH-37. Hog deer, fishing cat, civet, swamp deer, hog badger suffer maximum mortality. The park managers have identified 4 crucial animal crossing corridors (Gorikhat, kanchanjuri, Haldhibari, Panbari) on the NH-37 and have implemented several measures to reduce animal mortality including road signage, terrain easements, rumble strips, road awareness campaigns, intensive night patrolling and regulation of vehicular traffic. These corridors are frequently used by mega mammals like the elephant, water buffalo rhinos, tiger, leopard and the hog deer.

Physical features

The KNP is 40 km wide. It lies in the flood plains of Brahmaputra River, sloping very gradually from east to west against a backdrop of foothills and snow covered peaks of Eastern Himalayas. The riverine habitat consists primarily of dense tall grassland inter-spaced with open forest, interconnecting with streams and numerous small flood-formed lakes or bheels which cover some 5% of the park area. The whole park can be flooded for 5-10 days, and three-quarter of Baguri area in the West is submerged annually. A low range to the south, the Karbi-Anlong Hills, provides a

refuge during flood. The soils are alluvial (Spillet, 1966).

Background

The Greater One-horned Rhinoceros populations are increasing overall due to strict protection, especially in India. However, some populations are decreasing, especially in Nepal and parts of northeastern India. The species is currently confined to fewer than ten sites, with a total extent of occurrence of less than 20,000 km². There is a continuing decline in the quality of habitat, projected to continue into the future, which, if not addressed, will affect the long-term survival of some of the smaller populations, and could jeopardize the further recovery of the species.

The primary aim of the study is to evaluate if the road is a limiting factor for Rhinos in the use of their habitat along the road or does the road restricting the movement across alternate habitats and how best the dispersal of animals can be facilitated across its different functional habitat in a highly developed landscape with road contributing significantly to the modification.

FIELD FORESTER

Objective of study

Followings are the specific objective of the study:

- Assess impact potential of road reflected from traffic volume: Rhinos use roadsides as their habitat so there is every possibility of getting disturbances from the noise created by the vehicles.
- Assess must of roadside used by rhinos and behavioral response: Aimed to assess the suitable habitats that are used by rhinos and their behavioral responses to different levels of traffic volume.
- Suggest measures to minimize the road related impacts on rhino: Aimed to suggest remedial measures to minimize road related impacts on the endangered pachyderm.

Methodology

Assessment of traffic volume

Traffic related information was generated for assessing the peak traffic volume and peak travel time. Vehicle related information was collected by undertaking continuous monitoring over 3 days on the roads section passing along the Kaziranga National Park. Information on number of different type of vehicles (motor cycle, car, tempo, bus and truck) passing through the specific road section was recorded.

Road side habitat used by Rhino

The National Highway-37 is cutting through four animal corridors (Panbari, Haldibari, Kanchanjuri and Ghorakati). During the study period, three corridors (Panbari, Haldibari, Kanchanjuri) were monitored during 5 am to 5 pm. Data was collected based on presence and diurnal movements of Rhino. Each corridor was monitored continuously for one day. Additionally, secondary information about Rhino presences/movements during night time was collected from secondary sources (local people and the forest guards). The information about the group size, habitat

type and specific locations (GPS location) of the animal was recorded.

RESULTS AND DISCUSSION

The national highway NH -37 joins the western region of the state to its eastern side. It passes through the landscape of Kaziranga and Karbi Anglong, starting from km 326 + 500 to 387 + 650, a total of 61.150 km. There are identified places which act as animal crossings between the two regions of Kaziranga- Karbi Anglong landscape. These have been designated by highway authorities as low speed zone for vehicles. Despite this the animals do not always use the various designated crossings (Panbari, Haldibari and Kanchanjuri) while going from one region to another. During the study, various factors that are likely to influence the use of habitats by rhinos within these identified corridors were explored. These included volume of vehicular traffic on the road, characteristic features of the different corridors, anthropogenic factors operating in the area, changes induced in use of wildlife habitats as represented by animals sightings. These factors are discussed below.

Traffic volume

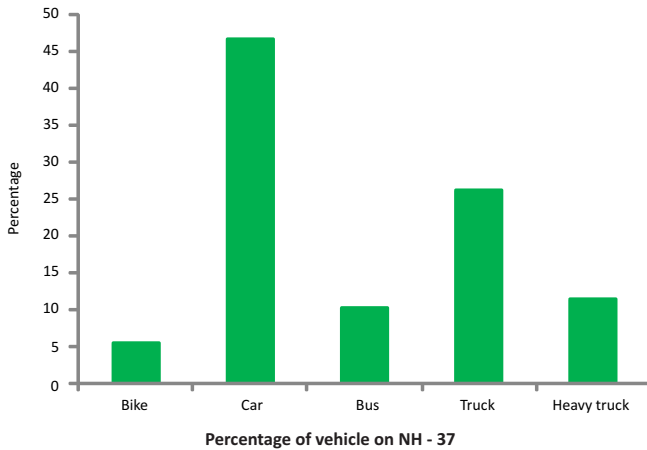
Based on monitoring of vehicular traffic on National Highway-37 for three consecutive days the average number of vehicles in one category and total number of vehicles in all categories was calculated.

It was observed that the average traffic on NH-37 was 5,247 per day. During the survey it was observed that the maximum traffic pressure was contributed by small cars (n = 2189) and followed by trucks (n = 1227).

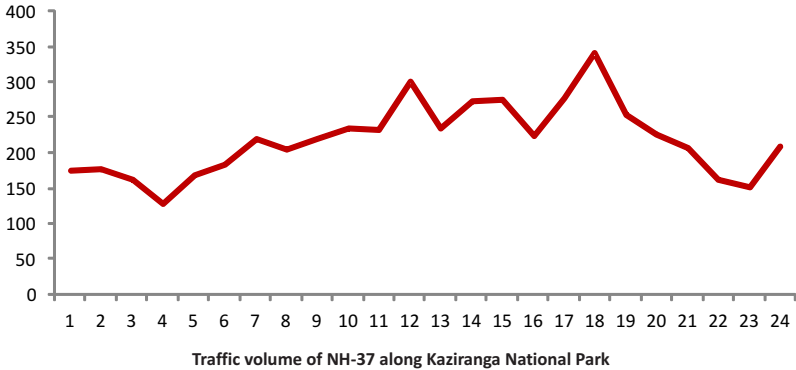
Traffic also varies with different time of the day. It was observed that, during the evening time (5-6 pm) the traffic recorded was maximum (n = 342) and during 3-4 am, the traffic was minimum (n = 128). The drivers preferred driving different time for driving different vehicles. It becomes

Number of vehicle plying on the NH - 37 on a given day

Time	Bike	Car	Bus	Truck	Heavy truck	Trailer	Total
1	0	30	23	50	36	19	176
2	0	30	45	38	40	7	178
3	0	31	40	27	38	8	162
4	0	21	20	34	30	5	128
5	4	57	17	41	27	5	169
6	4	74	4	50	28	5	183
7	5	108	2	74	12	1	220
8	20	88	14	48	15	2	205
9	16	107	21	48	8	1	219
10	19	122	22	50	0	4	235
11	21	114	30	44	6	0	233
12	21	165	23	68	6	1	302
13	14	135	34	28	6	0	235
14	22	151	32	41	8	2	274
15	15	150	20	57	15	0	275
16	17	104	18	55	8	4	224
17	19	143	15	57	20	5	277
18	13	158	15	83	43	12	342
19	23	108	8	51	37	9	254
20	12	85	3	62	38	9	227
21	5	79	12	55	26	12	207
22	1	50	10	42	33	8	162
23	1	36	14	54	26	2	151
24	2	43	36	70	29	11	209
Total	254	2189	478	1227	535	132	5247



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evident from Table: that the movement of heavy trucks and trailers occurred during the night time and early morning. On other time in the single day, the cars and bikes remained the dominant type of vehicles on the road. Numbers of buses on the road was almost homogenous with almost no distinction between night and day time frequency and numbers. The results show that the number of small cars (46%) was highest. The high tourist pressure, in Kaziranga which is a site of International Importance can be a factor influencing the use of small cars. Further the National Highway 37 is a state highway that connects different districts. It is the main route of transportation and provides a link between central Assam and Upper Assam. The Gas Cracker Project By BCPL in Lepetkota may have fueled the increasing numbers of Trucks as the equipments and raw materials for construction are generally transported from Guwahati via this route by heavy vehicles such as trucks.

Habitat use

The three corridors (Panbari, Haldibari and Kanchanjuri) were surveyed to assess the habitat used by the animal specially the one horned rhinoceros. No of animal sightings along the road at specific hour of the day was taken as a criterion for evaluating of habitat use by the Rhino. Table 2 provides the summary of the characteristic features of the different corridors surveyed

during the study, their use by wild animals and by rhinos in particular and factors that undermine the effective use of these movement corridors.

Based on this, it was found that the Kanchanjuri was the most used habitat by rhino and other animals. Number of Rhino sightings in Kanchanjuri corridor varied between 1 to 3 individuals per survey. During the early morning when the traffic was low, the sightings were more but as the day progressed and traffic increased, number of rhino sightings became relatively less. This could be associated with the fact that this area has tall grasses and adequate sources of water to make this relatively more preferred habitat for rhinos. Further, the areas preferred by Rhinos as grazing areas, are located away from the highway.

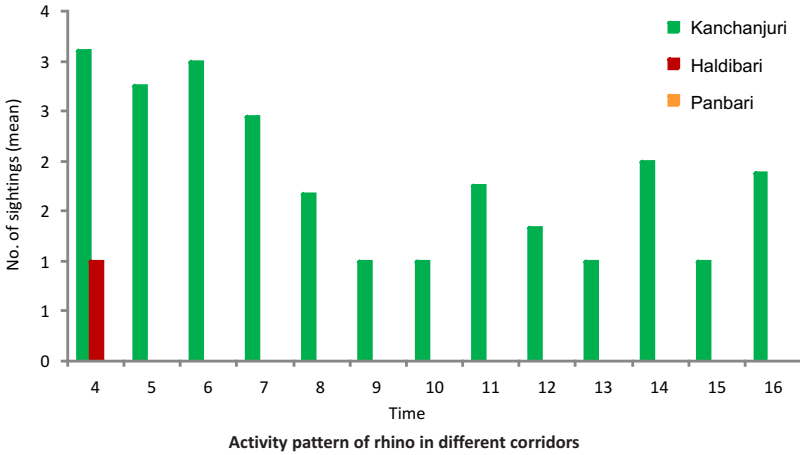
Animals sighted in Kanchanjuri corridor

In Haldibari and Panbari areas, the increasing biotic pressure is one of the major reasons of very rare sighting of rhinos. During the entire effort of assessing the use of Haldibari corridor, only one Rhino was sighted along the road. The location of *Burhi-ai-than* temple in Haldibari corridor That attracts large no of worshippers and a feat of vehicles that remain parked near the temple pose a source of disturbance that perhaps prevent the rhinos from using this area (Fig. 12). This corridor is completely non functional during day time.

Key feature of corridors

Corridor	Location	Key features	Animal sighting	Rhino sighting	Anthropogenic pressure	Remarks
Panbari	26°36'52.59"N 93°30'15.76"E	The Panbari corridor comprises of 3 tea gardens and 7 villages. This corridor connects the Kaziranga National Park in the north with the adjoining forests of the Karbi Anglong hills in the south. A stretch of about 4 km of NH-37 is cutting this corridor	Only Domestic animals like cow and goats were sighted during field work	No Rhino was sighted in this corridor	This corridor receives high anthropogenic pressure that is contributed by grazing, stone quarries, stone crushers, illegal NTFP, timber and bamboo collection.	This corridor is highly disturbed due to anthropogenic activity. Immediate effort is required to restore the connectivity between Kaziranga National Park and Karbi Anglong hills.
Haldibari	26°35'5.39"N 93°19'54.89"E	The Haldibari corridor consists of 5 th and 2 nd addition of Kaziranga National Park. A stretch of about 2 km of NH-37 is passing through this corridor	During field studies animals like Elephant Hog deer Were sighted in this corridor.	Only one rhino was sighted in this corridor during field work.	Burhi-ai-than temple is located in this corridor, congestion of vehicles in front of the temple serve as a physical barrier, discourage, and rather annoy the wild.	This corridor is rarely used during the day time and sparingly used during night time.
Kanchanjuri	26°34'25.10"N 93°10'44.01"E	The Kanchanjuri corridor represent the area included under the 4 th addition of the Kaziranga National Park. It is located in Nogaon district. This corridor connects the Kaziranga National Park in north with Bagger RF adjoining the foothills of Karbi Anglong. About 6km of NH-37 is running through this corridor.	Groups of wild boars, herds of water buffaloes, hog deers, were most common sights in this corridor during the field work. An elephant herd was also sighted in this corridor.	It is the corridor where maximum numbers of Rhinos were sighted.	Local people use this corridor for grazing their cattle's. This leads to heavy decline in grazing cover for the wild animals.	During field work it was found that this was the most often used corridor by wild animals.

FIELD FORESTER



During the survey of the Panbari area no animal was sighted. Considering that this corridor has high anthropogenic pressure like grazing, stone quarries, stone crushers, illegal NTFP collection, timber and bamboo collection, the use of the habitat by rhinos is seriously constrained. In addition, to these biotic pressures, 3 tea gardens and 7 villages located in this corridor further restrict the use of the corridor by Rhinos. These factors cumulatively contribute to a near permanent barrier for the wild animal using this area. This corridor is only functional during the monsoon.

Activity pattern

Animals vary in their activity profile over different time of the day. During the present study it was observed that during early morning time more number of animals were sighted particularly from morning 4 am - 6 am (Fig. 14). Pearson correlation was performed to see the relationship between traffic volume on NH - 37 and no of sightings of the animals on the corridors. The results show that the road side use of habitat by rhinos is negatively correlated ($r = -0.708$) to traffic volume on the road. It means that when traffic pressure was high, sightings were minimal and vice versa. The variations in sightings were also seen to vary with the

timings. Maximum sightings were observed during 4-5 am which corresponded with low traffic.

Activity pattern of rhino in different corridors Anthropogenic pressure operating in the road corridor

There are several sources of biotic pressures on the wildlife corridors. These predominantly include impacts of unregulated tourism owing to the World Heritage status of Kaziranga National Park. In addition to these, increasing pressures of cattle grazing, operation of stone quarries and crushers, illegal collection of NTFP, timber and bamboo, human habitations and tea gardens compound the intensity of anthropogenic impacts that reduce the habitat integrity and use by rhinos.

CONCLUSIONS

It becomes apparent from the results of the study that National Highway - 37 and associated impacts of vehicular traffic, ancillary developments and their related influences have resulted in the direct and indirect impacts on habitat use and movement of Rhinos within Kaziranga and Karbi Anglong landscape. One of the key impacts of National Highway-37 is the avoidance of habitats. This avoidance of habitats is intensified by barrier impacts of

roads and road induced secondary developments in crucial movement corridors.

During the study, only one movement corridor (Kanchanjuri) was observed to be utilized by rhinos. Habitats in the other two corridors-Panbari and Haldibari are not being utilized by Rhinos. Since Karbi Anglong is a high altitude region, animals cross NH - 37 during flood and stay there till the water in Kaziranga National Park dries down. The highway authorities have identified various places which act as animal crossings between the two regions of Kaziranga- Karbi Anglong landscape. This is necessary for maintaining the biological balance of the park. In spite of construction of such corridors and other steps taken for construction of road signage, terrain easements, rumble strips, road awareness campaigns, intensive night patrolling and regulation of vehicular traffic, animals do not always use the crossings while going

from one region to another. This has serious implications for rhinos and other large bodied animals during monsoon when three quarters of the Western reaches of the Kaziranga National Park is flooded and animals get drowned due to the inability to cross the road.

While the afore mentioned concerns call for more focused studies to understand the various dimensions of progressing developments in transportation and other sectors for their implications for conservation of wilderness values of Kaziranga National Park, this short term study has only triggered the interest and need for such study.

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WILDLIFE MANAGEMENT

The Jumbo Issue

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Harassment of foresters by local people is becoming common during elephant depredation in South Bengal. This behavior of some villagers increases damage and number of human death caused due to intervention in elephant driving by the forest officials

Elephant consumes enormous quantity of plant fodder estimated at 1.5% (dry weight) of its body weight. Any average elephant weighing 1.8 tons requires 27 kg dry (about 108 kg fresh) matter daily. Home range of elephant is between 100 to 500 sq km depending upon the habitat factors (Sukumar, 1986).

Habitat loss, degradation, fragmentation, conversion, and resource exploitation due to human activities result in alterations of the extent and spatial configuration of habitats available for wild species. Especially in tropical forests, habitat fragmentation often restricts wild fauna to habitat 'islands'. Wide-ranging animals, exemplified by species such as Asian elephants (*Elephas maximus*) and African elephants (*Loxodonta africana*), are threatened by many human activities. For Asian elephants, large scale conversion of forests to mono-culture plantations, crop-lands, and developed areas, has drastically reduced and fragmented available habitats (Kumar *et al.*, 2010).

The recent State Forest Report of 2017 published by the Forest Survey of India (FSI) states that Paschim Medinipur district

(consisting of Medinipur, Jhargram, Rupnarayan and Kharagpur forest divisions) has 22.96% area under forest. As per density class the district has 11.11% of its forest under 'very dense' category. These forests are also inhabited by world's largest land animal—elephant. However, the forest area of the district is too low to accommodate about 200 migratory elephants roaming in the region. Managing such a large number of this huge mammal is becoming very challenging for the forest department and local administration. The scattered and fragmented forest landscapes force the long ranging elephants to face human being regularly. This face-off mostly results in loss of life on both side and damage to crop and properties.

Elephant Population

The states of Odisha, Jharkhand, Bihar, Chhattisgarh, Madhya Pradesh and Southern part of West Bengal recorded 3128 elephants in All India Synchronized Elephant Population Estimation conducted in 2017.

Elephant groups in southern West Bengal are primarily “migratory” in nature.

Table 1: District forest profile of Paschim Medinipur

District	Geographical area (km ²)	Very Dense forest (km ²)	Moderately Dense Forest (km ²)	Open Forest (km ²)	Total (km ²)	% of Geographical Area	Change in total forest cover compared to 2015 assessment
Paschim Medinipur (now divided into Paschim Medinipur and Jhargram)	9368	239	591	1321	2151	22.96	(-) 19

(Source: Forest Survey of India, State Forest Report, 2017)



They have been visiting this part of the state from Jharkhand since 1986-1987. About 3-4 groups including several bull elephants immigrate into districts named Jhargram, Paschim Medinipur, Purulia, Bankura and Birbhum regularly. In this long course of immigration, several groups turned into permanent resident of the region and have made their permanent address in this part of West Bengal. During population estimation in 2017 in 57 forest beats total number of elephants was found to be 47 in this region.

However, rate of forest increment rate is not so high in West Bengal. This trend is not promising to accommodate a large no of

elephants in near future. Though the forest department is trying the best through fodder tree plantation into the forest, maintaining the route of elephant herd, arranging safe migration of the herd in communication with the local people.

Paschim Medinipur district consists of 4 forest divisions namely: Medinipur, Rupnarayan, Kharagpur and Jhargram.

