FIELD FORESTER

VOICES FROM THE FIELD

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Editorial Advisory Board

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From the Chief Editor's Desk

The September 2016 issue of Field Forester focuses mainly on People & Forests. It brings stories from states of Gujarat, Karnataka, Kerala, Madhya Pradesh and Tamil Nadu; with documentation on people - forests interface from the Tiger Reserves of Satyamanglam in Tamil Nadu, Bhadra in Karnataka and Periya in Kerala. These success stories provide a snapshot of the various programmes and activities from diverse ecosystems and landscapes which are representative of the richness of forests in India.

The documented case studies includes articles on preventive measures for conflict situation between humans and elephants in Kerala's North Wayanad Division, Issues related to relocation and rehabilitation and compensation in human animal conflict situation.

The issue includes case studies which examine to role of Non Wood Forest Produce (NWFP's) in creating opportunities for enhancing livelihood options for households and communities in around forest areas. Some of the lesser known forest products like "***Uppage***" (Garcinia cambogia) - A NWFP from Karnataka; more popular species like bamboo craftsmanship to the Kotwalia tribe in South Gujarat; and the new emerging field of bio-fuels again from Karnataka have also been included.

The last section is on *"Ecosystem Approach to Management"* and talks about restoration of grasslands, regeneration of degraded forest & the novel experiment of Water ATMs in Gujarat.

There are case studies on Joint Forest Management, one each from Tamil Nadu, Kerala and Madhya Pradesh, that reiterate the need for involving people in Forest conservation for ensuring success of such programmes. Ensuring sustainable alternate livelihood opportunities or a constant source of income automatically earns the people's confidence and their co-operation in conservation.

One importnat obejective of such documentation is to capture the prespectives of the Officer Trainees belonging to the State Forest Services and Range Forest Officer batches currently undergoing training in various institutions.

RP Singh

WILDLIFE MANAGEMENT

People-centric management scores at Sathyamangalan Tiger Reserve

The people-centric strategy has helped the Sathyamangalam Tiger Reserve authorities earn the support of the people and promote the conservation of wildlife in the reserve

S Sathish

Sathyamangalam Tiger Reserve (STR) in a collaborative project with the World Wide Fund for Nature (WWF-N) is monitoring the leopard and tiger movements in the STR. The monitoring of these animals is carried out in all the important parts of the tiger reserve especially in the hair pin bends of the NH 209 using the camera trap method. As per the present status, more than 60 tigers and 10 leopards are present in the tiger reserve. Sometime back a man eater leopard was trapped which was responsible for human deaths in the hair pin bends of the STR.

Anti Poaching Watchers (APW) Camp

Hassanur Division includes three Ranges namely Hassanur, Thalavady and Germalam. It has more than 8 APW sheds in three Ranges. For each shed a minimum 8 APWs are appointed and they carry out patrolling on a rotational basis. They are required to visit different interior parts of the tiger reserve every day, so that the occurrence of forest offences gets drastically reduced.

FRO Trainee, Telangana State Forest Academy, Dulapally, Hyderabad

Anti-poaching Watcher's Camp

Barricade and Caution Board

The Divisional Forest Officer cum Deputy Director of STR, Smt. C H Padma, IFS, has taken steps to erect barricades and caution boards to reduce the vehicle speed as well as giving intimation to the drivers about the 'animal crossing zone' on NH 209. These measures were undertaken following the death of a leopard on the main road due to a vehicle travelling at high speed.

Activities of the Village Forest Council (VFC)

A number of income generation and community development activities are carried out by the Village Forest COuncil (VFC). The Forest Department has provided subsidy for gas connections to reduce collection of firewood. They have also distributed flour machines, cooking vessels and accessories for marriages and threshing facilities to the local people. It was revealed by the DFO that Rs 40 lakh has been allocated for income-generation activities, largely for agriculture-based activities.

Providing Job Opportunities

A number of local youth have been appointed, particularly from the tribal community as anti-poaching watchers. The department also conducted a job fair for the educated youth in this area, through which many people have been placed in different companies both in Tamil Nadu and Karnataka.

Law and Order

Forest officials play a vital role in reducing the crime level in the tiger reserve. Cases have been booked and criminals involved in tiger poisoning and animal skin trade have been arrested. High vigilance has led to a drastic fall in the rate of offences in the STR.

NTFP Shop on the Highway

As part of ecotourism development, a shop has been set up near the divisional office to sell NTFP as well providing awareness to the public about the importance of tiger reserve by issuing leaflets and pamphlets.