In Southern West Bengal, forest is highly fragmented due to its nature of land, initial land acquisition system from the Jaminders (landlords), human habitation in between forest land from very old age and increasing demand for land for agriculture as to meet the needs of increasing

Table 2: Elephant population in southern West Bengal (as per Census 2017)

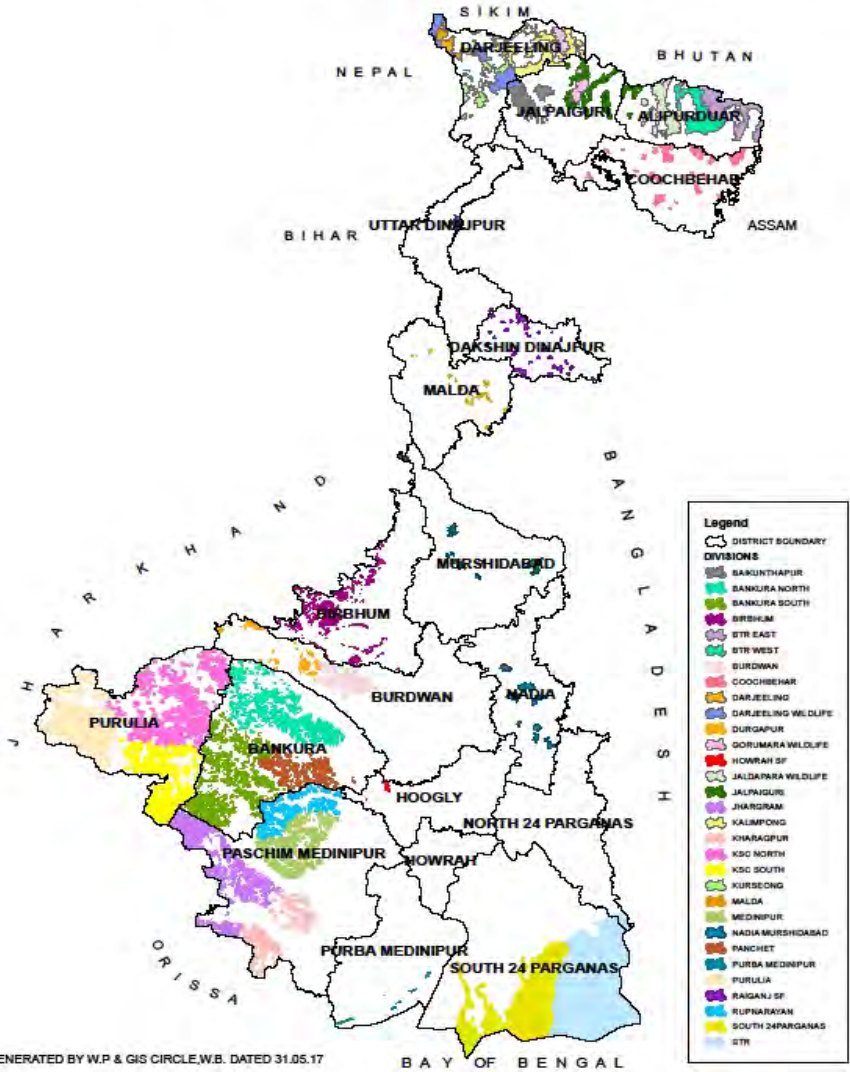
Region	Elephant density / km ²	Elephant distribution (km ²)	Elephant population
Southern West Bengal	0.05	4067	194

Table 3: Reasons for change detected in forest cover in consecutive FSI reports

Year	Change	Reasons stated by the State Governments
2015	Increase	Due to plantation activities, coppice growth inside forest, mangrove rehabilitation, and increase in commercial plantations and shade trees inside the tea gardens
2017	Increase in total forest cover (about 21 km ²)	Basically intense plantation activities outside legal forest land, besides conservation of mangrove forests

MAP OF WEST BENGAL SHOWING DIFFERENT DIVISIONS

RF=1:2,500,000



GENERATED BY W.P & GIS CIRCLE, W.B. DATED 31.05.17

population. As the result human-elephant conflict has crossed the limit. Some of the elephant experts believe that the elephants of this region are much more aggressive as they face continuous threats from some part of the fringe forest villagers who wants to

protect their land from being depredated and crops to be damaged.

Time of elephant depredation

Elephant herds once used to enter into the districts of Paschim Medinipur,

Table 4: Area under different types of forests in Paschim Medinipur (recent days Paschim Medinipur with Jhargram) district

District	Reserved Forest (sq km)	Protected Forest (sq km)	Unclassed State Forest and others (sq km)	Total area (sq km)
Paschim Medinipur	61.9564	1557.1109	106.3103	1725.3776

(Source: Annual Administrative Report, 2016-17; Department of Forests, Govt. of West Bengal)

Table 5: Combined profile of Paschim Medinipur (Presently Jhargram district included)

District	Geographical area in sq. km	Recorded Forest land in sq. km	% age of recorded forest area
Paschim Medinipur	14081	1725.3776	12.25

(Source: Annual Administrative Report, 2016-17; Department of Forests, Govt. of West Bengal)

Table 6: Percentage of forest land and tree cover in West Bengal

Year	% of recorded forest land	% of forest tree cover
1988	13.88	14.32
2017	13.88	21.31

Jhargram, Purulia, and Bankura from Odisha and Jharkhand during from the month of August till November. But nowadays they have extended this period and are also visiting throughout the year.

Causes of depredation

Elephants are known for their long range which makes them migratory. They migrate from place to place in search of food, water, favorable habitation and safe place for delivering their calf. The districts of Jhargram (recently carved out from Paschim Medinipur district), Paschim Medinipur, Bardhaman (currently divided into east and west), Birbhum, Bankura (but for the last 2-3 years out of elephant depredation zone), and Purulia adjacent to the neighboring Odisha and Jharkhand states are badly affected by elephant depredation. These districts are under the Western, Central, South-East and South-West Circles of West Bengal Forest Directorate. As per the

experts the situation was not so alarming before 1985-86 when elephant population in the region was hardly 30-50. With time they have adapted themselves with the geo-climatic conditions of the region and have increased their population. Causes of depredation are not always simple and detectable:

- Lack of food inside forest.
- Decreasing forest density.
- Encroachment and change of land use pattern in elephant routes causing elephants to take random unpredictable routes.
- Change in food habit of the elephants as there is easy availability of palatable food in bulk amount in the form of cultivated paddy, maize, vegetables etc. in the vicinity of forest.
- Lack of water in forest during summer.
- Disturbance created by a part of people during migration through their traditional routes.
- Sudden confrontation with any person may cause human death.
- Photography with the moving elephant herd sometimes become fatal and may cause death to the over - enthusiast persons.

Table 7: Area under different forest class in West Bengal

State	Total forest (sq km)	Reserve forest (sq km)	Protected forest (sq km)	Unclassed state forest (sq km)	Private forest land (sq km)
West Bengal	12102.3	7135.9308	4075.63	866.2048	24.53

(Source: Annual Administrative Report, 2016-17; Department of Forests, Govt. of West Bengal)

FIELD FORESTER



- Attraction of elephant towards locally made alcohol prepared from flower of Mahua (*Madhuca latifolia*).
- Sometimes patta land given to the tribes under Forest Rights Act, 2006 adjacent to forest which may create conflict as local tribes are very much dependent on forest for their livelihood and they are frequent visitors in protected forest for NTFP collection like: Chattu, sal leaves, dry woods for household use etc.
- Routes of elephant herds are continuously changing due to some over protective people as they are disturbing them at that time whenever they are staying or resting into the forest or some people are creating loud sound in advance to protect agricultural crops which is not necessary every time.

Type of damage caused

- Elephant herds always protect their integrity in emergency situations and

they attack people in groups when get confronted.

- People get injured or killed while driving away the elephants from their agriculture field or villages.
- Over enthusiastic people create problem for themselves by getting closer to the herds.
- Human huts are being damaged when the elephants try to enter the huts in search of food.
- Sudden confrontation of any villagers inside forest while collecting minor forest produce may cause death.
- Open defecation in villages adjacent to forests is also causing injury and death to the villagers.
- During summer, villagers stay outside their home till late night and sometimes get confronted with elephant.
- Stall-fed livestock also get killed sometimes by elephant (reported in



FIELD FORESTER

Table 8: Damage and death caused due to elephant depredation

Year	Human Death (No.)	Human Injuries (No.)	Crop Damage (area in ha)	Live-stock Death (No.)	Hut Damage (No.)
2013-14	3	4	150.00	Nil	80
2014-15	3	1	353.48	Nil	44
2015-16	9	33	874.00	Nil	20
2016-17	5	1	970.22	Nil	238
2017-18	3	8	1344.46	Nil	326
2018-19 as on 16.11.18	9	5	446	Nil	152

(Elephant depredation Report of Medinipur Forest Division under Western Circle, West Bengal Forest Department – For the year 2013 -2014 to 2018 -2019)

Medinipur division) when they enter into animal shed to collect fodder.

Hullah party: A special team for driving elephant (before Hon'ble Supreme Court's order on 12.11.2018)

- Due to the lack of adequate guards and staff in Forest Department it became impossible to manage human-elephant conflict. In this situation JFMC / FPC members were asked to work hand in hand with the department to reduce the conflict level. People from forest protection committee were chosen and engaged by the Forest Department to protect the local villagers and their farm lands from elephants. Locally they were named as hullah party. Each team of hullah party consists of 20-30 members. Hullah party used to change the path of herd movement from non forest areas towards the forest. Before Hon'ble Supreme Court's order on 12.11.2018 hullah party was using burnt automobile oil to light fire to move elephant herd in desired direction. Though the method was not always effective but it helps in reducing the accidental incidence. Insurance policies were made for the members of hullah party as the work was life threatening. Deaths of hullah party members have happened sometimes not only due to trampling by elephants but also because of snake bite during the process of herd movement.



Reasons for aggression among elephant herds / single male

- Herds are always on the move when they come outside forests due to continuous driving activity by people.
- Elephants become injured sometimes due to stone pelting and throwing fire crackers towards them by some over enthusiastic people.
- Burning torches are also sometimes thrown towards elephant by aggressive mob causing serious injury to them.
- Death of new born calves in the herd due to unsafe deep wells which are not walled or fenced properly. Some wells

are situated below ground level and shaded by field crops which is a danger point for the calves.

- When calves are in problem, naturally mother of the calf becomes abnormal in nature which is a cause of increasing agitation in the herd of elephant.
- Death of new born calves due to continuous migration in rainy season.
- Sometimes elephants fall into deep dry well, trench, or septic tank which injures the member of a herd and agitation level of the herd increases.
- Injured elephants are more aggressive and problematic for human.
- Single male / tuskers are most aggressive when they are in musth condition.

Sufferings of elephants

- Death of calves.
- Serious injury caused by fireworks and crackers thrown by some villagers due to lack of knowledge and over precaution.
- Injury / death due to electrification.
- Migration without rest in search of food, water and safer place for giving birth of calves.
- The herds are forced to shift their places even with the new born calves to save them from the attack of some cruel villagers.

Ways of Mitigation

People have found many ways to get rid of elephant depredation in south Bengal.

Table 9: Elephant death in recent years in Medinipur Forest Division

S.No.	Month of elephant death	Number and age
1	July, 2017	1 female - 7-8 years
2	September, 2017	1 calf - 5-6 months
3	October, 2017	1 male - 35-38 years
4	December, 2017	1 male calf - 6-8 months
5	October, 2018	1 calf

(Data source: Medinipur division, Western Circle, West Bengal)

Forest Department has formed an elephant squad consisting with experienced foresters and local people for monitoring the elephant herds. However, due to huge shortage of staff these kind of squads are becoming defected. Population is increasing so as the conflict. Moreover, people are so scared that they use crackers, torches and loud noise. Sometimes villagers create nuisance and injure elephants as well. Villagers some times demand money from the local foresters to help in driving the elephants towards forest. They block roads outside villages and elephant's route as well. Harassment of foresters by local people is becoming common during elephant depredation in south Bengal. This behavior of some villagers increases damage and number of human death caused due to intervention in elephant driving by the forest officials.

Mitigation ways are of two types:

Long term ways

- Creation of protected areas inside protected / reserved forest for the elephant which will help in safe habitat creation for the elephant herds. Also the protection level will be increased for that places.
- Augmenting fodder, water availability and other habitat parameters inside forest areas.

Short term ways

- Use of crackers and loud noise from safe distance.
- Driving elephants back to forest areas by a team of foresters and forest protection committee members.
- Public awareness camps arranged regularly by forest department.
- Alert messages are sent to the mobile phones of the villagers about the location of elephants.
- Energized (from solar power) fencing has been installed in some areas to protect human habitation adjacent to forest.

FIELD FORESTER

Table 10: Compensation given against elephant depredation in West Bengal

Year	Type of damage	Compensation
1	In case of any human death	Rs. 4,00,000/- per death incident
2	In case of injury to human	Free treatment done in any Govt. hospital inside West Bengal
3	Physically inactive(fully)	Rs. 1,00,000/- per person
4	Serious injury to human	Rs. 33,000/- per person with free treatment in Govt. hospital of West Bengal
5	Damage to crop	Rs. 15,000/- per hectare land
6	Death of cattle	Rs. 500 to 2,000/- depending upon damage quantity / number of damage
7	Hut (small mud hut)damage	Rs. 6,000/- per hut (for fully damage) Rs. 3,000/- per hut (for partially damage)
8	Damage to tin-shade or tile-shade house	Upto Rs. 10,000/-
9	Damage to brick and concrete house	Upto Rs. 20,000/-

- Speed of train has been reduced inside the forest to avert accident and elephant death.
- Search lights have been distributed among the villagers.
- Watch towers have been constructed in important areas to monitor elephant movement.
- Solar street lights are set up in some of the depredated zones by the department.
- Awareness through loudspeakers is done in areas where elephant herds are present.
- Public toilets are established in different places to reduce open defecation in the villages.
- Fodder trees for elephants are planted inside forests to reduce the chance of depredation into villages.

From 29.10.2018 West Bengal govt. is giving a compensation of ₹ 4,00,000/- for death of any human being to their families. Three tier (by forest department, local gram panchayat and Block level Karmadhakya regarding forest and land matter) checking for any compensation is mandatory.

Although human-elephant conflict is in a critical situation in south Bengal like all over the country we have to analyze the scenario on regular basis and find new solutions to mitigate the problem. Any new idea for solving the situation is welcome to save human and wildlife. A sense of coexistence among people is necessary that they have to survive with the situation and adapt accordingly with the aids and helps of forest department and foresters.

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WILDLIFE MANAGEMENT

Camera Trap: A Revolution in Wildlife Monitoring

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Camera traps, also known as trail cameras, are used to capture images of wildlife with as little human interference as possible. Camera traps are also helpful in quantifying the number of different species in an area; this is a more effective method than attempting to count by hand every individual organism in a field

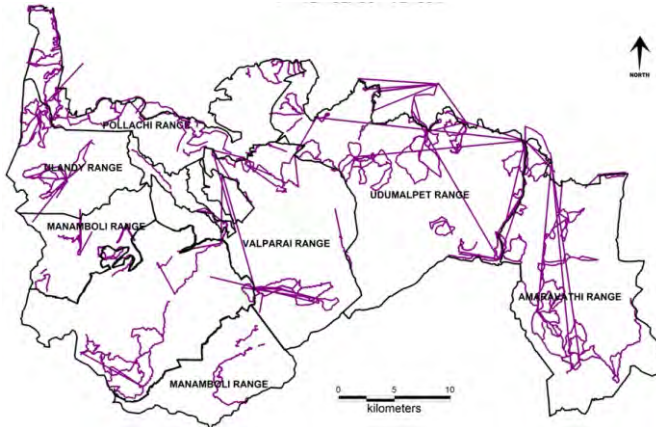
India owns the pride of having the largest population of Royal Bengal Tiger in the world. Ever increasing human population and resultant pressure on ecosystems have often resulted into habitat degradation. However, rising above all difficulties, India stands tall with its diverse flora and fauna. Monitoring the population dynamics of our national animal becomes more important as the tiger is not only pride of our nation but also the symbol of ecological security. An elaborate estimate of tiger population is complete only when the tiger is seen as an integral part of the habitat it lives in along with all the other denizens of the habitat like the co-predators, and herbivores in light of the various habitat parameters. This is possible through employment of scientific census techniques relying on most suitable

sampling methodology and advanced tools and techniques in all the tiger habitats spread across multiple landscapes.

Anamalai Tiger Reserve (ATR) located in the southern part of Western Ghats is one such tiger habitat wherein a holistic habitat and population monitoring of the charismatic carnivore is undertaken. Occupying a legal boundary area of 958 sq. kms, altitude of this reserve varies from 150 meters to 2515 meters. ATR is a mosaic of diverse ecosystems like the tropical thorn and scrub forest, tropical dry deciduous forest, tropical moist deciduous forest, tropical semi-evergreen forest, tropical wet evergreen forest and shola forests interspersed with rolling grasslands. The rain fall varies from 400 mm in the foothills of Amaravathi range and over 5000 mm



Map showing Anamalai tiger reserve beat boundaries



Map Showing GPS Tracks of Carnivore Sign Survey in Anamalai Tiger Reserve

rainfall in the Grass Hills of Valparai range. The terrain is very undulating in ATR. Almost half of the area is more than 20% sloping and it makes the work very hard to lay the transect lines and also makes it difficult to walk while conducting census.

As per the protocol of NTCA summer season census is conducted for eight days. Sampling for carnivore signs and line transects for herbivores is conducted in 102 census blocks covering 56 beats in ATR. Volunteers from colleges, local NGOs and local people are used to make the census operation transparent. An orientation program is also conducted for the field staff and volunteers in Attakatti Training center, Valparai. They are briefed about how to collect data in the field using Global positioning System (GPS), Range finder, Field compass etc. Equipment like Range finder, Field compass, GPS, 15 meter measuring tape, 20 meter rope, marker pen, census data books and polythene bags are provided to each census team.

Carnivore signs Survey

ATR is blessed with a variety of fauna like tiger, leopard, sloth bear, wild dog, jackal and several species of smaller carnivores. The survey on the encounter rate

of carnivores include signs like pugmark, scats, scrape marks on the grass patches and rake mark of tiger, leopard and sloth bears on the tree barks and fresh kills by carnivores. Each team walks along the trails, roads, dry river beds and along cattle and human foot paths looking for the signs. The census teams start walking early in the morning at 0630 hrs and continue till 1200 hrs. The distance and trails walked by the census team is monitored using GPS. The teams generally walk on an average of 5 kms every day for three days covering 15 km in each census block. All the carnivore signs found along the sampling tracks, Scat samples of tiger, leopard and dhole are recorded for further analysis and interpretation.

Line transect sampling

Line transect sampling is a universally accepted sampling technique for estimating prey base. As per the NTCA guidelines in each census block a straight line for 2 km is marked with red paint and the thorny bushes and exotic weeds are cleared for 1-1.5 meters width without disturbing the native vegetation. The transect is cleared only 2-3 days before the line transect sampling. Transects are walked early morning between 6:30 and 9:30 and in the evening between 3:00 to 6:00 o'clock.

Whenever an animal or a group of animal is sighted, corresponding information like time of sighting, species, number, sighting and transect angles using field compass and animal sighting distance using range finder and whenever possible the number of adult male and female, sub-adults and calf/fawn are recorded. The data collected in the field is entered in the computer and it is analysed using distance 6.2 version software. This software is used universally to estimate the density and numbers of prey animals / herbivores.

The encounter rate of tiger signs in Tiruppur Division is low when compared to the encounter rate in Pollachi division. This means that there might be more number of tigers in Pollachi Division than in Tiruppur Division. However, encounter rate of dhole is higher in Tiruppur Division. This disparity

in encounter rate of dhole signs may be due to high density of spotted deer in Tiruppur division as spotted deer is a major prey base for dholes. The habitat is also open in Tiruppur division that favours coursing predator like dhole to chase their prey and kill.

Line transect survey

The herbivore data collected along the line transects are entered in Microsoft excel software and the data table is sorted for each species. This data is then saved as text tab delimited format and analysed in Distance 6.02 software. The density and numbers of the major prey base like Spotted deer, Sambar deer, Gaur (Indian Bison), Wild boar, Barking deer, Nilgiri Langur, Common langur and the the mega herbivore the elephant density and numbers are given in Table 2.

Table 1: Encounter Rate of Carnivore Signs in ATR as observed during summer 2016

Division of ATR	Range	Tiger	Leopard	Sloth Bear	Dhole
Pollachi	Ulandy	5.8	8.0	5.4	0.2
Pollachi	Valparai	1.3	4.4	2.8	4.0
Pollachi	Manamboli	4.5	9.1	0.6	1.1
Pollachi	Pollachi	4.1	9.9	4.2	15.5
Tiruppur	Udumalpet	0.1	9.8	1.4	3.6
Tiruppur	Amaravathi	0.3	6.1	4.8	1.4

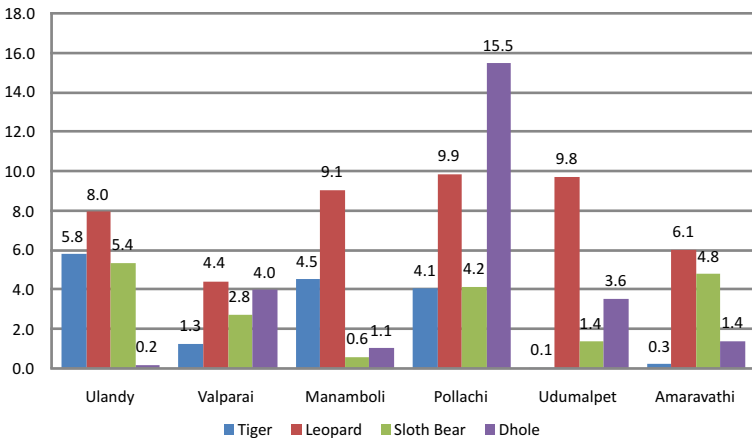


Fig. 1. Encounter Rate of Carnivores in different Ranges in ATR during 2016 summer Census

FIELD FORESTER

Camera traps: A revolution in wildlife census

A camera trap is a remotely activated camera that is equipped with a motion sensor or an infrared sensor, or uses a light beam as a trigger. Camera trapping is a method for capturing wild animals on film when researchers are not present, and has been used in ecological research for decades. In addition to applications in hunting and wildlife viewing, research applications include studies of nest ecology, detection of rare species, estimation of population size and species richness, as well as research on habitat use and occupation of human-built structures. Camera traps, also

known as trail cameras, are used to capture images of wildlife with as little human interference as possible. Camera traps are also helpful in quantifying the number of different species in an area; this is a more effective method than attempting to count by hand every individual organism in a field. It can also be useful in identifying new or rare species that have yet to be well documented. By using camera traps, the well-being and survival rate of animals can be observed over time. The great advantage of camera traps is that they can record very accurate data without disturbing the photographed animal.

One of the most important things to consider when setting up camera traps is choosing the location in order to get the best results. Camera traps should be set up near mineral licks or along game trails, where target animals are more likely to visit frequently. Animals congregate around mineral licks to consume water and soil, which can be useful in reducing toxin levels or supplement mineral intake in their diet. These locations for camera traps also allow for variety of animals that show up at different times and use the licks in different ways allowing for the study of animal behavior.

Another major factor in whether this is the best technique to use in the specific research is which type of species one is

Table 2: Density and Number of Prey-base and other Important Herbivores found in Anamalai Tiger Reserve during 2016 summer Census

S.No.	Species	Estimate	
		Density (per SQKM)	Number
1	Gaur	5.5	5256
2	Sambar Deer	4.3	4146
3	Spotted Deer	9.1	2168
4	Barking Deer	2.0	1901
5	Elephant	1.1	1082
6	Wild boar	5.5	5286
7	Malabar Giant Squirrel	0.8	757
8	Common Langur	1.1	1019
9	Nilgiri Langur	2.8	3537

Table 3: Population of Prey-base and other Important Herbivores found in ATR 2013 - 2016 summer Census

S.No.	Species	Population During 2013-2016 in Summer Season		
		2013	2015	2016
1	Gaur	6890	5791	5256
2	Sambar Deer	6717	4806	4146
3	Spotted Deer	1664	1500	2168
4	Barking Deer	1289	1627	1901
5	Elephant	1241	1100	1082
6	Wild boar	4881	4500	5286
7	Malabar Giant Squirrel	989	950	757
8	Common Langur	1177	1500	1019
9	Nilgiri Langur	3537	3100	2645

attempting to observe with the camera. Species such as small-bodied birds and insects may be too small to trigger the camera. Reptiles and amphibians will not be able to trip the infrared or heat differential-based sensors, however, methods have been developed to detect these species by utilizing a reflector based sensor system. However, for most medium and large-bodied terrestrial species camera traps have proven to be a successful tool for study.

- 2 sets of cameras are placed in a 2 x 2 sq km grid in the Anamalai Tiger Reserve.
- Cameras should be placed on a tree or any rigid structure in the forest.
- The distance between 2 cameras should be 14 m or more depending on the terrain. More the distance, good the quality of pictures taken.
- The angle between the cameras should be 90 degrees if possible, as it will give a good field of vision.

Camera trap in summer 2016 census

Entire ATR was divided into grids of 2 x

2 km size (4 sq km) and each grid was installed with a pair of camera trap. Thus a total of 240 camera traps were installed for 40 days continuously, in effect recording 9600 nights. All tiger, leopard pictures are identified and the population is estimated (Table 4).

M-STrIPES (Monitoring System for Tigers - Intensive Protection and Ecological Status)

It is a software-based monitoring system launched across Indian tiger reserves by the National Tiger Conservation Authority (NTCA) in 2010. The system's objective is to strengthen patrolling and surveillance of the Endangered Bengal tiger. Forest guards in tiger reserves are equipped with personal digital assistants, smart phones and GPS devices to capture data relating to tiger

Table 4: Population of carnivores during summer 2016

Species	Population of Carnivores during Summer 2016 Camera Trapping		
	2013	2014	2015
Tiger	15	23	28
Leopard	100	125	130
Wild dog (Dhole)	100	120	125

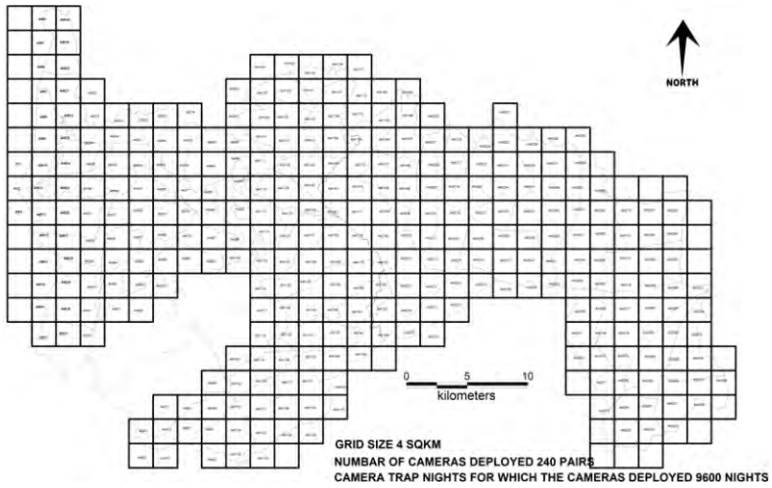


Camera



Installed camera

FIELD FORESTER



Map Showing Grids in which Camera Traps were deployed during 2016 Summer Census



A tiger “trapped” in a camera at ATR



An Indian Gaur caught in a camera trap at ATR

Table 4: Density of Tiger and its co-predators in ATR as observed during 2012-2015

Predator	Density per 100 Square Kilometer				Trend
	2012	2013	2014	2015	
Tiger	1.8	2.4	2.7	3.0	Increasing
Leopard	12	12	14.0	14.0	Stable
Wild dog	10	7.8	9.4	13	Increasing

sightings, deaths, wild life crime and ecological observations while patrolling. The software system maps the patrol routes of forest guards, and the resulting data are then analyzed in a geographic information system. This is intended to enhance the effectiveness and spatial coverage of patrols. Additional target outcomes are the

evaluation of human pressure and ongoing monitoring of habitat change. Use of such software’s has resulted into improved and efficient protection measures in the protected areas of India especially in the Tiger Reserves thus keeping a check on anti-forest and anti-wildlife activities such as poaching and illicit felling. The field staff



Anamalai Tiger Reserve landscape

and managers of ATR are also equipped with M-STRIPES app on their smart phones. Observations recorded during patrol and movement in the forest areas not enables the managers to plan better coverage and efficiency of patrolling efforts but also provides ecological information as an important tool for decision making.

CONCLUSIONS

Monitoring the flagship species – tiger is a very complicated process as tiger is inseparable from other members and components of the habitat. Such a complex monitoring and estimation of population dynamics of the flagship species and other wild animals that share time, space and resources with the flagship species is an inevitable tool for decision making by the wildlife and habitat managers at all levels. Use of camera trap, modern software's and apps like Distance, M-STRIPES combined

with manual and intellectual efforts of field personnel at grass roots level result into better management and protection measures in the field. Such advanced tools and techniques should not be restricted just to the Tiger Reserves and Protected Areas, but should also be adopted in different forest areas and habitats that are not covered under the PA network of our country!

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*Photo : All Women JFMC, Pedua, Sirmour, Himachal Pradesh
Credit : Abhilash Damodaran, IFS, Lecturer, CASFoS, Dehradun, Uttarakhand*

FOREST AND PEOPLE

FORESTS AND PEOPLE

A New Chapter on "Good Forest Governance in Jharkhand"

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We have been given a voice by Joint Forest Management program of Government of Jharkhand "GOJ"; it has also given us a new confidence to conserve our forest on sustained basis: the villagers of Chatra district of Jharkhand

This real life case attempts to capture indulgence of a forester to achieve the goals of "Sustainable Forest Development", achieving the principles of "Good Governance in forestry" in practice and evolving good protocols of practicing "good conflict Resolution mechanism" in Natural Resources Management. The issue like complexity of "Participatory Management" paradigm (with its differential understanding and appreciation at different levels of hierarchy; affecting the outcome); different interpretations of regulatory provision of statutes; different levels of "sensitivity"/ "sensitivity" of different field functionary, limitations of negotiation process to help reach the "just outcome", ensuring the level field for the "weaker" parties (here the JFMCs) – are attempted to be highlighted in this case study.

Many a forest fringe village and its dependent communities in Jharkhand (like other states of India, also) are getting affected on regular basis by diversion of their "village forest", due to various development activities. These "development activities" could be a project on Power / Road / Dam, Transmission line etc., which often is either located, affects or passes through the surrounding forest of many a village. Due to spurt in these developmental activities in recent years, by these "developmental project", which are taking a heavy toll on limited extent of "village

forests" and its diverse resource base, depriving the villagers in various manners. The villages are adversely affected by these "developmental projects", which is not due to simple depletion of their forest area, but more by the resultant loss of whole bundle of Eco-system service. Alarmed more by later, a distinct possibility *i.e.* the loss to their source of livelihood from the forest (that too affecting them in perpetuity)- many of these villages have been raising their concerns at various levels. Hence many a times they have been opposing such "development project" quite vociferously or challenging them in the very first place, when they are supposed be consulted. Now further, enlightened villagers often demand to get at least the compensation for the loss of their "diverted Forest Resources" (if the "Development" project has to go ahead, in any case).

Paini Kalan and 23 more of such villages in Chatra District, were initially hesitant and vehemently protested against the, Chatra - Gaya 765-KV Power Transmission line

Foot Note: In India, in order to restrict indiscriminate loss of forest due to such "developmental or any other project"; an Act called Forest Conservation Act (FCA) of 1980 is in force. The ultimate authority to allow; any such project to happen on "forest land" is the GoI. The FCA, 1980 in its evolution over the years has accepted the "Principle of affected persons to be compensated".

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project of Power Grid Corporation of India Ltd, which was to run through their village forest. For them this meant and it included cutting of various useful trees of their village forest (which were being protected by the villagers religiously after the formation of VFMP in their village). This also meant reduced availability of timber, small timber, fodder and depletion in all kind of ecosystem service, for all time to come to the affected populace of village. The affected villagers, who were initially "meek" but got empowered enough after creation of VFMP (due to effective implementation of "JFM" program of GoJ). This gradually has helped them to be articulate logically, while airing their views on conservation / protection of forest. They knew that felling of 4 existing trees and the diversion of forest land was to ultimately affect the village economy, badly.

The resistance turned quite strong and it became difficult for "User Agency", i.e. Power Grid Corporation Ltd. to make any headway on the ground. The villagers resorted to all kind of "non-cooperation" and even resorted to "Chipko" like scene; to show their anger to the agency people when their agents wanted to cut and remove the trees.

At the end when everything failed, the Forest Department, led by forest officials,

had to chip in to pacify the agitating villagers. On the one hand, the villagers were adamant for conservation and protection of their forest. But the clearance under FCA under by GoI, given to "User Agency" was forcing the 5 State Forest Department to resolve this issue for the sake of Nation's and State's "development". Gradually, the villagers could be persuaded to arrive at trade off position through the protracted negotiation process. They were made to realize that as per clearance conditions of GoJ / GoI, trees have to be cut / removed to facilitate the "Transmission line project". The conflict between the issues of "Development" and "Conservation" was quite intense and it was extremely complex too, to be appreciated by the villagers. One of the emotional arguments used was to that they have to sacrifice the need of village for the development of nation. The villager also knew that the Transmission line would help in easing of life in neighboring state but their own villages would still remain in dark. But in this negotiation on "Conservation vs. Development", many a times "emotional" issues overwhelmed the "substantive issues".

But always at the end only saving grace was the "revenue", accruing by the sale of such timber which could be shared with the villagers, so that the deprivation of affected villagers can be mitigated to some extent.

The villagers reluctantly allowed the diversion of forest and felling of trees, as it



Villagers in discussion



The transmission line – passing through forest

was the next best choice available to them. As usual the felled trees in the affected village were to be taken to the depots of JSFDC (Jharkhand Forest Department Corporation, an agency whose job was to auction them off and realize the best sale price). Even this job got completed within a short period, but the money realized remained in the account of JSFDC. This is a notable fact that in 2017, JSFDC itself took a landmark step to help Forest Department pay back the village / community for their lost forest and trees (while, laying out the Transmission line project).

Contribution of JSFDC; in resolving the wrangle

Another importance issue in get sharing of the "Timber Value" was- assessing the exact value, accruable for each village and it was hindering the Forest Department to move ahead.

JSFDC; using its transactional documents available in its office, identified the number and details of trees (village wise), calculated the exact value of timber. Hence; hence eligible amount due to every village could be calculated based on the basis of price it fetched in sale.

Further it was ensured that the following villages:

Painikala, Kataiya, Demdem, Baratand, Raharbar, Daha (All from Chatra North Forest Division), through their VFMPCS could get more than ₹ 1.6 lakhs; through their Bank account.

Similarly, Sanghari, Sajna, Gulhatu, Amouna, Sikid, Kasari, Lutidih, Ichahar, Kutirengania, Tatej, Darha, Arsel, Gothai, Barwadih, Ratnag, Chandanpur villages through their VFMPCS could get more than 14.8 lakh rupees in their bank account.

This is perhaps the first time ever in the history of "Participatory Management of Jharkhand" that the forest fringe villages, "affected by diversion of forests for non-forestry project" are getting compensated

for loss of their green resource (by way of felling of trees by User Agency). Normally, the such affected trees after the harvest, gets valued/sold and finally the money is realized as per GoJ Resolution/rules. But in the instant case for a long time after all their trees got felled and disposed, as per in the process approved by GoJ and under the provision of Forest Conservation Act, yet villagers could not get their dues. This story tells how different actors i.e. Villagers, VFMPs, Forest Department, Jharkhand Forest Department Corporation etc could rise above the bureaucratic red tape mentality and each went beyond the normal call of duty. This has resulted in "sale value realized" for trees assessed accurately and shared to the concerned villages- over coming all the procedural wrangles.

If we go back to conservation history of Chatra district of Jharkhand – it has been, known for its extensive and rich forested area. But the huge forest area has degraded over the years for several reasons. Hence when GoJ, came with its JFM resolution in 2001, many of these villages of Chatra District took it very enthusiastically. This resulted in remarkable effect to regenerate forest in their villages by VFMPs and Forest Department, jointly. Hence, the VFMP members always felt emotionally very attached, to the "forest" they nurtured while protesting against the passage of 765-KV transmission line of Power Grid Corporation of India Ltd (PGCIL) from Chatra to Gaya, Bihar. PGCIL's project required 1,675 trees of various species like Mahua, Amla, Behera, Tendu, Harra etc. to be felled. As these trees to be removed were standing on part of the different Protected Forests, (over which the VFMC of different village had rights for protection and management, under the JFMC rules). These different villages were initially very apprehensive of this "Forest diversion proposal". This fear was not unfounded also as in very first place, it would reduce the greenery from their already depleted forest. Beyond

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Transmission line – near villagers

that, these forests which have been providing much needed succour to them in difficult times, particularly to the poorest people would not be able to do so. More over; this "Development Project" had no direct beneficial effect on their livelihood and well being and on several other counts also.

But, as stated earlier-on June 13, 2016, all these affected villagers finally relented to allow the "Power Grid Corp. Ltd." to go ahead. As a follow up the Forest Department of GoJ, enumerated the trees which would fall along the length and breadth of the proposed transmission line. The JSFDC, being the official Government agency for harvesting and marketing, harvested and disposed the trees. As the story unfolds, the value of these trees after their sale was realised. But other challenge came as how this amount was to be apportioned to all these affected villages and thus complexity of process made the "sharing of revenue" issue go into limbo. However, the same could be resolved, after long process of revival.

These affected VFMCs in the several earlier meetings had been resolving and demanding their share from PGCIL for compensation to the VFMPC, affected by the transmission line. These meetings, which required presence of the local forest official was also sometimes attended by local DFO, when VFMPCs took resolution for not allowing the "User Agency" to start the work. All this is now part of history.

Kisun Yadav a member of the Village Forest Management and Protection on Committee of Painsi Kalan, Village, is now quite ecstatic. He claims that the same co-villagers, who had earlier opposed and stalled the construction of the transmission line, are now having different view, after getting their due amount deposited into the bank account of their VFMPC. This small gesture is also turning out to be a very positive support of the people to the Forest department and the State Govt. and ultimately helping achieve the cause of "conservation". They better appreciate the sincerity and sensibility of the different organs of government, which has taken care to these far located and almost forgotten villages of Chatra district (earlier the hotbed of naxal activities).

The VFMCs, which have been constituted in majority of the villages of state of Jharkhand for the co-operative and joint management of forest, involving local FD and villages- are expected to get a new lease of life by this new initiative if replicated.