Awareness Generation Programmes

A number of awareness generating programmes have been organised for school children, women, and youth on special occasions like World Environment Day and the wildlife week.

Infrastructure Development and Conservation Activities

Since Hassanur is a newly formed division, a lot of infrastructural developments have still to be carried out to meet the basic needs. Buildings like range office, staff quarters, watchtower and also soil moisture conservation structures like check dams, percolation ponds, water troughs are being constructed based on the necessity.

Network Development

Making use of social media, the Tiger Reserve has created 'Hassanur Str Group' on Whatsapp which includes the staff who are working in this division. This platform helps them to communicate quickly with each other in emergencies terms of any urgency or when important tasks have to be carried out. Through this, the DFO too can keep track of work of staff like APWs. The frontline staff is also enthused when their work is recognised by their superior officers, like the DFO, instantaneously.

Conclusion

The main thrust of the Sathyamangalam Tiger Reserve management, is to concentrate on people-centric activities in ensuring forest conservation. Their various efforts help them touch the lives of people and ensuring their cooperation and support of people. The people centric management will also prove to beneficial for the flagship species and other wildlife. The performance of the Tiger Reserve also earned it accolades from the National Tiger Conservation Authority this year.

FOREST MANAGEMENT

Uppage – A Non Timber Forest Produce

A necessary requirement for sustainable exploitation is a land tenure system which ensures exploitation rights to local extractors

Piyush Kumar Sharma and Shubham Jain

India has for long been known as the Land of Spices and spices have for long been a commodity for export. The Portuguese sailor, Vasco de Gama, discovered the sea route to India in 1498. He too came to India in search of spices, but very few people know that he came for a particular type of spice – black pepper – a spice use for preservation of meat (as there was no refrigerator or cold storage system developed in medieval times).

Forests are a rich source of Non Timber Forest Products (NTFP's). These include plants used for food, beverages, forage, fuel, medicine, fiber and biochemicals; animals, birds and fish for food, fur and feathers; as well as their products such as honey, lac and silk. However, most NTFPs are characterised by limited quantities, seasonal availability, problems of quality control and an inelastic supply. This poses a constraint on the commercial development of many products and confines their sustainable use mainly to the subsistence sector, where there is no incentive to harvest more of a product than can be utilised by a household or a community.

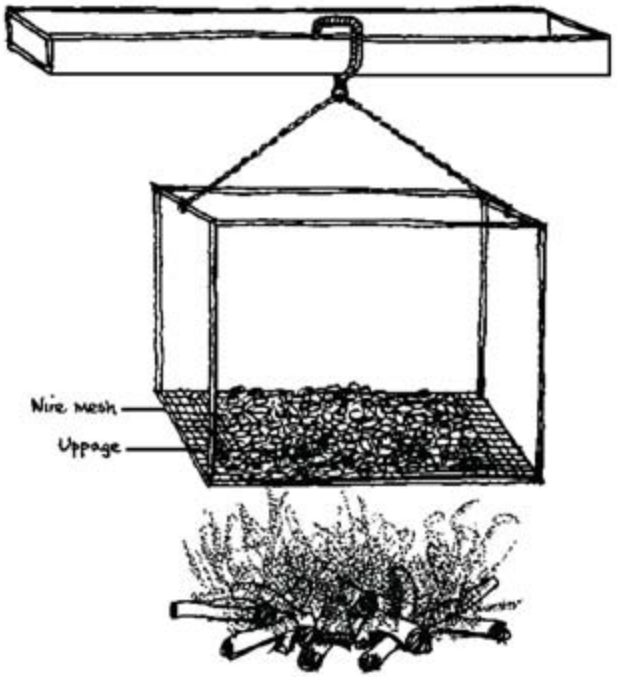
Garcinia cambogia, commonly known as uppage, is a medium sized (10m) evergreen tree, it grows in tropical moist evergreen, semi-evergreen, and wet temperate forest types in Southern India. Occasionally uppage trees grow along road sides, in residual

Table: **Estimated earnings of village collection agents**

Agent's Village	Amount of Uppage collected (2014) (in Quintals)	Likely earnings	
		at Rs 0.50/kg	at Rs 0.30/kg
Vanahalli	60	3000	1800
Gadihithlu	190	9500	5700
Kyadgi	175	8750	5250
Bilgi (agent 1)	55	2750	1650
Bilgi (agent 2)	70	3500	2100

SOURCE: ISST 2015a

ACF Trainees, Batch 2015-2017, CASFOS, Coimbatore



Uppage being dried on a mat in a village home

forest patches and on wastelands around villages.

Uppage fruit production has a two year cycle. The seeds of uppage have a 30% fat content and are used locally to produce a substitute for ghee. The dried fruit rind is the chief commercial product. Uppage rind is also used as a condiment in the preparation of fish curry because they are very acidic. The fruits are edible but they are too acidic to be eaten raw and are now valued more for their dried rind.

However as the uppage collection increases, serious questions arises as to the sustainability of the resource base. Better data is need on the distribution and number of uppage tress, their ecology and the amount of fuel wood consumed for uppage drying before accurate assessments of resource degradation can be made. The following table show the estimate earning of villagers by uppage collection.

In principle, exploitation of uppage from natural forests can be sustainable. In practice, it is frequently not. A necessary requirement (but not a sufficient one) for sustainable exploitation is a land tenure system which ensures exploitation rights to local extractors, like the Forest Rights Act (2006) enacted by the Government of India to provide collection rights of 26 minor forest produce by communities living and dependent upon forest produce.

Though the differences between

Uppage Product

Uppage Fruit

the use and management of NTFP on one hand and timber and natural forest management on the other cannot be denied, there are also some striking similarities. Both products are characterized by over-exploitation, affected by government regulations, their weak enforcement, and a trend towards domestication or plantation management. The biggest difference lies in the composition of stakeholders. While natural forest management in the region is performed by government departments and capital intensive industries, the NTFP sector is predominantly dominated by the rural poor and labour intensive small-scale industries.

NTFPs are an extremely heterogeneous group. They are collected for different reasons by different people. Some are consumed without any further processing and play no role in the market place. Others go through a long chain of traders and processors before reaching a highly competitive international market. Some come from the natural forests, while others have been domesticated for centuries.

Ample opportunities exist for enhancing export earnings by developing appropriate facilities for processing, drying, storing, packaging, and marketing. Many technologies are available and need only be adapted for local use to revive. A trend towards green markets may affect the future role of NTFPs. However, this will apply only to few products and niche markets.

To ensure sustainable yield of any forest product, proper utilisation and adequate regeneration need to be assured. Non timber forest produce is very important for the rural economy and forest dwellers livelihood. There is growing need to scientifically and sustainably harvest and collect these invaluable products given to us by Mother Nature.

JOINT FOREST MANAGEMENT

Vaigai Association for Nature Resources and Mountain Ranges

VANAM, a not-for-profit organization works closely with the Forest Department and other stakeholders to conserve nature in the Meghamalai Wildlife Division in Tamil Nadu

M Jeevana

VANAM (Vaigai Association for Nature Resources And Mountain Ranges) founded by VANAM Trust, a non-profitable environmental organisation based at Theni, Tamil Nadu helps in conservation of nature and environment in and around Theni district so that the forest wealth of district is available for the benefit of future generations. The trust formed in the year 2007, has been active in nature conservation, creating awareness among the public by working in close association with forest department in wildlife management and protection.

Introduction

Theni district which has 33 per cent of forest cover is located in southern-western Ghats and is one of the global biodiversity hotspots. Part of Theni Forest Division was declared as the Meghamalai Wildlife Division in the year 2009 and started functioning from the year 2012 with an area of 627 sq. km. Meghamalai is contiguous with Periyar Tiger Reserve in the state of Kerala in the south west and bounded by the Grizzled Giant Squirrel Wild life sanctuary of Tamil Nadu to its south-east. The east and western limits are bordered by Madurai forest Division and Cumbum Valley. Megamalai Wildlife Division which lies between Periyar Tiger Reserve and the Grizzled Giant Squirrel Sanctuary forms an important connecting corridor habitat for elephants and is an important refuge for the spillover tiger population from the adjoining Periyar Tiger Reserve.

Meghamalai is the only source for Vaigai river and fulfills the water need of nearly one crore people in 5 districts (Theni, Maduarai, Sivaganaga, Ramanad and Dindigul) in southern Tamil Nadu. Meghamalai is home to many endangered species including the apex predator – the tiger – and has sizable populations of the highly endangered Lion Tailed Macaque and is also home to the highly endangered state animal of Tamil Nadu – the Nilgiri Tahr. The rare mega-bat – Salim Ali's fruit bat – was also first discovered from this area. The Hutton's pit viper was last collected from this area by naturalist/ planter Angus Hutton in 1949 and is yet to be rediscovered. It comes as no surprise that the Meghamalai Wildlife

FRO (Trainee), Telangana State Forest Academy, Dulapally, Hyderabad

Division is commonly known as 'Eden of Tamil Nadu' and is representative of all species which are available in the Western Ghats.