As Kisun Yadav, further shares, the sentiments of the villagers is positive and "The Village Forest Management and Protection committees" have now decided to use the amount, got from Forest dept. for the various village development activities including planting trees of various MFP / NTFP species and various other activities in village. He speaks with gleam in his eyes "We also want to use a part of the funds for enhancing our common irrigation facilities for our village". Now, various difficult questions from apprehensive members of the JFMC, which earlier used to be raised by the sceptics, are now over. Beyond that, with their enhanced faith on Forest Department, they are far more committed to conservation of village forests.

"We look forward to officials of Forest Department for further guidance for better management of the forest and its utilization", another villager from Darha echoed.

Putting Pains Kalan's genuine demand into context

Kisum Yadav having said that further adds, "the village "Pains Kalan VFMC"s resolution" which previously had found support from locals for not allowing diversions of Forest- has found new path".

The villagers and VFMC once belligerent could be could be reconciled and took a less aggressive stance on "Development Project?" when balancing it with "Conservation". This "Trust deficit" slightly improved gradually, with assurance of Forest Department to get their share from the realized sales of forest produce. However, this transfer of money to villager could not take place for pretty long time. The amount accruable from the sale proceeds of Forest produce, (from the value of trees on forest, land diverted to "User Agency" seeking Forest diversion though not in full) is theoretically a "token compensation" to communities for the perpetual loss of livelihood and other opportunities. But even this "token gesture" remained, unimplemented as many stake holders / Actors involved in this process thought it was not in legal ambit. Though, the revised VFMC resolution of 2001 Jharkhand Government made it very clear

that the villagers would be getting share from the cases of forest land, which is diverted for non-forestry purposes, (and it is based on sound social / economic / political principles, as being accepted and followed globally). This resolution No.- 05/2000-3658 dated 27.12.2001 of GoJ, says that local villagers should be entitled to 100% of the value of Non Timber Forest produce (NTFP), fuelwood and fodder etc. available on the diverted forest land.

Unfortunately, this "important" provision of JFMC resolution of GoJ remained unimplemented, because of misunderstanding / lack of initiatives on part of villagers / section of forest officials, originating from lack of clarity in interpretation of statute-lack of or the absence of developed methodology or precedents.

However, the issue remained conveniently, ignored getting low priority, staying undecided when compared with other priority issues for Forest Department, like infrastructure development, Green India Programme, wildlife protection and other related activities etc. Villagers, who were so far ignored, had been facing nonchalantly the ill-effects of "Forest diversion projects" on their livelihoods, which remains not well



Villagers; JFMC members of Darha

"This story brings a newer perspectives and analysis from the ground, straight from LWE affected villages of Jharkhand, who now have confidence that they can make a change, staying together for the betterment of forestry"; by ensuring effective negotiation.

addressed in all such cases. If not effectively dealt by the Forest Department and if not tackled sensibly such cases, in all likelihood, would have enhanced the level of conflicts in the future. As more and more cases of "Forest diversions projects" are coming up affecting the numerous villages, this "case" assumes it importance. This case was also bound to increase the trust deficit between villages and Government, due to lackadaisical handling of "Forest diversion projects" in the yester years. But the efforts of sensible Government and sensible Forest Officials led to amicable resolution of the issue.

Importantly the crisis created in this "case" has precipitated the issue of "revenue sharing" to VFMP; for once and all. With the coming of new and responsive GoJ in 2014, the situation in the state had changed. In 2016, VFMP through their members, time and again took to reminding the Forest Department, for sharing their dues, (accrued from "Power Grid project" related forest diversion). The Government and official machinery needed to be convinced that what local communities are entitled. The matter was also discussed, at great length, both at Forest Department and Government's level- whether these villagers are eligible or not and it emerged that the "regulation" is in favour of VFMPs.

Paini Kalan's case is perhaps the first of its kind where the empowerment of communities has compelled the state forest administration to take concerted action on the subject. It is normally impossible for the Govt. to provide their guidance to each and

every case; hence the effective solution can be negotiated only by local forest officials, who are supposed to have clear vision and will / intent for welfare. With increasing "Developmental emphasis", when more and more forests are diverted for non-forestry purpose, this is an opportunity for forest officials to be more sensitive to the villagers, who have been conserving their forest. Thus the need and process to negotiate for a more balanced outcome in favours of villagers and conservation issues; without succumbing to one sided demand of "Developmental priorities", is the need of the hour.

Thus case also highlights that the field foresters; need another skill, *i.e.* "negotiating conflicts" at ground; involving multi parties – each having its own and conflicting (often) objectives to pursue. Arriving at an outcome; which balance the duel between the "Development" and "Conservation" (which is easy talk at philosophical level) is also expected from the foresters on the ground. But this can only be achieved, if foresters of every level realize problems in context of bigger picture; work in harmony and use the scientific negotiation process – which this "case" partially teaches.

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FORESTS AND PEOPLE

Co-ordinated Public Services for Tribal Development

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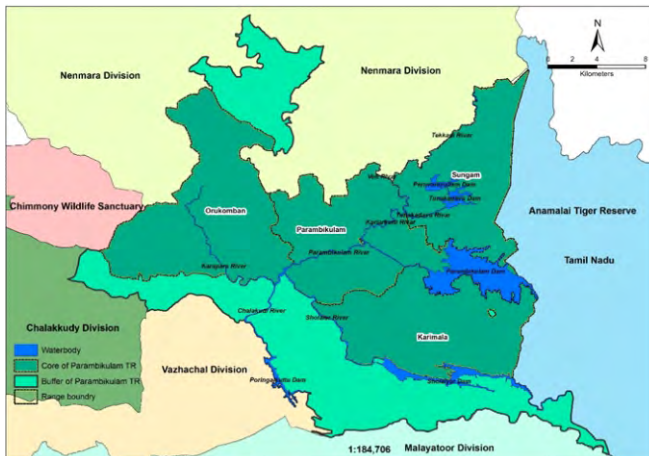
Local tribal people forms an integral part of the protection and conservation effort by the forest department. The Forest Department should ensure participation of the local people to make the protection and conservation measures more effective

Parambikulam Tiger Reserve is located in the Western Ghats landscape of Anamalai – Nelliampathy in Palakkad district of Kerala. This ecosystem comprises of large landscape with evergreen, deciduous, mixed deciduous forests and teak plantations with rich floral and faunal diversity. The Tiger Reserve with an area of 643.66 km² is a potential habitat for breeding population of Tigers. The northern boundary of the PKMTR is the Nelliampathy hills, where a considerable portion of the wet evergreen and montane wet temperate forests has been converted in to commercial plantations. The eastern boundary of the reserve is shared with that of the Anamalai Tiger Reserve of Tamil Nadu,

consisting of mountain ridges and valleys with grass land and bamboo breaks on the ridges; and dry deciduous forests and teak plantations in valley. The wet evergreen forest on the southern side of the Tiger Reserve, is contiguous with similar vegetation type of the Vazhachal forests. Towards the western side are, Vellikulangra range of Chalakudy division and Chimmony wildlife sanctuary. The reserve is home of four indigenous communities residing in six tribal settlements with 296 families and total population of 1254 individuals.

Key Problem

Parambikulam Tiger reserve is one of the most remote areas in Palakkad district of



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Kerala. The district head quarter is about 100 km away from this place. The approach road for Parambikulam is only through Tamil Nadu. This area is having restricted transport facility with only two public transport bus connecting this place with the other places in Kerala as well as Tamil Nadu. Because of its remote location and limited transportation facilities, it is very difficult for the local Tribal people in this area to get easy access to the services provided by the

Government. Keeping the above points in consideration, a survey was conducted by the forest department to know, to what extent the services provided by the various departments of the Governments are reaching the Tribal people living in this area. The survey brought out three prominent things. Firstly it came to know that around 80% of the people have not registered their birth and they do not have birth certificates or any documents recognized by the



Postal savings and Rural postal life insurance awareness camp

Government as official age proof. Secondly most of the people don't have any savings or insurance as financial security for their future and thirdly it was also noticed that most of the educated tribal youths have not registered their names with the District employment exchange and with state public service commission.

Approach to address the problem

Birth certificate is an important document which is necessary for obtaining several benefits from the Government. The practice of saving money for the future is not prevalent among tribal people but it is necessary to create awareness among them to inculcate the practice of small savings and insurance to ensure their financial security during the old age. Registration of names in the District employment exchange and State public service commission will provide the tribal youths an opportunity to get a job in Government sector or to become beneficiary under various skill development schemes sponsored by State or Central Government.

Thus to facilitate the people to obtain the above services, it was decided by the forest department to take up this issue with the concerned authorities. The officers of concerned departments were consulted to know the actual procedure involved and the documents necessary for obtaining a birth certificate, employment registration card as well as for starting a small savings account.

The procedure for obtaining the birth certificate for a person who had not

registered their date of birth, when they were born, is very cumbersome process and the papers in connection to this has to move through different offices like Revenue department, Grama Panchayath, Tribal Department and Health Department. For a common citizen to get such a certificate it will take not less than six months and he has to spend most of this productive time in shuttling from one office to other.

Similarly for a person from Parambikulam to himself registered in the District employment office, which is 100 km away, it will take a couple of days and he has to spend money for his travel, food and other expenses.

In most of the cases, lack of awareness, absence of banking or other financial institutions in the nearby areas and also difficulties involved in reaching these places are the discouraging factors for the Tribal people to do small savings.

To overcome this problem, and provide the service to the people at their place instead of people going to different offices, Parambikulam Tiger Reserve took lead in organising birth registration camp, Postal saving camp and employment registration camps in remote tribal areas in coordinate with all the concerned offices like Revenue Divisional Office, Grama Panchayath, Tribal Department, Health Department and Postal department.

Formal communications were sent by the forest department to the concerned



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Birth certificate registration camp

offices appraising the need for organizing such camps. Discussions were held between the forest department officials and concerned officers of the other department to develop initial rapport and making them understand that how such camps will benefit the tribal people. The matter was discussed with the district collector and was requested to issue directions to the concerned officers to organise the camps. The Forest Department assumed the role of coordinating among the concerned officers and arranging necessary logistics for the camp.

Before organizing the camp a lot of preparatory works in connection with gathering of necessary documents was done. For this the forest department staff, who are the secretaries of the different JFMCs were

instructed to coordinate among the beneficiaries and help them gather the necessary documents.

The Birth registration camp was held on 08-09-2016. 545 members had submitted their applications for obtaining the Birth Certificate. Due to shortage of time, in the first stage, it is planned to issue Birth Certificate for few members and for others, it was decided to issue the Birth Certificate within 3 months. The camp was inaugurated by the local people representatives officers of concerned offices were under one roof and on a single day, birth certificates were issued to 83 beneficiaries.

For the educated youths from tribal community, for registration of their name with employment office and also with the

Number of people who took up Rural postal Life Insurance Scheme and other saving schemes of Postal department

Total	RPLI	Recurring deposit	Time deposit	Monthly income scheme
Poopara colony	17	9	4	5
Earth dam colony	23	13	-	-
5th colony	18	7	-	-
Kadavu colony	27	18	3	2
Pap colony	7	22	2	6
Kuriyarkutty colony	55	25	-	3
Chungam colony	43	20	-	-
Thekkadi-allimooapan	9	2		
Total	199	116	9	16

State public service commission, registration Camps were held at Parambikulam during the month of February and May 2016, in association with the District Employment Office, Palakkad. 152 tribal youths, who were seeking employment registered their names with the Employment Office and obtained Employment Card.

Parambikulam Tiger Reserve in association with India post introduced Social Security Scheme (Rural Postal Life Insurance) small savings Scheme (SB, RD, TD and MIS) by conducting camps in various Tribal settlements in Parambikulam. In addition to this the various aspects connected to MGNREGS payment through Post Office was also studied to make it hassle free and customer friendly. This has paved way to the inhabitants of the area to know more about the small savings options and life insurance options available with the Post Office, the facilities of which can be enjoyed at the door steps in the wake of no other financial institutions prevailing in the area and the only means is Post Office.

CONCLUSIONS

The local tribal people forms an integral part of the protection and conservation effort by the forest department. The Forest Department should ensure participation of the local people to make the protection and conservation measures more effective. In a Tiger Reserve like Parambikulam, because of remote location and limited transportation facilities, it is very difficult for the local Tribal people in this area to get easy access to the services provided by the Government. Also most of the line departments find it difficult reach out to these people in remote areas because of lack of sufficient staff strength. As a result of this most of the benefits arising out of various social welfare schemes of Government will not reach these poor people. If the flow of these benefits is ensured for the Tribal people by the intervention of forest department, we can earn the goodwill and support of the local tribal people and ensure their effective participation in Protection and conservation effort.

FORESTS AND PEOPLE

The Women Foresters of Amboya

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An army of ten women stood firm against all odds pledging not only their support but time and efforts for regenerating the forests

Yes, its hard..... asserts Kamla Devi when nudged about the balancing act she performs everyday along with nine other women of her village. And the balancing act consists of unending domestic chores on one side and nurturing a patch of dense sal forest on the other side. “..... but we do it!” The ten women of Amboya village have been performing a sacred act since more than two decades – protecting a forest patch that was once degraded due to heavy lopping, illicit felling and un-controlled grazing.

Amboya village is located 16 kms away towards North Eastern direction from the town of Paonta Sahib of Sirmour district in Himachal Pradesh. The area falls under the Bhagani Range of Paonta Sahib Forest Division. Characterized by the dominance of *Shorea robusta* (sal) trees, the forests are situated on gentle to steep slopes, vulnerable

to heavy top soil erosion and severe anthropogenic factors like ruthless lopping, intensive grazing, wanton firewood collection and mindless illicit felling of trees. The area represents a haphazard mosaic of lopped forests, mined out streams and nalas, terraced agricultural fields and tiny hamlets. But for the 80 or more hectares of lush green forest patch, zealously protected by Kamla Devi and her team, the area shows a grim face as far as conservation of natural resources is concerned.

It all started with silvicultural felling that was carried out in Compartment number 7 of the Danda - Amboya Reserve Forest over an area of about 36 ha in 1984-85 after which the forest was left with very few mature sal trees and some poles. In no time degradation set in as the Forest Department had failed to protect the area from uncontrolled grazing of domestic cattle, illicit felling and lopping



Women marching towards forest for patrolling

of trees for firewood and fodder. Under such constrained circumstances for over a decade, the forest had failed to regenerate, thus threatening its own existence. However, threat to survival of the forest was perceived as a threat to their own survival by a few women lead by Maina Devi and Sumitra Devi prompting a discussion on the matter in the Gram Panchayat meeting. Scarcity of firewood and fodder had already set in as a fall out of the continued degradation of the forest patch that shared boundary with Amboya village. Subsequently Maina Devi and Sumitra Devi succeeded in convincing other women folk of the village to join hands in protecting the degraded forest. Soon, an army of ten women stood firm against all odds pledging not only their support but time and efforts for regenerating the forests. Stiff opposition from rest of the villagers did not hinder the ten women as they stepped up protection activities in the year 2000. Compartments 8 and 9 were also brought under protective cover by the women.

The first strategy adopted by them was to protect the area from grazing of domestic animals and keep away those men and

women who would destroy the young regeneration and lop the trees. The task was not easy being an uphill one with no support from the village. The ladies declared an embargo on grass cutting, lopping of trees and removal of firewood from the forest. Field officials of the Forest Department also offered generous support to this endeavor. Armed with a sickle, a stick and a bottle of water the ten women patrol the area even today in shifts carving out time from their daily chores looking after the family, home, agriculture and cattle. Its only their zeal that has increased over a period of two decades. The extremely hot and dry summer spells are misused by miscreants to set forest fire in an attempt to destroy fruits of the decades old protection. Night or day, the ten women are ever alert and prepared to meet any such devastating forest fires by not only informing the forest officials but also actively dousing the raging forest fires. Several hundreds of sickles and axes have been 'seized' by these women from people who enter 'their' forest. Its not an easy task protecting the forests from hundreds of cattle and twice the number of human beings surrounding the forest. They deliberate upon their achievements, activities and efforts required for protection of the forest in frequent meetings that they hold at least once in a month. The minutes of the meeting are recorded in a register in simple yet lucid writing signed by all the members.

The impact of protection spread over 80 ha of degraded forest. Soon, new coppice shoots and seedlings emerged out of the



Sickles and axes 'seized' by the Group



Joint patrolling with Forest Guard



The dense pole stage stand in RF Amboya protected by the women group

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Women involved in plantation activity

(Photo courtesy: Sh. Kunal Angrish, IFS, DCF Paonta Sahib)



Members of Mahila Van evam Paryavaran Suraksha Samiti, Amboya

(Photo courtesy: Sh. Kunal Angrish, IFS, DCF Paonta Sahib)

happy earth under the umbrella of protection offered by the committed and brave women of Amboya. Not only did the sal trees regenerate, but also several other plants like *Asparagus adscendens*, *Bauhinia vahlii*, *Curculigo orchiodes* to mention a few started thriving in this newly found abode. The young sal forest has become so dense that it is nearly impenetrable on foot. Wild animals like barking deer, sambhar deer, spotted deer, ghoral, mongoose, snakes, leopards and numerous birds made this forest as their home. The ecosystem services offered by this patch of forest is invaluable

especially the huge biomass that acts as a sink for carbon sequestration.

Recognizing the selfless efforts of these poor and illiterate women, the Paonta Sahib Forest Division stepped in to co-ordinate in a better way with them by getting them registered in 2008 as a Society under the Societies Registration Act 1860. Thus, the Self - Initiated Forest Protection Group got a formal identity as “Mahila Van evam Paryavaran Suraksha Samiti, Amboya” An area that was blank and being engulfed by a widening seasonal gully was taken up for afforestation by the women with funding



Kamla Devi and her team in the plantation

Profound *sal* regeneration

and guidance from the forest officials. The successful plantation consisting of *Syzygium cumini* (jamun), *Dalbergia sissoo* (shisham), *Terminalia bellerica* (bahera), *T. chebula* (harar), *Phyllanthus emblica* (amla) among others stand as a testimony to the conservation efforts put in by the women. As the planted trees have started yielding fruits today, the once fast-widening gully is no more to be seen! The women have already taken areas in and around the forest patch for eradication of *Lantana camara* - an invasive alien species. The unhindered conservation efforts of these ladies deserve more than just support in protection activities. Being from poor rural families, there is a need to reward them with better income generation opportunities, better agricultural productivity and increased returns from animal husbandry which they have been doing traditionally. Aligning them with micro-financing activities and entrepreneurship should also be explored. The exemplary dedication of these women in protecting and nurturing the forest has been recognized far and wide, even being appreciated and rewarded by the Chief Minister of Himachal Pradesh in the year 2016 and best JFMC award in 2019 worth ₹ 1 lakh and certificate.

Fruits of Conservation

Beyond being home-makers, these women also exemplify women empowerment *vis-à-vis* natural resource conservation in scarcity hit rural landscapes. Fervent in their determination to protect their forest, the women have designed their own uniform – green *salwar - kamez*. As usual, the women have their sickles, stick, bottle of water and more importantly determination and courage carried with pride and honour as they walk into the dense vegetation of Danda - Amboya Reserve Forest.

I have been visiting the village and interacting with the women group since last nine years. Kamla Devi, Maina Devi, Sumitra Devi, Satya Devi, Santro Devi, Gangi Devi, Champa Devi, Leela Devi, Kamla Devi, Shanti Devi are not just ten rustic, illiterate women, but the face of conservation in this part of the country. As I watch them march into the forest, clad in green, for the day's patrolling, I would ask, "You don't even remove anything from the forest. What benefit do you get out of your sincere efforts?" The reply would mostly be a smile on their wrinkled yet shy face. At the most, they would say, "We don't want anything except for satisfaction. Our forests are safe, we are safe!"

□□□

FORESTS AND PEOPLE

Role of School Education in Forest and Environment Conservation

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The key to sustainable environment management and biodiversity conservation is education and educating children would strengthen the efforts and the impact

School is considered as the temple of learning and education. The role of teachers is not only important in imparting knowledge related to subjects but also imparting values related to social and ethical behaviour, societal obligations, environmental concerns and commitments. Thus school's play a very important role in framing the society. Educating children on the issues of environmental concern is critical for the survival of future generations. The recently popular approach to conservation education for school children, relying solely on audio-visual aids and to the exclusion of direct nature experiences, is unlikely to achieve much success. It is important to provide an opportunity to the children to interact with the nature and inculcate a sense of appreciation and responsibility towards it. Once children are empowered with the knowledge on forest and environment conservation, it is important to enable them to put this knowledge into action. The schools may facilitate formation of nature clubs etc. so that students can be actively involved in conservation related efforts.

Role of school education in Forest and Environment Conservation

School is the mould for a child's personality. Various traits of nature and behaviour find their origin in the classrooms where children interact either with their mentors or among themselves. Formal

education system limits the role of schools to imparting lectures on subjects in the curriculum. Transfer of knowledge may not be the mandate for most of the teachers these days, leave apart the inputs on moral values and social necessities. But for disciples, teachers are like God and their words like God's command. In Hindu mythology teacher has been referred to as the Supreme.

*Guruh Brahma Guruh Vishnuh Guruh
Devo Maheshvarah
Gurureva Param Brahma Tasmai Shrii
Guruve Namah*

Which portrays Salutation to the noble Guru, who is Brahma, Vishnu and Maheshwara, the direct Param brahma, the supreme reality.

For younger minds teacher influences the thinking pattern and thus leads them to frame certain guiding principles of their lives. In the long run these guiding principles form the spine of an adult individual with various vertebrae (principles) placed appropriately. Thus school's play a very important role in framing the society. They may build or deteriorate the societal values depending upon their orations to produce immaculate or defiled individuals.

Education on any subject is required for creating awareness, appreciation, understanding, unravelment and evaluation of issues. It helps in filling the voids of empty minds, as an empty mind is a devil's

workshop and devils cannot work for constructive objectives.

Environmental Education is an interdisciplinary process that aims at equipping people with the knowledge, attitude, skills and motivation that they need to address environmental issues. International Union for the Conservation of Nature (IUCN; 1971) defines Environment Education as "... the process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the interrelatedness among men, his culture and his biophysical surroundings".

Since children are the future of a nation, education on forest and environment conservation is critical for the survival of forest and environment for future generations. Many of the threats faced by environment and forest are due to lack of adequate knowledge and understanding or mere ignorance of facts by the stakeholders about the importance of forest biodiversity, its conservation and the consequences of its destruction.

Educating children on these issues is critical for the survival of the forest and environment. In the longer run, creating awareness about forest conservation among children will pay off when they become decision-makers, forest managers and mature adult users. These children when they grow up as manufacturers and/or consumers of forest produce would influence the way forest and its produce are exploited. The decision makers of tomorrow, if enlightened today, would make conscious decisions in future.

The legal significance of the issue

In an unique case *M.C. Mehta vs. Union of India*, WP (Environmental Education Case) 22nd Nov 1991, Supreme Court of India observed that' ... *Law is a regulator of human conduct ... , but no law can indeed affectively work unless there is an element of acceptance by the people in society... it is*

necessary that there should be appropriate awareness about what the law requires and there is an element of acceptance that the requirement of law is grounded upon philosophy which should be followed... possible only when steps are taken in an adequate measure to make people aware of the indispensable necessity of their conduct being oriented in accordance with the requirements of law.' The Court said "*We accept on principle that through the medium of education, awareness of the environment and its problems related to pollution should be taught as a compulsory subject.*"

The court further directed that:

1. At least two slides / messages on environment in each film show. Material in this regard prepared by the Ministry of Environment and Forest should be circulated directly to the Collectors who are the licensing authorities... Failure to comply with our order should be treated as ground for cancellation of the licence
2. Production of information films of short duration on various mind catching aspects of environment and pollution by the IB Ministry, GoI without delay
3. Doordarshan and AIR to devote 5-7 minutes daily and once a week longer program on the importance of the environment and the necessity of protecting it.
4. Introduction of environment education at school level.

As a result of this order formal Environmental Education was started with the inclusion of this subject in the school, college curriculum through MHRD, UGC, NCERT etc.

- Two Centre of Excellence, on Environmental Education were established.
- Environment Education in School System on pilot basis in many schools as a sub- component under the World Bank assisted EMCBP.
- GLOBE (Global Learning and Observation to Benefit the Environment), an

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international environmental science and education program launched in selected schools.

- Environment Appreciation Courses were launched by IGNOU etc.

Methodology to be adopted for imparting education on forest and environment:

Target Group

School children, children in villages who are not necessarily attending formal schools.

Issues to be covered

the importance of forest biodiversity, its conservation, consequences of its destruction and alternative activities that could reduce the pressure on the forest, sustainable exploitation of forest products and how the local communities could best conserve the forest by adopting alternative energy, degradation of land, resource depletion causes and ways to conserve, environment degradation, causes and types of pollution etc.

Mode of imparting inputs

It is said that visual methods of imparting knowledge are more effective than oral means of communication. Hence television, documentaries, slide shows have a long lasting impact in the memories of children.

The recently popular approach to conservation education for school children, relying solely on audio-visual aids and to the exclusion of direct nature experiences, is unlikely to achieve much success. It is important to provide children, in accordance with their individual personality and expressed interests, with a variety of field opportunities to form their own connection with the beauty, novelty, fascination and joys of nature (*National Strategy Plan of Japan on Biological Diversity*).

Children while encountering the real situational circumstances stimulate their senses out of curiosity and this helps them to

acquire the ability to grasp issues and solve problems. In this process they understand the issues with greater depth and understanding and develop a sense of independency and ownness.

As Aldous Huxley one of the most prominent explorer of visual communication said "*The more you see, the more you know*", so providing hands on experience of interaction with nature in the form of nature tours, training programs in conservation related activities such as installation of fuel wood energy-saving stoves, use of solar lights etc. may be very effective in enabling young minds to see, sense, perceive and act.

Resource persons

Local forest department officials, environmentalists and NGO's working in these areas may act as primary resource persons for training of trainers. Later as the teachers of the schools get trained in the basic knowledge imparting skills then they may themselves act as resource persons. However, for technical know how and technical inputs, specialists from these fields may always be preferred resource persons.

While during field visits the local departmental officials and local inhabitants may act as excellent resource persons to provide extremely valuable inputs.

Putting lectures into action

Any knowledge imparted is ineffective till it is put into action. Unutilized knowledge may corrode and fade away from young minds. Hence after empowering children with the knowledge on forest and environment conservation, it is important to enable them to put this knowledge into action. The schools may facilitate formation of nature clubs, National Green Corps etc. so that students can be actively involved in conservation related efforts. Children can act as '*the Green crusaders*' of the society.

Providing alternative economic activities that can reduce pressure on the

forest- There are many local inhabitants of the forest, as well as many poor people living in and around the forest who depend on forest for their survival and daily needs. These people need to be provided with alternate economic activities to help them sustain without destroying the forest. Children of such people, once made aware about the consequences of unsustainable harvest of forest, can play a very significant role in adopting alternate economic activities. This can help to check illicit felling and illicit trade of forest produce and wildlife as well.

Providing alternative/renewable energy resources- As a symbolic gesture and to motivate children to adopt alternative / renewable energy resources, solar lights can be provided to children. This will necessarily force them to use this renewable energy resource and may further motivate them to continue using such resources in future. Children should be motivated to earn energy points by conserving energy and using alternate/renewable energy resources. These energy points may be included in their progress reports as well.

Environmental Education and Climate Change to be introduced as a compulsory subject in the curriculum.

The UN Decade of Education for Sustainable Development (2005-2014) already established the role of education as a key driver for realizing sustainable development, consequently, the education systems, and therefore the teachers, the world over, have been entrusted with the

responsibility of preparing global citizens. This has been reiterated in the UN Sustainable Development Goals as well. The world has set an ambitious 2030 Agenda for Sustainable Development, with Goal 4 of SDGs focusing on education “*Ensure inclusive and equitable quality education and promote life-long learning opportunities for all*” and Goal 4(c) on Teacher Capacity Building.

Banerjee (1995) analysed that preserving the biodiversity of the planet is a monumental task, which needs to be addressed jointly by governments, NGO's and the people. Thus it is necessary to involve children to understand and appreciate the significance of preservation and protection of nature.

Children need direct encounters with the natural world to enable them to appreciate the beauty and serenity of nature and this will enable them to become responsible citizens of tomorrow. The key to sustainable environment management and biodiversity conservation is education and educating children would strengthen the efforts and the impact.

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FORESTS AND PEOPLE

Defining Forestry through a Cultural and Religious Window

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Cultural and religious aspects in the field of forestry sometimes come to great help in saving the natural resources

Forestry sector in future besides being facilitated through plantations, nurseries creation, and timber operations can also be benefitted through the rendezvous of people, their culture mingled with ecological restoration. Our country features a rich cultural heritage and an admixture of religious sects. Tribals, poverty ridden section find refuge in forest wealth by over-exploiting the resources and neglect their passion by which they can be mutually benefitted. We hear of *Dandakaranya*, *Khandava vana* in our epics and efforts are on keeping the view in mind if spiritual, religious, cultural sentiments can knock the society's conscience and cease the destruction of forests.

A Few Instances of cultural and religious efforts by the local community in conservation of forest and wildlife observed during the tours of the training is elucidated by the authors in this article.

The Pakkes of Paga

The Nyishi tribal along the Pakke river of lower Seijosa who were using "*Paga's*" (hornbill) feathers and flesh for traditional rituals, their beaks for headgears since 2002 the headgears made of Hornbill beaks are banned by the Arunanchal Government, the Nyishi tribal have now opted for the artificial synthetic counterpart and subjected themselves for saving the critically endangered species.

And also concept of three parents viz.,



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Through a few songs composed by him and a red ribbon, he has been able to arouse a sense of brotherhood amongst the locals. He promotes this concept of nature's cause by visiting different parts of the Country for which he acclaimed nationally.

Bishnois and their love for nature

The Sam Desert, Blackbuck N.P of Velavadar, Gujarat is another example of love for nature through religious preaching of Bishnois. This community has been the harbinger of flora and fauna in the Thar Desert for a long time. The sacrifice of the Bishnois of 'Khejarli' village for opposing the felling of the Khejri trees "*Prosopis cineraria*" by the then Maharaja is an historical event in the annals of conservation. Their love for wild animals such as "*Chinkara*" deserves special mention.

Sundarban - presenting a communal harmony in the Forest scenario

Sundarban Tiger Reserve (STR) is

मेष /Aries	रक्त चंदन
वृषभ /Taurus	सातविन
मिथुन /Gemini	काळा कुडा
कर्क /Cancer	पळस
सिंह /Leo	बोर
कन्या /Virgo	आंबा
तुळु /Libra	नागकेशर
वृश्चिक /Scorpio	खेर
धनु /Sagittarius	पिंपळ
मकर /Capricorn	तोथाकथी
कुंभ /Aquarius	शमी
मीन /Pisces	वड

वन देवी वन्दना

जय-जय वन देवी कृपा करो माँ,
तेरा भक्त शरण में है आया।
दया करो है जीवन दायिनी,
तेरा भक्त है सब घबराया ॥1॥
घरती माँ का श्रृंगार तूम्हीं हो,
तुने उन्हें है सजाया।
पर्वत, झरना, चूँआ, नाला,
सबको तुने ही बनाया ॥2॥
वर्षा का आघार तूम्हीं हो,
तुम्हीं से फल पाया।
भोजन, वस्त्र, आवास, शिक्षा,
तेरी कृपा से ही पाया ॥3॥
तेरी दया से सब जीव जीते,
तू ही आँकसीजन दाता।
शंकर सम तूम विष पी पीकर,
पर्यावरण स्वच्छ बनाता ॥4॥
तूम जहाँ नहीं होती माता,
अकाल महामारी आता।
घर बैठे रोवे गाँव किसनवां,
फसल नहीं लहराता ॥5॥
भूल हुई है माफ करो माँ,
अब दर्द सहा नहीं जाता।
रक्षा बन्धन कर तुझे मनाऊँ,
“मंजुल” मंगल गाता ॥6॥

located in the Southern-most part of the state West Bengal in the districts North and South 24-Parganas. It lies between latitude 21°31'22"31N and longitude 88°10'89"51 E.



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STR bounded by fringe villages along the northern boundary, Bay of Bengal on the South, territorial division South 24-Pargana on the West and Bangladesh on the East.

Total area of the Sundarban Tiger Reserve is 2585 sq. km comprising 362.40 sq. km of Sajnekhali Wildlife Sanctuary, 1330.10 sq. km of Sundarban National Park and 892.43 sq. km of the Reserved Forest.

The Moulis and the villagers often chant the *Bonbibir Johurnama*. Which they believe as agreement between the spiritual and the human forces that permits them both to respect each other's needs.

Ma Bon bibi (the mother of working men folk), *Shah Jongli* (the brother of Bon Bibi), *Dakhin Rai* (the tiger God), *Narayani* (the mother of Dakhin Rai) and *Kalu Roy* (crocodile God) are some of the famous characters folktales of the locals.

The Hindu community perform *Bonbibir Palagaan* whereas the Islamic sect does *Pir Sahitya*, all find their existence in the *Johuranama* which presents a unique feature of worshipping the almighty, the forest, before going for honey collection and fishing. This brings a striking communal harmony worth mentioning.

Warli tribe and its customs

Dadra and Nagar Haveli lies within the North Western Ghats with moist deciduous

forests eco-region, characterized by forests of teak and other dry-season deciduous trees.

About 43% of the land is under forest cover and the protected forests constitute 2.45% of the total land area. The tribal's here have their own folklore customs and colourful traditions.

The main tribes of this region are Warli, Kokna, Dhodia. Amongst them, the Warli painting has found its immense usage in various facets of the everyday life and with their forest customs depicted through painting, they are magnificent to watch.

They possess strong willpower for protecting the forest and wildlife and showcasing them to the modern world.

Yes we can

The cultural and religious aspects in the field of forestry sometimes come to great help in saving the natural resources. We admire and respect the culture which in turn should be channelized to protect our forests. The concept of preserving bio diversity as a whole has come into existence. So we certainly are quite aware to the fact that mere planting and captive breeding of wildlife can't compensate the loss we incur while destroying to dense natural forests. So be it for the sake of our religion or cultural heritage we should promote the sense of conserving natural resources.



Eco-tourism in Periyar Tiger Reserve : Tourists' Perception

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PTR is one of the best tiger reserves of the county known for both tiger conservation and eco-tourism. Majority of the visitors are satisfied and happy with the eco-tourism activities of the reserve, through there is always as scope for improvements

Protected areas (PAs) or natural areas are the cornerstone of global biodiversity conservation and prime destinations for nature-based tourism due to their unique biological, natural and cultural features (Ceballos-Lascurain, 1996; Whitelaw *et al.*, 2014). They constitute an important sector of the global tourism industry and contribute substantially to local and national economies (Archabald and Naughton-Treves, 2001; Nyaupane and Poudel, 2011).

Eco-tourism is best defined as a responsible travel to natural areas which conserve the environment and improve the welfare of local people. Ecotourism is reliant on natural phenomena in relatively undisturbed sites (Boyd *et al.*, 1994), such as protected areas. It causes a number of social, environmental, educational, and economic impacts. Ecotourism can affect the sustainability of natural resource use at ecotourism sites in several ways (Steele, 1995). For example, ecotourism may generate higher economic returns than other resource activities (Tobias and Mendelsohn 1991). Ecotourism may benefit local economies, providing incentives to ensure nearby biodiversity is used sustainably (McNeely and Dobias 1991). These economic benefits may serve as a stimulus for the establishment of protected areas (Ceballos-Lascurain 1996; Dabrowski 1994). Finally, eco-tourists may contribute

to the conservation and management of ecotourism sites, through mechanisms such as entry fees and donations (Wallace and Pierce 1996).

About Periyar Tiger Reserve (PTR)

PTR is one of the 50 Tiger reserves of India established in the year 1982, covering an area of 925 sq km. and India holds about 60% of the world's wild tiger population wild (Jhala *et al.*, 2015; WWF, 2016). The reserve is famous for Royal Bengal Tiger but tourists can also see Indian elephants, Malabar giant squirrel, Lion-tailed Macaque, Leopards, Mouse deer, Gaur and Bear. Community based ecotourism programs were started at PTR with a view to strengthen the conservation efforts and to ensure livelihood of the community by providing a source of income to them. The skills of local peoples such as camping in jungle, bamboo rafting, making artifacts etc. have been utilized to operate programme under the tourism zone of PTR. Following are the plans which are being implemented in PTR, and have been launched by Eco development Committees (EDCs) and approved by Park Management-

- Nature Walk
- Green Walk
- Bamboo Rafting
- The Bamboo Grove
- Jungle Scout

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- Tiger Trail
- Jungle Camp
- Jungle Inn
- Border Hiking (Closed for some period)
- Tribal Heritage Museum.

A questionnaire survey was conducted among local tourists to ascertain their views on these eco-tourism activities operated through EDCs. This exercise was done during April 2018 to June 2018 as part of summer internship work of first two authors at PTR. About one hundred tourists were surveyed to arrive at conclusion regarding tourists' perceptions of eco-tourism activities in PTR. The perceptions of tourists regarding eco-tourism activities is very important as it enables proper designing and execution of such activities.

Mainly four categories/types of tourists are arriving at PTR. Majority (82%) came for re-recreational purpose, while rest were wildlife enthusiasts and researchers (Fig. 1).

Tourists were asked from where they came to know about PTR. Majority got information about PTR through travelling agents and travel blogs (44%). About 17% received idea of visiting PTR through friends/colleagues, 16% through PTR website and rest through other advertisements (Fig. 2).

Tourists guides of PTR are given specialized trainings and lessons for the activities. We found that majority of tourists

(59%) rated guide services as excellent or good category. Only 17% were not satisfied or rated them unsatisfactory (Fig. 3). Main cause was poor English language understanding and conversational skills. This area needs attention of the PA managers.

The tourists were asked about their present experience and past knowledge about wildlife conservation. Based on the data we can say that eco-tourism activities are helping in creating awareness towards environmental and wildlife conservation. They are making people aware why it was necessary to protect and conserve biodiversity (Fig. 4).