Even though the Meghamalai Hills have many unique and ecologically important areas, its status till 2009 was only as a reserve forest / reserve land, it had many threats to its conservation from cattle grazing, encroachments, wood cutting and poaching. With this background VANAM Trust was started with 12 likeminded people in order to create awareness among the public to work in close association with forest department in wildlife management and protection. The Trust has played a vital role in advocacy and in supporting the Government to declare Meghamalai Wildlife Sanctuary by closely working with district forest division.

Activities of the Trust

Since the year 2007, VANAM has conducted many activities in close association with the forest department to achieve its objectives. The main activities are as follows:

1. Environmental awareness creation

Awareness level on environment and wildlife among the public, villagers and Government officials of the line department was very low. This posed difficulties for the forest department in implementing their day to day management and protection work in the district. VANAM has acted as a buffer between the forest department and other stakeholders by creating awareness which helped to ease the work of forest officials at management level.

a. Creation of awareness among school children, college students and teachers

In order to achieve this, schools, colleges and school teachers around the Meghamalai Wildlife Division were targeted and VANAM conducted a series of awareness classes, photo exhibitions and quiz programmes. Along with the Zoo Outreach Organization of Coimbatore, a fresh water biodiversity conservation programme was conducted for interested/selected school teachers as part of a trainers training.

b. Creation of awareness among villagers and public

On a few occasions, during the month of May, before the schools re-open, a wildlife film show is arranged for a big gathering and this is advertised in the daily newspapers. Leading conservationists, field workers and scientists are invited for live interaction with the audience at the end of the film show. VANAM has coordinated regular awareness meeting for villagers along with forest department.

c. Creation of awareness among the line department and stake holders

VANAM in its assessment felt that for effective conservation, the active involvement of all the stakeholders like the police department, journalists, the judiciary and other environmental NGOs was very essential. To achieve that VANAM has created a Green

Corps among the armed reserve police of Theni Division and Green Lawyers Association among practicing lawyers in the Madras High Court and has conducted regular awareness campaigns along with field exposure visit to Periyar Tiger Reserve.

Personnel from the Anti Naxal Squad (ANS) of the police wing were chosen and sensitized on environment and wildlife issues, since their regular duties are only in the forest areas to control and check the naxal movement. Regular sensitization meetings were conducted and it resulted in the ANS team working in close association with forest department and reporting wildlife movement, rare sightings, illegal unauthorized movement of public, poaching activities, illegal weapon holders etc. That helped in improving thewildlife conservation efforts in the district.

Journalists play a major role in creating positive as well as negative awareness. Being an NGO, VANAM has a friendly approach in creating awareness on positive aspects of the conservation and forest department. VANAM had organized regular series of 2 days awareness campaign for journalists of Theni district and the reporters of 'Dinamalar' who are working in Western Ghats ranges.

d. Nature awareness trekking

A series of trekking expeditions along with Forest Department were arranged for school children, teachers, journalists, lawyers, and doctors and for other NGO's so as to create more concern and awareness on wildlife conservation.

2. Skill upgradation programme

VANAM also organized a skill upgradation programme for frontline field level forest staff – anti-poaching watchers, forest watchers, forest guards and foresters – on various aspects of wildlife management like anti-poaching techniques, animal behavior, fire management, conflict mitigation measures, rescue of wild animals, wildlife law and wildlife offence and court proceedings. VANAM also organized trainings for handling GPS, jungle survival techniques and first aid in the wilderness to the forest staff and ANS police.

3. Research and scientific documentation

Even though Meghamalai is unique in its ecological importance, many aspects of the area have not been studied and still remain unexplored. VANAM started an initiative to take up scientific documentation of the wildlife in the area. This documentation includes among others, the Lion Tailed Macaque, the highly endangered Nilgiri Tahr and the Great Indian (pied) Hornbill. This document became the basis for the declaration of the area as a wildlife Sanctuary. VANAM has conducted the first scientific wildlife census after the creation of the wildlife sanctuary and has laid out the transects systematically for periodical monitoring every year. Currently VANAM has made efforts to rediscover the endemic Hutton pit viper and in that process 6 more

amphibians and reptiles have been newly discovered. The Trust also organises seasonal bird watching and census operations in coordination with the Forest Department and other NGOs.

4. Medical camp to forest staff and villagers

VANAM conducts many health camps for the forest staff and people in the surrounding villages along with NALAM Trust and the Forest Department.

5. Plastic free campaign.

VANAM has also organised anti-plastic campaigns in the important tourism places within the Sanctuary like Suruli falls in coordination with the line department.

ECOSYSTEM SERVICES

Water ATM in Gujarat

The concept not only caters to the need of safe drinking water for the devotees of Dev Mogra Temple but also create awareness about the role of forests in sustaining water sources.

Champak Deka

A unique intervention by the Forest Department, the Water ATM was installed to provide drinking water to the devotees visiting the temple of Mata Kunti at Devmogra. The project also created awareness among the visitors for the need to conserve the existing natural forest.

Introduction

Devmogra village is located in Sagbara Taluka in Narmada District of Gujarat State, India. It is situated 54 kms south of the district head quarters Rajpipla. The village is also home to the temple of Dev Mogra (also Devmogra or Mata Kunti) - a Goddess for the Satpuda mountain people. It is believed that the temple was established seven generations back when the then high-priest saw a vision of Dev Mogra. One of the myths about this goddess is that she was a beautiful Princess. Dev Mogra had a sister, however no one wanted to marry the sister since Dev Mogra was very beautiful and many of the Princes wanted to marry her. Feeling saddened by this Dev Mogra decided to go to the jungle and live there. An annual festival is held from February to March at the temple and an estimated 5 to 7 lakh people come to worship during this period.

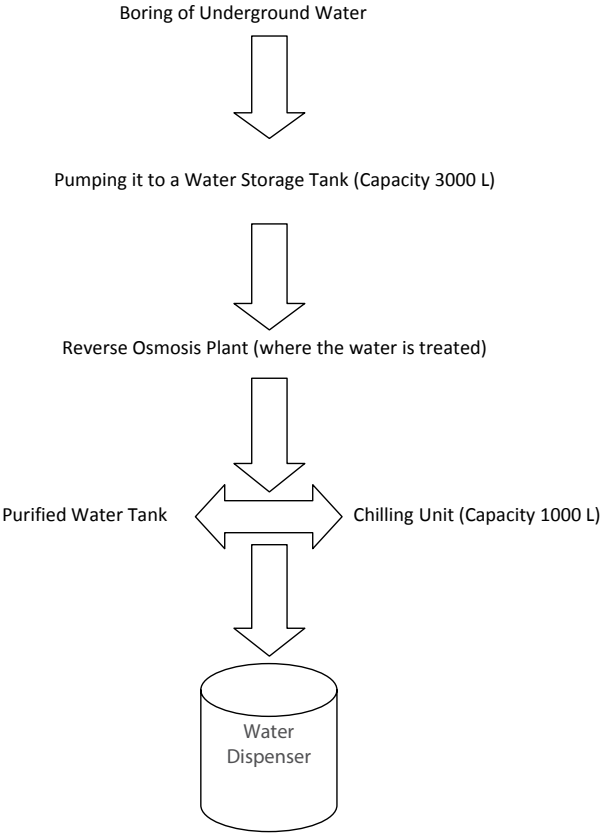
Conceptualising the Water ATM

The concept of installing a water ATM near the temple was the brainchild of the Shri S Dhanapal, DCF, Narmada Division. It was felt that this would not only cater to the need of safe drinking water for the devotees but also create awareness about the role of forests in sustaining water resources. It would also establish a bridge between the Forest Department and the devotees visiting the temple. The water ATM is actually a reverse osmosis water plant, it purifies the groundwater and then supplies it to the delivery point (water dispenser).

Once the RO plant is switched on for purification of water, it is cleaned

Officer Trainee, 2015-17 Batch

How the Water ATM Works



by the Backwash, Rinse and Filtration processes for about half an hour. In order to prevent bacterial infection, two drops of antibacterial liquid are added to the storage plant once in a week. The discharge rate of the water ATM is about 500 L/hr. Safe drinking water (200 ml) is dispensed when a one rupee coin is inserted in the ATM machine.

In order to ensure accommodation for the devotees, an Eco-Development project has also been initiated by the Forest Department and now is nearing completion. The infrastructure created under this project includes a Reception Centre, an Interpretation Centre, a Kitchen, three Cottages and six modern tents. The water ATM has been installed in the Eco-Development Centre to ensure care and maintenance.

Conclusion

The cost of installation of the Water ATM is about Rs 10 lakh (it includes both establishment cost as well as machinery cost). As the Water ATM is

in the initial stage of functioning, it is difficult at this point of time to do a cost-benefit analysis. However, in the future time, it will definitely render a positive feedback from the devotees as well as from the local people.