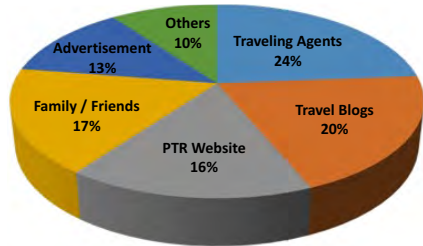


Fig. 2. Source of information about PTR



Fig. 3. Guide rating

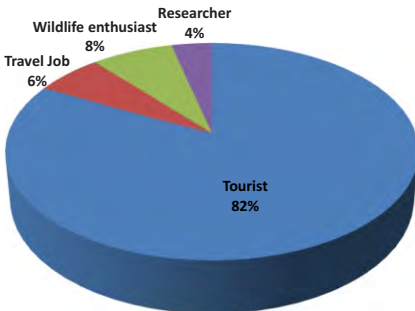


Fig. 1. Categories of tourists visiting PTR

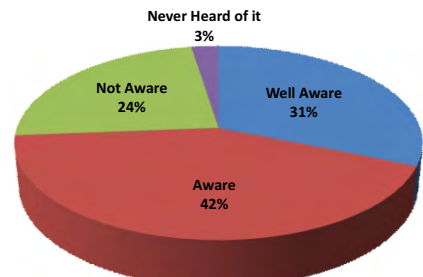


Fig. 4. Conservation awareness



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The tourists were asked about the services provided at information centre of PTR *i.e.* whether the centre has been able to achieve the objectives for which it was setup. As the pie chart shows, majority of people are happy with the service provided at information center of PTR (Fig. 5).

Breakfast and lunch is provided during the full Day Bamboo Rafting activity, as it takes whole day to complete. Many of the people were unsatisfied with food quantity and quality. As far as breakfast was concerned, only fruits and juice was given. People also felt that only 1 litre drinking water was not sufficient enough for the whole day while some opinion that spoon should be provided for having food. There reasons made some people rate food service in bamboo rafting as poor while 53% were satisfied with sarve. This rating is elaborated in Fig. 6.

CONCLUSION

PTR is one of the best tiger reserves of the county known for both tiger conservation and eco-tourism aspect. PTR has a count of estimated 45 tigers during last census in 2014 and also many other wild-animals and birds. But as the tourism pressure is increasing day by day some measures should be taken for maintaining the floral and faunal diversity of the reserve. Because of increase in frequency of visitors, roots of trees have also been exposed on trails and soil erosion is increasing. Over the years approximate same number of tigers has been spotted on camera traps installed near CBET (Community Based Eco-tourism) routes. To decrease the pressure of the tourism during season, management can limit the number of visitors for each activity in a day. Visitors can book the activity according to the vacancy on that day.

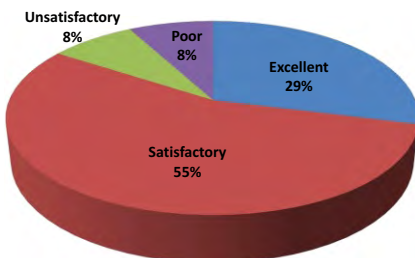


Fig. 5. Information centre rating



Fig. 6. Food service rating at bamboo rafting

Majority of the visitors are satisfied and happy with the eco-tourism activities of the reserve through there is always as scope for improvements like increasing the quality of food service provided in the bamboo rafting program can go miles in positively imparting perception of the tourists'. English language training should be given to all guides so that they can easily convey information to the tourists. Furthermore, some more eco-tourism programmes can be added such as Bird-watching, as many foreign tourists were found interested in bird watching and trekking, as found during unscheduled meeting and discussions.

PTR management should organize special programmes to educate the tourists' regarding the need for conservation. The park guides should also undergo such training modules which would enable them to convey the message of conservation to the visitors without any hurdles. Visitors centric special activities may also conducted on specific days dedicated to forests, wildlife and environment like International Day of Forests, World Wetland Day, Elephant Day etc.

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FORESTS AND PEOPLE

Role of Women: Sustainable Forest Management and Climate Change Mitigation and Adaptation

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Improved productivity of JFM forests has made available increased quantities of fuel wood and fodder, benefiting the women a great deal

Preamble of the “*Draft National Forest Policy, 2018*” focuses on sustainable forest management, climate change adaptation and mitigation, advancement of forest land, livelihood and women empowerment through domestic sources and international collaboration. There is a growing debate on gender differences between women and men in terms of the extent to which they rely on forests for their livelihoods, and for which purposes.

What is Role of Women ?

The role of women in forest resources management is very important. Collection of forest products to meet subsistence requirements and also to augment family's income is generally the responsibility of women. Awareness about trees, shrubs and grasses is higher amongst women than in men because women devote more time than men to collect forest produce to meet family needs. About one-third of poor women are directly involved in forestry or forestry related works in the unorganized sector.

How Women Play Key Role ?

The women have to spend major part of their time and have to walk long distances daily to collect fuel wood, fodder and other Non Timber Forest Products (NTFPs) from forests. While men are interested in

commercial forestry, women are concerned with biodiversity conservation and multiple products-based management which ensures fuel wood, fodder, water and other NTFPs. Women, therefore, remained at forefront in conservation movements like *Chipko* Movement.

What are the Effects of Forest Degradation on Women?

The effect of forest degradation is particularly severe on women. Women, therefore, greatly value forest conservation. The Indian national forest policy, 1988, therefore, rightly emphasized the role of women in conservation and sustainable management of forests and recommended greater involvement of women in forestry related activities.

Forest policies and forest management practices, have, remained gender blind and ignored the intimate relation between women and forests and remained insensitive to gender issues. As a result, the women continued suffering and their drudgery increased as the forest degradation continued. Therefore the forest policy provided for creating a massive people's movement with the involvement of women to meet objectives of the policy. The policy provided that domestic requirements of fuel wood, fodder, minor forest produce and

construction timber of the tribal and poor living within or near the forests should be the first charge on forest produce.

The women, as principal collectors of forest produce, suffer the most as a result of forest degradation. Forest degradation results in short supply of fuel wood and fodder and consequently in increased hardship of the rural communities in meeting their subsistence needs. The women have to walk long distances to collect fuel wood and fodder and have to spend several hours per day, neglecting their more important household jobs. The distance covered to collect NTFPs during 1960s and 1980s is reported to be 1.7 and 7.0 km, respectively in Orissa and 1.6 and 4.1 km, respectively in Chhattisgarh.

The production of NTFPs is adversely affected by forest degradation, resulting in corresponding reduction of income of women from this source. The potential production of NTFPs is estimated to be about four times of the present production from forests. Forest degradation results in loss of job opportunities and out-migration of male members in search of employment. This necessitates women to shoulder the responsibilities of agricultural operations normally handled by men which increases the workload affecting their health.

What is Joint Forest Management ?

To Arrest forest degradation and rehabilitation of degraded forests the Government of India issued guidelines on June 1, 1990 regarding Joint Forest Management (JFM) stating that JFM program should be implemented under an arrangement between voluntary agency, the village community (beneficiaries) and the Forest Department (FD). The JFM approach was adopted to protect and rehabilitate mainly degraded forests and has recently been extended to good forest areas also.

The JFM is the concept based on recognition that FD communities have to be

involved in protecting and managing the forest resources, regardless of the fact that ownership may rest with the Government. The starting point of JFM has to be the realization of the need of JFM both by the Forest Department and the local people. JFM process is initiated through a dialogue between the Forest Department and the village community. The process ends with the constitution of a Village Level Organization (VLO) to undertake the work of JFM in partnership with Forest Department.

Have Women Benefited from JFM ?

The JFM approach has undoubtedly helped in rehabilitating and improving the degraded forests. The Forest Department has, therefore, every reason to be satisfied with the result, it needs, however, to be critically examined as to how much have the participating villagers, particularly women benefited from their participation in this program. Their investment of labour for protection is sizeable, besides sacrifice in foregoing grazing and fuel wood collection from these areas. Improved productivity of JFM forests has made available increased quantities of fuel wood and fodder, benefiting the women a great deal. Closure of JFM forests to grazing and consequent shift to stall-feeding, however, increases the workload of women. The women are further disadvantaged when increased income from dairying as result of stall-feeding is pocketed by men who usually undertake the responsibility of milk sale.

Importance of Non-Timber Forest Products?

It is often argued that women are greatly benefited from collection of NTFPs from JFM areas. The NTFPs are very important for women in the following way:

- I. Three times as many women as men are involved in gathering of NTFPs.
- ii. Processing of NTFPs is exclusive to women.

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- iii. Twice as many women as men are involved in marketing of NTFPs.
- iv. Sal leaf plate making is mostly done by women.
- v. Women do about 75% of the marketing of mushrooms, fruits and mahua flowers.
- vi. Gum collection from Gujarat forests is generally done by women.

Special efforts are necessary to help women establish and run NTFP-based enterprises. Such an approach is likely to distribute benefits more equitably within communities and families, as women have a better record of reinvesting incomes into families than men. Not much progress has been made towards enabling women to establish NTFP-based enterprises and a number of problems related to finances, technical know-how and marketing remain to be resolved.

Women Participation in JFM

The women participate in JFM activities in various ways and the level of participation in no single activity can suffice. Holistic approach is, therefore, necessary to assess the level of participation of women in JFM. The JFM activities broadly include following activities:

- i. Development of protection and management strategy for JFM areas.
- ii. Field operations, participatory process and decision making.
- iii. To elicit active participation of villagers in creation, management and protection of plantations.
- iv. To achieve ecological needs consonant with sustainable productivity of wood and other non-timber forest resources.
- v. To wean away the land owning communities from shifting cultivation by adopting an alternative.
- vi. To productively utilize the degraded shifting land thereby checking soil erosion.
- vii. To conserve biodiversity through people's action.

- viii. To create and generate forest –based economy for the villagers.

The development of protection and management strategy is a participatory process. The perceptions and approach of men and women were found to be generally different. While women are interested in the management strategy ensuring increased and sustained availability of NTFPs, the men are generally interested in maximizing monetary returns. It is important to analyze as to what extent is the management strategy influenced by women enrolled as members of the VLOS.

Constraints for Women in JFM

The participation of women in JFM is constrained by following factors:

- I. Women participation is greatly handicapped in view of social customs.
- ii. In a male dominated society, the women follow outdated system and do not mix with males.
- iii. Women are very shy of attending any meeting and if present in a meeting, they huddle together in one corner and very seldom participate in the discussions.
- iv. Women are not even informed by male members about the meetings to be held for decision-making or for PRA exercises.
- v. As JFM program is still young, most of the women are not yet convinced about the likely benefits from JFM and, consequently, they do not take adequate interest in JFM activities.
- vi. The women from elite households who may venture to participate in JFM discussions do not normally represent the interests of women from poor households.

Future approach to increase women participation in JFM

Women participation needs to be improved to ensure success of JFM

approach. To achieve this objective, following steps should be taken:

- i. Awareness among women needs to be increased.
- ii. Women need to be involved from the very beginning of JFM program and constant and sustained dialogue with them should be maintained.
- iii. The need for their participation and benefits accruing to them from JFM need to be properly explained to women to create their interest in the program.
- iv. It should be ensured that benefits accruing to women from participation are quick and tangible.
- v. Gender equity in benefit sharing should also be ensured.
- vi. The policy provisions regarding women participation should be clear and mandatory.
- vii. The existing provisions leave much scope for discrimination against women.
- viii. Special care is necessary to provide proper extension support to motivate women and also their husbands for their active participation in JFM.
- ix. Female extension workers need to be employed with whom women may talk

freely. Because of the hesitation on the part of women to actively participate in meetings in the presence of men, separate meetings for women may be arranged to get their views.

- x. Formation of all women societies need trial in view of encouraging results of such societies at some places.
- xi. Social changes are necessary to empower women so that they may assert for their rights equal to men in all matters.

CONCLUSIONS

The notion of joint forest management can help to reduce women's vulnerability by enhancing their socio-economic empowerment; by reducing informality in the production and marketing of Non-timber forest products where women dominate; and by promoting legal reforms, and institutional development through training, skills, capacity building and personality development. Therefore, to ensure gender equality and for reaching goals of Draft New National Forest Policy, 2018, the JFM can be a game changer, because it has strengthen and capacity to unite and integrate the society for a common goal.



Impact of Forest Department Interventions in Tribal Welfare: ATR

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Forest department naturally has a major role to play due to poor development in remote tribal areas. Need of the hour is to bridge the gap between tribal and non-tribal population with respect to economic, education and social status

Anamalai Tiger Reserve (ATR) is known for its anthropological diversity with 6 indigenous people / tribal settlements in and around the tiger reserve. The case study involved visiting 3 settlements of these indigenous people out of 35 settlements distributed in the reserve to study the Forest Department Interventions in tribal welfare and it was noticed that these people form an important arm of department. Tribal settlements selected for study in ATR are Chinnarpadi (Pollachi Range), Karattupathy (Amaravathi Range) and Old Sarkarpathi (Pollachi Range). This article highlights their importance in forest management and the approaches adopted by the department for their welfare and upliftment.

Tribal Settlements : Marching Towards Development

Chinnarpadi settlement

This settlement is of Malamalasar tribe with 33 families and 150 members. The people were originally nomads and opted for settled living after Aliyar dam construction in 1970 at the bank of its back waters. This settlement is close to a famous tourist place "Monkey Falls". This provides them opportunity in selling NTFP's viz., jackfruit, honey, black peppers and mango collected from the ATR. Each family own a mango tree inside their colony which they

harvest for sales at the monkey falls. They are employed by nearby farmlands as agricultural labourers and as watchman to guard their produces against wild animals attack. Residents of this settlement have unique skill of evading elephants with irritating noise and have good physical endurance with hard working ability. Men and women both are excellent tree climbers. Some residents are employed by the forest department as APC watchers, Eco-watchers to maintain the waterfalls plastic free, fire watchers and for creating fire lines and weeding of *Lantana camara*. A primitive Eco Development Committee (EDC) is established to uplift the settlement condition. But the earning of EDC is marginal and it is limited to money collection at Monkey Falls in the way of ticketing at entrance to the waterfalls and maintenance of public toilets at this tourist destination.

Their living standard is inadequate with poor condition concrete structures to dwell which was constructed by the Forest Department. They depend on perennial stream passing through the settlement to meet their water needs. Common light facilities are provided to the settlement and energy dependence is only on fire wood collected from the forest. They harvest fish from the back water of the dam for self consumption. The settlement has large

number of fish tailed palm tree. This tree bark is wounded to collect the milk which is dried and stored for later use. The dried powder milk is boiled and consumed which is known to fill stomach with less quantity consumption. The leaves and flowers of the fish tailed palm are used to prepare garland which has value in the local market nearby.

The common problem in the settlement is man animal conflict in particular elephant, sambar and boar. The settlement is in the elephant corridor so frequent entry of elephants into settlements and destruction of jackfruit tress are common occurrences. Also, the settlement is very close to the dam back waters so frequent flooding is common. So there is requirement to construct wall around the settlement to avoid flooding.

Kodanthur settlement

This settlement is of Pulayar tribe. They have EDC committee of 14 members managing the affairs of the famous Katala Mariamman temple inside the reserve forest. The temple is opened on Tuesday, Thursday and Sunday every week for worshippers and also on new moon day every week. The EDC runs vehicle transport facility to the temple with ₹ 30/seat out of which ₹ 15 goes to the EDC. Around 7 vehicles operate to take worshippers to the temple. NTFP's *viz.*, honey, *Terminalia chebula* fruit, amla are sold in the neighborhood of the temple. EDC amount is used for the development of settlement. From EDC fund water pipes for each houses and a community marriage hall are constructed. The Forest Department has provided 1 acre per family to 52 families earlier. Now around 103 families are recorded in the settlement. The people cultivate beans, groundnut, rice and corn in the allotted land. Only rice is cultivated for self consumption. Other products are sold to Udumalpet market. Very large herds of goat

are reared and sold to middle person for meat. Milch animal - cow is used for milk production for community consumption. The rearing of live stocks inside the reserve is not admissible as per the law and it should be stopped at the earliest and efforts should be taken for stall feeding of cattle. Man-animal conflict is common in the area in particular elephants and wild boars.

Their dwellings are self made by mud, stone and wood which has a life-span of 30 years. The houses can be replicated for eco-tourism purposes. The department has distributed solar lighting to each dwelling which is in inoperative condition and requires periodic maintenance. At present only a common light facility is present in the settlement. People are employed with the department with various capacities *viz.*, APWs, Eco-watchers, Fire-watchers etc. The settlement has one landline connection which aids in informing forest fires and other illegal activities to the department from people.

Old Sarkarpathi settlement

Old Sarkarpathi is a decent settlement of Malasar tribe with development works from the Forest Department and the Revenue Department by which in the year 2000, huts were replaced by permanent settlements. This settlement has a unique model to empower the people. In the year 1956, survey of reserve forest area revealed encroachment of 45 acres of the reserve forest area by neighbouring affluent agriculture communities. This encroached area was given to the tribe "Malasar" for settlement (5 acres) and to practice agriculture (40 acres). 40 families (Presently 116 families reside in the settlement) were distributed land with 1 acre per family to practice agriculture and build their livelihood. The land rights are not given to families but inheritance within the family is allowed. The community engages itself in

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cultivating groundnuts and coconut. The produce is sold to middlemen at 15-25/coconut and 47/kg for dried groundnuts and 15/kg for raw groundnuts. To facilitate irrigation to fields, the Forest Department has dug a well with pump house. The electricity charge of the pump house is borne by the department with bill addressed to the wildlife warden. The affluent people in the community also meet their individual irrigation needs by pumping water from the nearby stream passing their fields using diesel run pump sets in summer. Here only one crop per year is harvested. The forest department has participated in constructing EPTs around the 40 acre fields to protect the crops from elephants in major and other wild animal entry into fields in general and also night patrolling of fields is carried out by people. The community practices organic farming that complements conservation ethics. They are also involved in cow, goat and chicken rearing for self sustenance. They are employed by neighboring farmers as watchman to look after their produces from wild animal destruction. Also they work as agricultural laborers in the nearby farms. For their own use they collect NTFP's viz. tamarind, honey, firewood (*Prosopis juliflora*), fallen timber (*Eucalyptus*), fishing in nearby stream etc. The forest department has deployed them in APC and as Eco-watchers and utilizing their skills of forest know-how and wildlife. The Forest Department has participated in constructing metal sheet dwellings and community water tank. The bore well serves the requirement of drinking water and almost all houses are electrified.

The metal sheet dwellings are constructed for few families of the settlements. The lack of proper flooring, hot interior in summer season and disturbance in the rainy season has caused the dwelling to be used as goat and cattle shed. With Panchayat intervention in their development

concrete dwellings are constructed in majority for decent living. The Forest Department has constructed low cost school classrooms for an elementary school inside the colony which was abandoned for poor construction. This should be taken as learning experience in planning and execution of livelihood projects from the department.

CONCLUSIONS

Socio-cultural life of tribal is centered around nature. Tribal have symbiotic relationship with forests and existence of both is mutually beneficial. Degradation of forests have reduced the resource availability and there by striking their livelihood opportunities. So Forest department naturally has a major role to play due to poor development in remote tribal areas. Need of the hour is to bridge the gap between tribal and non-tribal population with respect to economic, education and social status. The Forest Department can provide adequate impetus on this regard by employment generation, improving infrastructure facilities in tribal villages, livelihood improvements and woman empowerment through Eco-Development Committees (EDCs). Nehruvian Panchasheel spelt out in 1952, have been guiding the administration of tribal affairs. They are:

- a. Tribal should be allowed to develop according to their own genius.
- b. Tribals' rights in land and forest should be respected.
- c. Tribal teams should be trained to undertake administration and development without too many outsiders being inducted.
- d. Tribal development should be undertaken without disturbing tribal social and cultural institutions.
- e. The index of tribal development should be the quality of their life and not the money spent.

Empowering the dis-advantaged and most neglected tantamount to empowering the entire society. Emerging economy like India needs inclusively in its programs and schemes to empower each and every section of society. In the last seven decades India have strategically initiated interventions for the tribal by enabling Economic, Educational, Psychological, Social and Political Empowerment. The major policies of the government aim to ensure the overall development of both Scheduled Tribe men and women. On these line the Forest

Department has a pivotal role to play in conserving and developing forests with the helping hands of these indigenous people. Before ATR notification *i.e.* before year 2008, tribesmen were involved in illegal harvesting of hunted animals by dhole and now these indigenous people have found new ways to develop themselves with the Forest Department interventions and the department has long way to go in developing these people who reside in the ambit of the Forest Mother.



Effect of Socio-political Conditions on the Protected Area with Special Reference to Manas National Park

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Article mentions about socio-political turmoil in Assam between the period 1983 to 2003 leading to complete annihilation of Manas National Park, a world heritage site of UNESCO. Due to untiring efforts of State Forest Department, local NGOs and research institutions; the park is slowly reviving and returning to its old glory

North-eastern state of Assam, India shares its boundaries to the north with Bhutan and Arunachal Pradesh, to the east by the states of Nagaland and Manipur, to the south by the states of Mizoram and Tripura, and the west by the state of Meghalaya. It is also connected with the state of West Bengal in the west via a narrow stretch of land of around 22km long called as Siliguri corridor famously known as Chicken's neck because of its resemblance to the neck of the chicken. The Brahmaputra is one of the major river flowing through the state.

Assam is blessed with rich bio-diversity. The Indian state of forest report 2011, states the forest cover at around 35.68% of the state's geographical area (Fig. 1). According to Forest Survey of India Assessment concerning Champion and Seth classification, Assam has 18 forest types under five major classification which are Tropical wet evergreen, Tropical Semi-evergreen, Tropical moist deciduous, Tropical dry deciduous and Subtropical pine forests.

Protected area network (PAN) of the state covers around 4.98% of the geographical area and consists of five

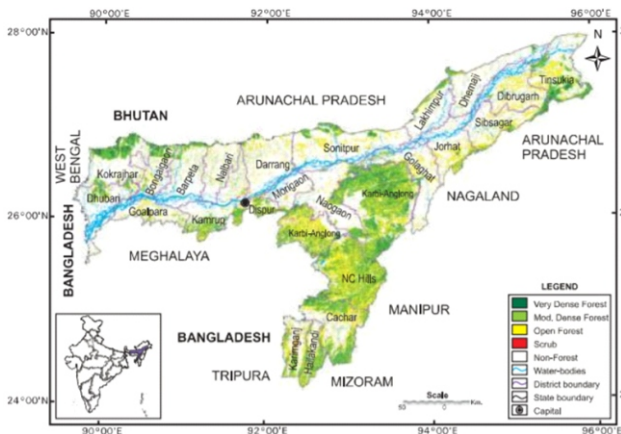


Fig. 1. Forest cover map of Assam

national parks and eighteen wildlife sanctuary (Table 1).

The state is home to many of the endangered and critically endangered species like Pygmy hog (*Porcula salvania*), Hispid hare (*Caprolagus hispidus*), Bengal florican (*Houbaropsis bengalensis*), Asian Elephant (*Elephas maximus*), Bengal Tiger (*Panthera tigris*), White Winged wood Duck (*Asarconis scutulata*) and Golden Langur (*Trachypithecus geei*). The state boast to be the home of around 69% of the world's wild greater one-horned rhino (*Rhinoceros unicornis*) (Vigne and Martin, 1998).

The state has 33 administrative districts

as on June 2016. There are three autonomous councils present in Assam according to the sixth schedule of the Indian constitution. They are as follows:

1) Bodoland Territorial Council (BTC): It consists of 4 administrative districts namely Udalguri, Baksa, Chirang, Kokrajhar under its control. The Bodoland legislative council consists of 40 elected members, and there is a provision for appointing six members to the council which can be done by the Governor of the Assam. It came into being after 2003 peace accord between the Government of India and Bodoland Liberation Tigers after a long history of protests which saw a long period of violence and turmoil in the region.

Table 1 : Conserved Area

S.No.	Name	Number	Remarks
1	National Parks	05	
2	Wildlife Sanctuaries	18	Excluding two proposed
3	Tiger Reserve	03	Manas, Nameri, Kaziranga
4	Biosphere reserve	02	Dibru Saikhowa, Manas
5	World Heritage site	02	Kaziranga, Manas
6	Ramsar site	01	Deepar Beel
7	Important Bird Area (IBA)	46	
8	Elephant reserve	05	

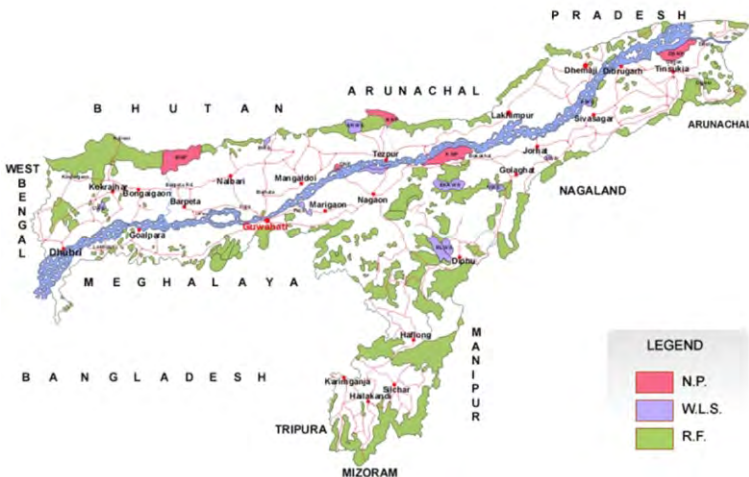


Fig. 2. Map showing Reserved Forests and Protected areas of Assam

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2) Dima Hasao Autonomous District Council (DHADC): It was constituted for the Dimasa people in the state.

Karbi Anglong Autonomous District Council (KAADC): It was constituted for the development of the Karbi community people.

In the 20th century, Assam saw a huge influx of migrants, and this slowly resulted in one of the main reason for the turmoil in the Assam. It is believed that tribal groups are the original inhabitants of the Assam and Bodos were the first to create culture and civilization along the Brahmaputra valley (Das, 1994). From the 1980s to 1993 the districts dominated by the Bodo population namely Dhubri, Kokrajhar, Bongaigaon, Bakha, Goalpara saw major conflicts because of the demand for separate Bodoland. In the state, the law and order situation during this period went for a toss, and even the protected areas of the state were not left out of the conflict. Manas National Park faced a major brunt during

this period as poaching was rampant. Now we will look into the detail about the history of the conflict and how do the socio-political conditions affect the management of the protected area by taking the example of Manas National Park.

Bodoland Agitation

All Bodo Students Union(ABSU) was formed in February 1967 with the main demand of forming a separate state of Bodos. A separate political party called as Plains Tribals Council of Assam (PTCA) was also formed in 1967, and since its conception, the PTCA demanded a union territory for the Bodos. ABSU extended its support to PTCA because the aim of both of them was similar. However, in 1979, ABSU withdrew its support because it found that PTCA was not being to fulfill the demands of the people. Further in 1984 PTCA itself got split, with one of its militant leader forming a new party named United Tribal Nationalists' Liberation Front, Assam (UTNLF) (George, 1994).

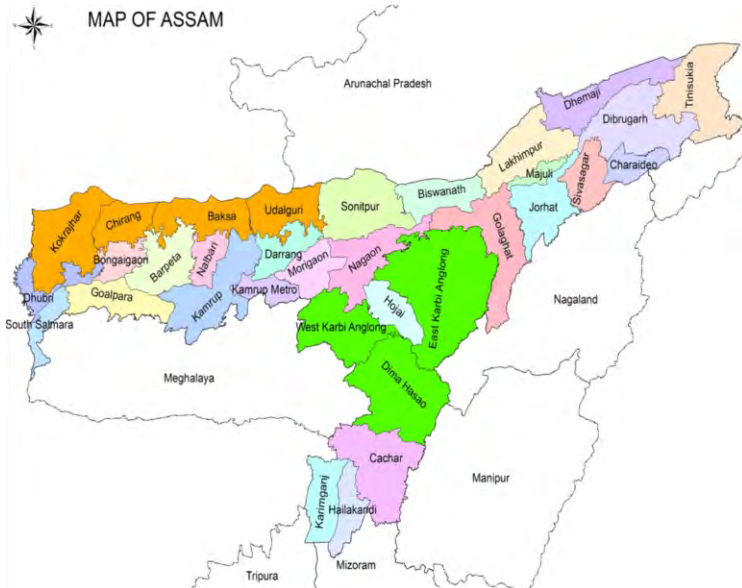


Fig. 3. Map of Assam showing the districts of Assam

On March 2, 1987, ABSU launched a movement for full autonomy with the demand of creation of the state of Bodoland. The two districts with a huge number of Bodo population namely Kokrajhar and Darrang became the epicenter of the militant struggle. There were three major demands of ABSU:

- 1) Formation of separate state named Bodoland on the north bank of the Brahmaputra.
- 2) Establishment of autonomous district councils in the tribal-dominated areas on the south bank of the Brahmaputra.
- 3) Incorporation of the Bodo Kacharis of Karbi Anglong in the Sixth Schedule of the Indian constitution.

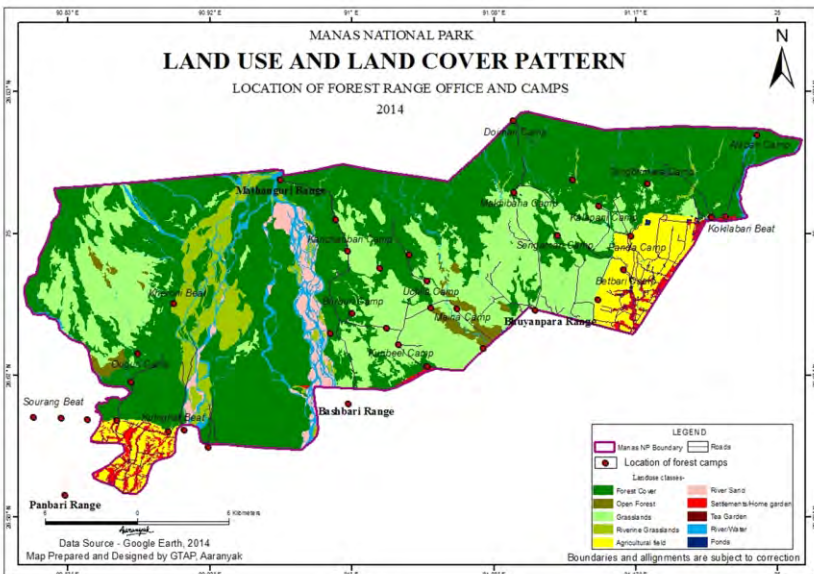
There were multiple reasons for separate statehood demand by Bodo people. Some of the major reasons were:

- 1) **Economic:** Because of continued entry of the migrants into the state of Assam the illegal land encroachments were at a high. Bodo people who were mainly

dependent on agriculture for their livelihood, started slowly losing their land and this resulted to as much as approximately 60% of them becoming landless, and this led to Bodos becoming more marginalized because of being pushed into deeper poverty, unemployment, and debt trap. Also, it was observed that “the educated tribal youth felt that they had been left out in cold as the Assamese cornered the lucrative jobs and monopolized administrative power.” (Das, 1994).

- 2) **Language and identity:** An act passed in 1960 made Assamese the official language of the state, and huge efforts were made to impose the language on all the people living in the state.

As like most of the struggle, most of the phases were marked by a prolonged period of closures and blockades, which completely disrupted the rail and road links of the Assam. Property worth of millions which were mostly government was destroyed, and normalcy became a



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farfetched dream for the people living in those areas.

The agitation also saw extortions and killing of non-tribals, non-Bodos teachers, clerks, foresters posted in tribal areas. A rebel insurgent Bodo security force (Bd. SF) was formed which resorted to violent tactics for achieving the demand of a separate Bodoland.

The prolonged struggle seriously affected the economy of the Assam and disrupted the normal life. Conditions deteriorated in Assam with the violence unleashed by United Liberation Front of Assam (ULFA). The central government on November 20, 1990, declared President's rule in the state. In 1992 the conditions again started to become worse when two bomb attacks were carried out on a train running through the Bodo area where the militants were reported to be active. Subsequently, the Bodo accord was signed resulting into formation of Bodoland Autonomous Council (BAC). This also ended the long standing Bodoland agitation.

Manas National Park

Manas came about in 1973 through Project Tiger during Indira Gandhi's regime. There are many theories regarding the origin of the name Manas. According to one school of thought, the name originated from the river Manas, which is named after the serpent goddess Manasa. Manas river is a major tributary of the Brahmaputra river. The Manasriver passes from the national

park. The entire area is of 2837 sq km. Manas tiger reserve comprises 1 Wildlife sanctuary, one national park, 14 reserved forests. This is the second largest tiger conservation landscape (TCL) in Asia after Mekong valley. In 1985 Manas was declared as World Heritage site by UNESCO.

Manas is one of the very few parks in India which is accorded with five different status, *i.e.* National park, World Heritage site, Biosphere reserve, Elephant reserve, and Tiger reserve.

The situation during the agitation

Manas was left in ruins because of the long drawn agitation of nearly 18 years demanding an independent state. The situation of so worse that in 1992 UNESCO had to declare Manas as a world heritage site in danger. The militant separatist chooses Manas as the base of their operations. For many years the insurgents used to attack the villages from their forest hideouts.

The park was closed from February 1989 to 1 October 1995, because it was completely run over by Bodo militants. Forest guards were killed, and the place where the guards used to stay inside the park were destroyed. Thus to sum it all up to the complete park infrastructure for proper management of the park was destroyed.

According to the World wildlife fund for Nature the wildlife trafficking is the world's fourth largest illicit trade, the militants raised the required funds to carry out the armed struggle by selling the forest most



Fig. 5 & 6. Ruins of the infrastructure inside the park



Fig. 7. Severed head of the tiger



Fig. 8. Tusks of the elephants

precious resources which include the skin of tigers, horns of rhinos and tusks of the elephants. For them, anything that moved became target practice.

Within few years nearly all the major animals of Manas national park were presumed dead. Rhinos which are the pride of Assam went extinct from Manas. The management of the park was more difficult because the civil life at that time was itself in such danger that it was very difficult even to take care of the national park and the animals living inside the park.

Situation after the peace accord

Because of the continued efforts of the

forest department of Assam and various NGOs working in the Manas landscape like WWF, WTI, and Aaranyak to name a few, the park is reviving. Today park is the home of nearly 23 Schedule I animals. It hosts around 61 species of Mammals, more than 450 species of birds, more than nine species of amphibians and more than 42 species of reptiles. Because of good habitat that includes nearly 40% of the grasslands, Manas can support nearly 37 threatened mammals species and nearly 28 threatened bird species of IUCN redlist. A lot of efforts go into the maintaining of the grasslands because it is the natural habitat for many of the species like pygmy hog which is a



Fig. 9. Pygmy Hog



Fig. 10. Golden Langur



Fig. 11. One horned rhinoceros

critically endangered species and found near this region, and also for maintaining the ecological balance.

Currently, there are about 39 tigers in the park and around the rhinoceros which were reintroduced in the park from Kaziranga national park are doing well. After 2015 no poaching incident has been reported in the park.

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FORESTS AND PEOPLE

Decoding the Fringes

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The negative impact on the health of forests due to its proximity with the forest fringe village stands affirmative as revealed by the regeneration status, Simpsons Diversity index and Importance Value Index. The situation would be much similar in many other similarly situated forest fringe areas. Thus, it becomes imperative to adopt management strategies that focus not only restoring and protecting the forest fringes but also managing the socio-economic dynamics of the people living such villages.

George Orwell did not commit an inch of error when he said “*Man is the only creature that consumes without producing. He does not give milk, he does not lay eggs, he is too weak to pull the plough, he cannot run fast enough to catch rabbits. Yet he is lord of all the animals.*” And men will always find a way to prove George Orwell wrong with an unparalleled confidence. But the fact is that nature around us bears the testimony of the impact we humans have had on the world around us. One of many sufferers of the collateral damage of human evolution and subsequent development have been the

forests all across the globe. They have been the cornerstones of the burgeoning civilizations of the world, bearing the majority of exploitation without remorse and little retribution. The plight of forests of our country is no different from anywhere else. Forest Survey of India has estimated India's forests and tree at 8,02,088 sq.km occupying about 24.39% of the country's geographical area (Forest Survey of India, 2017). However, millions of people depend on this forest area for meeting their sustenance and livelihood in addition to the ever-growing demand for land and resources of the fast growing economy that



Degraded forest landscape of Sironj Salaiya

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India is. Thus, forests of India face multidimensional threats among which degradation assumes a significant position. The immediate brunt of degradation is borne by the forest areas that lie adjoining to human habitations. The fringe forests are degrading greatly, because people living near fringe areas are heavily dependent on forest resources and due to unavailability of basic amenities in these villages, this degradation is beyond the carrying capacity and ultimately results in to over-exploitation. Keeping in view the significance of managing the fringe areas, National Working Plan Code – 2014 seeks to address the problems and issues pertaining to manage the fringe areas.

Understanding the “fringe village”

Essentially, any village or hamlet sharing boundaries with forest areas are referred to as fringe villages. However, it is also important to understand the extend of penetration of villagers into forest areas for various purposes to understand the concept of fringe village. The concept of forest fringe village is broad and needs to be

understood with reference to the locality and socio-economic aspects of the region. The National Forest Commission stated the presence of 1.73 lakhs villages in and around the forest areas of India (MoEF, 2006). In its landmark study, Forest Research Institute (2017) estimated a total of 1.47 lakhs of forest fringe villages that are located within 1 km distance from the forest boundary in the rainfed districts of India. It is noteworthy that around 12% of India's forest fringe villages are located in Madhya Pradesh. Most of the forests in Madhya Pradesh are impacted by such fringe villages and thus qualify to be referred to as “fringe forests”. Out of a total forest area of 77,414 sq.km, an astonishing 68% of Madhya Pradesh's forests are fringe forests that sustain the livelihoods of the rural poor and hence bear the brunt of excessive anthropogenic disturbances.

The first impact of over dependence of rural population on the forests is felt by the fringe areas. Therefore, it is necessary to manage the fringe areas in such a way that these areas act as a buffer between the fringe village and the intact interior forests. This is possible only if the dynamics of fringe areas is understood in terms of socio-economic and ecological context. In order to decipher this dynamics and socio-economic and ecological inter-linkages in the forest fringe areas, a study at micro level was conducted in Sironj – Salaiya village of Chhatarpur district of Madhya Pradesh during October 2018 to January 2019. Chhatarpur district is characterized by low rainfall of around 1080 mm annually while the temperature varies from 7°C to 42°C. The forests are mainly tropical dry deciduous type with preponderance of *Anogeissus latifolia*, *Diospyros melanoxylon*, *Acacia catechu*, *Butea monosperma* and *Lagerstroemia microcarpa*. The area also has an abundance of dry teak forests and plantations and forms a buffer for adjoining Panna Tiger Reserve. The study village is situated just 1.74 km away from buffer zone of Panna Tiger



Woman with headload of firewood

Reserve. Out of 8687 sq.km of forest area in the district, approximately 1289.53 sq.km have been categorized as fringe forests thus accounting for 15% of the total forest area of the district (FSI, 2011). Similarly out of 1080 villages of Chhatarpur district, 130 are situated on the forest fringes.

Objectives and study area

The broad goal of the study was to understand the socio-economic patterns and spatial impact of the socio-economic parameters on forest ecosystem in the selected fringe village Sironj – Salaiya. The study though restricted to a single village, has attempted to elucidate problems and issues pertaining to forest fringe area management and people – forest interface in depth. The objectives of the study are listed as follows:

- Assessing the socio-economic characteristics of Sironj – Salaiya village.
- Identifying and quantifying the forest dependence patterns of the selected village
- Identifying and quantifying the impact of forest dependence on fringe forest ecosystem on a spatial scale.

- Devising management strategies for managing dependence and restoring the fringe forests

Sironj Salaiya: Living on the Fringe

Located in Sironj Beat of Chhatarpur Range, Chhatarpur Forest Division along the Chhatarpur – Jhantoli road, the remote village of Sironj Salaiya is not less than an imagination painted on a muddy brown canvas. Scarred by acute water shortage during a major part of the year, Sironj Salaiya largely depends on low productivity rainfed agriculture. Approximately 3000 people dwell in the village distributed in 180 households as per Government records. However, the system of nuclear families have set in and households have now been split into several smaller families with overlapping land and livelihood resources. The intensive socio-economic survey revealed the presence of members belonging to Scheduled Tribes (20%) and Scheduled Caste (10%). About 37% of the households live below poverty line while the literacy rate is as low as 53%. Though the family size varied from 4 to 11 members, the



Firewood kept for drying in Sironj Salaiya

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average family size was determined to be 7 members per family which means a large number of stomachs to be filled under scarcity conditions. Most people in the villagers are not blessed with the luxury of having 'pakka' or concrete houses as 43% of the houses were 'kacha' made of mud and stones with tiled roof. The annual income was found to vary between ₹ 17500 to ₹ 220000 with an average of ₹ 56075. This pattern of low income level reflects the hardships faced by the villagers and their tendency to access natural resources in huge quantities that are available without any costs. Break-up of income from various sources is elucidated in Fig. 1.

Agriculture: Harvesting woes

Though the average land holding is 4.9 acres (2.00 ha), these lands are deprived of round-the-year irrigation facilities and have to depend on the scarce rainfall that the area receives. As a result not all the lands are suitable for cropping throughout the year. Thus, most of the villagers are either marginal farmers or small farmers in effect despite of owning more than 2 ha of unproductive land. Sironj Salaiya that depends on tankers for drinking water supply during summers cannot imagine of continuous water supply for their parched

farm lands and has to look up to the Rain Gods above. Majority households being marginal or small farmers with very little cultivable unirrigated land, the average annual income from agriculture is a meagre ₹ 13121 though it plays an important role in sustenance economy. Wheat is grown as an important crop a part of which is sold by those who have larger land holding while majority utilize wheat for their sustenance. Other crops like sesame (*Sesamum indicum*), black gram (*Vigna mungo*) and mustard (*Brassica juncea*) are also widely preferred and earns some revenue which is often negligible. Poor agricultural productivity has pushed households into labour works in adjoining villages and district headquarters. In fact about 40% of the meagre income in the village comes from such labour works.

Cattle and Fodder: Milking it wrong

As is practiced in all rural areas in the country, every household owns substantial number of livestock that includes, cows, buffaloes, goats and sheep. These animals not only provide the much-needed additional income to the family, but also takes care of nutrition of the household and manure for the agricultural land. Every household owns at least 1-3 cows out of which at least 1 cow is yielding milk at a given time. Number of buffaloes also have similar trends. About 53% of households have goats or sheep varying from 1 to 12 in number. Goats and sheep consists of 43% of

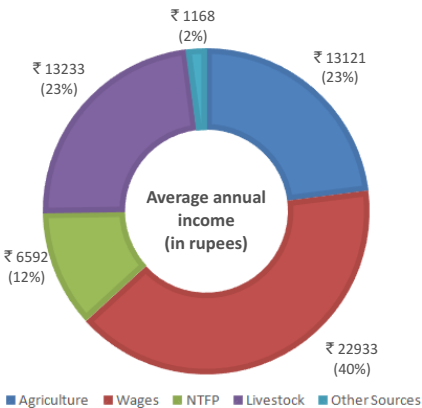


Fig. 1. Break-up of average annual income of villagers of Sironj Salaiya



Cattle grazing in fringe forest

the cattle population while cows / bulls comprise of 32% and buffaloes 25%. Even though the number of cattle is moderate to high, the productivity per cattle head is abysmally low with an average milk yield of 2.4 litres/cow/day or to say 0.7 litre/Cattle unit/day when all livestock is taken into consideration. The type of cattle owned was found to have a correlation with economic status as 45% of the Below Poverty Line households own more number of goats per household whereas in the APL category only 11% own more number of goats. Considering the browsing nature of goats, it is a well known fact that goats cause much damage to the forest vegetation and regeneration. The fodder requirement for such a population of livestock is also huge when quantified. On an average, every household collects an estimated 5.85 tonnes of fodder from various sources like agricultural land, forest areas and other categories of resources. Considering the low output, agricultural land contributes only 13% of the fodder requirement. Thus the wrath of huge demand and supply gap is borne by the adjoining fringe forest areas. A

whopping 75% consisting of 4.36 tonnes is extracted by an average household from the fringe forest areas every year in Sironj Salaiya by cut and carry method. Applying this figure to the entire village, it can be seen that the fringe forests are the source of at least 785 tonnes of cut and carry fodder thus subjecting the fringe areas to drastic degradation. Fig. 2 explains the fodder collection patterns of Sironj Salaiya village as observed during the study period.

Even as the fodder collection figures speak a million words about degradation of forests, the situation becomes more sinister as 75% of the cattle owned by the villagers are let out in the forest areas for open grazing on an average of 9 hours a day. Adding to the woes of forest ecosystem, there is an estimated population of at least 100 stray, unproductive and unclaimed cattle that raze the forest vegetation in addition to the ones owned by the people and intensive lopping.

Lopping is the most preferred method of fodder collection from forest trees. The intensity of lopping is highest in the fringe forest sharing boundary with the village and its intensity decreases as one goes farther

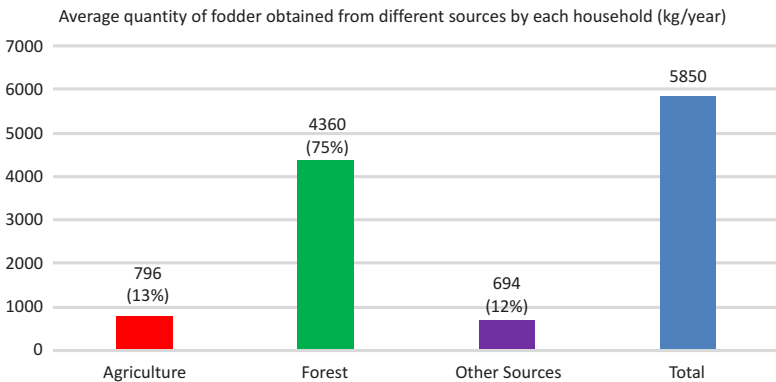


Fig. 2. Fodder collection pattern

Table 1: Lopping intensity in different zones of fringe forest adjoining Sironj Salaiya

Zone (distance from village boundary)	Farthest Zone (>1000 m)	Critical Zone (0-100 m)	Proximal Zone (100-500 m)	Middle Zone (500-1000 m)
Percentage of lopped trees	75%	40%	33%	25%

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into the forest away from the village. This pattern is evident from the observations made on ground through stratified random sample plots laid out at different distances (zones) from the village boundary farther into the forest area. Variation in lopping intensity as one moves farther from village boundary into the forest is tabulated in Table 1.

The most lopped trees are *Acacia catechu* (khair), *Butea monosperma* (palash) followed by *Bridelia retusa* (kasai) among several other species. As the lopped trees stand testimony to the disastrous impacts, availability of fodder has also been rapidly decreasing over a period of time. All respondents in the study lamented the fast dwindling forest-based fodder resources that was available in plenty a couple of decades ago and now the same forests reveal a picture of acute fodder scarcity. At times, people walk beyond the fringe areas as far as 5 to 9 km just to collect fodder. At times, people travel 5-9 km for fodder collection. Over a period of last twenty years, fodder availability in the fringe forest has been

declining as 100% of the respondents felt that currently there is acute shortage of fodder which was just enough quantity a decade ago and plenty a couple of decades ago. This indicates the high rate of forest degradation in the last 20 years. All this degradation of the forests and hard toil of the villagers, at the end of the day, does not yield any good returns. Such large scale ecosystem destruction through hard labour of the people does not generate any substantial income through livestock sector. The average milk yield is a negligible 2.4 litres/cow/day while average annual income from livestock is a meagre ₹ 13233 (23% of average annual income from all sources). It thus becomes imperative to take concrete measures for improvement in animal husbandry practices and provision of quality fodder in adequate quantity from alternate sources in order to save the fringe forest from ever-mounting pressure for grazing and fodder. Such a measure will also improve the socio-economic conditions of the poor villagers empowering them to adopt more sustainable land use systems.

Firewood: The burning issue

Energy is yet another factor that is critical well being of rural households and general health of forests in such rural areas. Clean and healthier sources of energy have not yet marked their presence in remote forest fringe areas as is visible in Sironj Salaiya. More than 90% of households in the village depend on firewood and dried cow dung cakes as primary source of energy to run the household whereas a negligible 13% of the respondents used kerosene and 30 percentage had LPG in their kitchens. The use of LPG was found to be very limited due to low income levels that barred people from refilling the LPG cylinders if used frequently. As a result, free of cost firewood from the fringe forests is the most preferred source of energy. The survey revealed that on an average, each household requires approximately 4058 kg of biomass to meet



A lopped and damaged tree of *Acacia catechu*

energy needs per year. Almost 70% of this biomass comes in the form of firewood extracted from the adjoining forest areas while just 30% is sourced from agricultural wastes and other sources. Thus an estimated 5.11 lakhs kg of firewood is extracted every year from the forest areas located adjacent to Sironj Salaiya, which turns out to be a giant figure questioning the very pillars of sustainability. Further analysis and interpretation points out to the fact that again, it's the poor households that depend more on firewood and severity of their drudgery is higher. On an average, the BPL households require approximately 20-25 kg of firewood per day where as it is comparatively lower at 15-20 kg/day for APL households and 5-10 kg/day for other well-off households. Owing to larger requirement, the BPL members, majority of whom consists of women have to go deeper into the forests as afar as 8-10 km. This trend not only cause drastic and intensive degradation of the forest eco-system, but

also expose the women folk to hazards of smoke causing respiratory diseases. As the forests continue to degrade, firewood keeps on burning in Sironj Salaiya.

Non-Timber Forest Produce: The other alternative

Typical to villages near forest areas, it was found that about 90% of all the respondents collect one or the other type of Non-Timber Forest Produce (NTFP) from adjacent forest areas. Flowers of *Madhuca latifolia* (Mahua) is the most collected NTFP with 70% households involved in its collection. On an average, about 123 kg of mahua flowers are collected by each household every year. About 33% of the households collect *Diospyros melanoxylon* (Tendu) leaves while just 10% households collect seeds of *Cassia tora* also. Tendu leaves and *Cassia tora* seeds are primarily collected by low income households. Major portion of income from NTFPs is contributed by sale of tendu leaves (102 kg /

Table 2: Elucidates the spatial trend in regeneration status of trees

Zone (distance from village boundary)	Critical Zone (0-100 m)	Proximal Zone (100-500 m)	Middle Zone (500-1000 m)	Farthest Zone (>1000 m)
Seedlings/ha (<2 cm collar dia)	0	1200	200	225
Saplings/ha (2-5 cm collar dia)	175	825	675	0
Adults/ha (5-9 cm collar dia, <10 cm dbh)	150	225	300	700
General Status	Poor	Good	Good	Fair

Table 3: Phyto-sociological characteristics of tree species

Zone	Ecological dominance patterns / IVI	Remarks
Critical Zone (0-100 m)	<i>L. parviflora</i> (IVI = 145), <i>B. monosperma</i> (IVI = 64), <i>A. catechu</i> (IVI = 48), <i>D. melanoxylon</i> (IVI = 42)	Excessive dominance of <i>L. parviflora</i>
Proximal Zone (100-500 m)	<i>L. parviflora</i> (IVI = 100), <i>A. catechu</i> (IVI = 83), <i>B. monosperma</i> (IVI = 22). The other species like <i>D. melanoxylon</i> , <i>Brideliaretausa</i> , <i>Lanneacoromandelica</i> , <i>Cassia fistula</i> have very low IVI below 35.	Tree community characterized by <i>L. parviflora</i> - <i>A. catechu</i> association. <i>B. monosperma</i> population reduced drastically showing lesser degree of degradation.
Middle Zone and beyond (>500 m)	<i>Lagerstroemia parviflora</i> (IVI = 62), <i>Lanneacoromandelica</i> (IVI = 54). <i>A. Catechu</i> , <i>C. fistula</i> , <i>Terminalia tomentosa</i> , <i>Brielia retusahave</i> IVI of less than 30. <i>B. monospermahad</i> very low IVI of 18 when compared to other zones.	Tree community characterized by <i>Lagerstroemia parviflora</i> - <i>Lanneacoromandelica</i> association. Lowest dominance of <i>B. monosperma</i> reveals least disturbance in farther zone in comparison to critical and proximal zones.

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year collection) that fetches approximately 62% of income from NTFPs, while Mahua fetches 37% followed by Cassia tora seeds fetching 1% of income from NTFPs. People walk for over 3 to 15 km to collect NTFPs. Though the annual income from NTFP varies from ₹ 3000 to ₹ 18000 with an average of ₹ 6592.00 per family/year which is very low, the timing of such income is very crucial as it provides money for the poor farmers to purchase seeds and arrange for other inputs required for agriculture.

Forest ecosystem: derailed parameters

Forest health and vitality is reflected by ecological parameters like regeneration status, structure and composition of tree community and bio-diversity indices. The faulty resource use pattern of Sironj Salaiya was found to have a far-reaching devastating effect on these selected ecological parameters of the forest ecosystem. Drawing methodology prescribed by the National Working Plan Code – 2014, regeneration status of different zones located at different distances from the village boundary was assessed through sampling in different zones. Regeneration status was found to be extremely poor near the village in critical zone and showed slight improvement as one moves farther away from village into other zones (Table 2).

Phyto-sociological analysis through determination of importance value index (IVI) of tree species also revealed variable

patterns in forest area closer to the village when compared to forest areas that are farther away from the village. The result of phyto-sociological study is elaborated in Table 3.

It is widely appreciated that anthropogenic disturbances also affect diversity patterns of an area. This was put to test by analyzing Simpson's Index of Diversity of the plant species in different zones of the fringe forest. The diversity was found to be least in the closest critical zone and increased as one moves farther away from the village. Fig. 3. Indicates the positive increase in Simpson's diversity index of plants as one moves from the critical zone to the farthest zone from the village boundary.

Future tense to future positive

The effect of anthropogenic activities on the immediate environment is obvious to anyone who doesn't wish to ignore it. Every parameter that indicates forest ecosystem health has been negatively impacted by the socio-economic conditions and forest dependence patterns of the people residing in Sironj Salaiya fringe village. The negative impact on the health of forests due to its proximity with the forest fringe village stands affirmative as revealed by the regeneration status, Simpsons Diversity index and Importance Value Index. The situation would be much similar in many other similarly situated forest fringe areas. Thus it becomes imperative to adopt

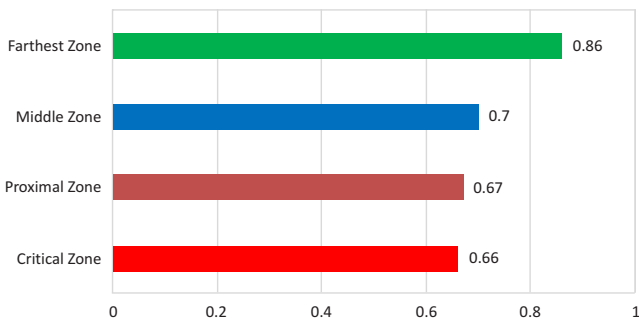

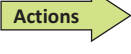
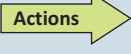



Fig. 3. Simpson's diversity index of plants in different study zones in the fringe forest

Management Goal	Strategy	Action
Increase Income by sustainable livelihood measures	I. Increase agricultural productivity	<ol style="list-style-type: none"> 1. Improving water availability by in situ water harvesting methods. 2. Switching to crops that require less water. 3. Multiple cropping and rotation cropping system and horticulture crops like lemon, guava etc through dryland based agro-forestry systems. 4. Distribution of tillers in a cluster based approach. 5. Live fencing with Opuntia, Agave etc. and other natural fence species to prevent entry of Nilgai. 6. Adoption of conflict free crops like lemon grass on marginal unproductive land holdings supported by oil extraction units on cluster basis.
	 II. Encouraging entrepreneurship	<ol style="list-style-type: none"> 1. Agro-processing. 2. Better market accessibility for micro enterprises like dona making, cowdung, dhoop batti etc. 3. Value addition of milk products like Paneer, curd etc.
Reduce dependence on forest resources	I. Alternative sources of energy	 <ol style="list-style-type: none"> 1. Awareness on the benefits of LPG and ill effects of smoke from traditional chulas. 2. Advanced bio-gas plant can be distributed for utilizing huge stock of cow-dung. 3. For people to adopt alternatives, its necessary to increase their income levels.
	II. Reducing dependence for fodder	 <ol style="list-style-type: none"> 1. Adoption of Silvi-pastoral systems. 2. Pooling panchayat lands for developing common fodder resources and its maintenance through payment of nominal fees. 3. Disposing off useless cattle and keeping less but better breeds. 4. Immediate sterilization of stray cattle.
Restoration of already degraded forests	I. Improving regeneration	 <ol style="list-style-type: none"> 1. Urja van with high calorific value species for fuelwood and protein rich species for fodder requirements. 2. Planting NTFP species like <i>Madhuca indica</i>, <i>Buchanania lanzan</i> etc. in the forest village interface. 3. Poor regeneration in the critical zone needs to be immediately supplemented with ANR 4. IVI index reveals excessive Tendu and Palas in the critical zone, improvement in index through adequate plantation of important native species.

management strategies that focus not only restoring and protecting the forest fringes but also managing the socio-economic dynamics of the people living such villages. The matter in concern remains the measures that need to be adopted in theory and in practice to preserve what we have and proliferate what is scarce.

Sets of measures, suggested in this study, attempt to alter the foundations of customs rooted in heedless consumption and aim a diversion towards sustainable practices. The basic rests on adopting a three

– pronged strategy in addressing the issue pertaining to both the village and fringe forests:

1. Increase the income by sustainable livelihood measures
2. Reduce dependence on forest resources
3. Restoration of already degraded forests

Although the topic takes an ecological and hence restrictive outlook, but the resolution is clearly one that finds its roots in administrative planning, policy making, mass awareness and economical interventions

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to make a comeback in what clearly now seems to be a losing battle. However, the silver lining is the holistic way our concerned institutions are approaching the diverse and challenging sets of problems and attempting to eliminate both the causes and effects of the incumbent set of challenges. Through concerted and educated efforts, one can certainly hope to see the fringe forests embark on a journey to abundance and perennial conservation.

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Voices from the Field

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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.
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