Acknowledgement

I owe my sincere thanks to Mrs Meera Iyer, IFS, Tour In-charge, West India Tour for providing all the facilities for undertaking the Case Study tour to the Narmada Division of Gujarat. My sincere thanks goes to Mr S Dhanapal, IFS, DFO, Narmada Forest Division and all the office bearers in the division for helping our group in all aspects to make our tour a successful one.

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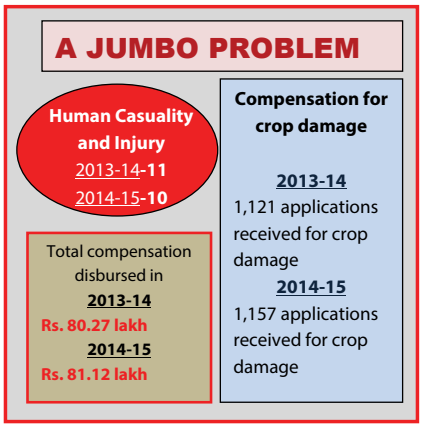
WILDLIFE MANAGEMENT

Elephant repellent spray: Preventive measure for man-animal conflict

Elephant repellent spray is a different and relatively cheap method and is based on the natural behaviour of the animal

Ashish Vyas and Yadvendra Singh Chundawat

Crop raiding by elephants is one of the biggest problems in Kerala's North Wayanad division. Every year, lakhs of rupees are spent as compensation. A variety of mitigation measures have been taken by department such as solar fencing, elephant proof trenches, elephant proof wall, etc. These approaches have been unsatisfactory because they are either too expensive or ineffective and they also need regular maintenance. Therefore, there is a pressing need for a reliable, low cost and effective elephant repellent system. Elephant repellent spray is a different and relatively cheap method that can be used as preventive measure. It has been successfully used in the case of African elephants. It is based on the natural behaviour of elephants.



Repellents based on resins from capsicum spp. peppers have been used to alter animal behaviour. The resin contains capsaicin, a chemical found in fruits of capsicum spp. which is the agent that makes them taste hot by stimulating nociceptors. The irritating quality of this stimulation produces a burning sensation that animals find unpleasant. Since 1997, farmers in Africa have been using the capsaicin to repel elephants. The simplest method consists of planting a wide row of chili peppers around cultivated fields and gardens. So successful has this been that the chilies themselves have become a cash crop for farmers. The Elephant Pepper Development Trust now assists the farmers in cultivating their crops and managing elephants. In addition, the Trust formed two companies — African Spices Company in Zambia and the Chili Pepper Company in Zimbabwe – that help farmers produce,

SFS Trainees, 2015-17 Batch, CASFOS, Coimbatore

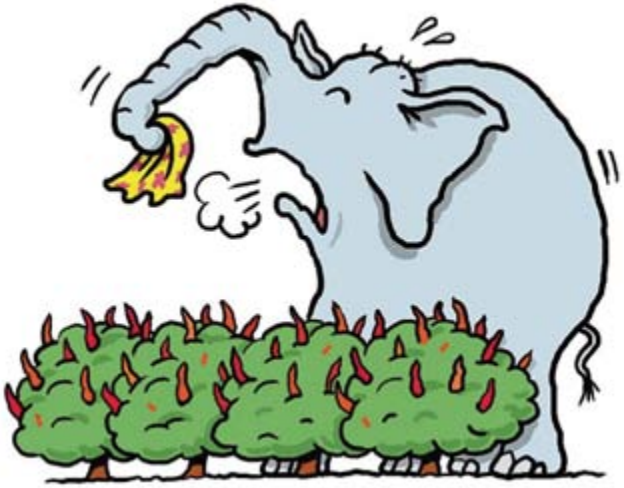
Wild elephant destroying the crops of a farmer in Begur range, north Wayanad division.

sell and distribute the chili peppers and products such as hot sauces, jams, and relishes.

Sprays made from capsicum oleoresin are now commercially available in Africa. Airborne capsaicin is a strong deterrent, working to quickly drive elephants out of fields. The main difficulty with the aerosol method is that the spray is subject to wind and other weather conditions. It is also an irritant to humans and can remain in the air long after it is sprayed. A pepper spray can be used to deter wild elephants from raiding farms. The spray can is being developed by Loki Osborn, a zoologist at the University of Cambridge, UK and Jack Birochak, an inventor based at Valley Forge, Pennsylvania. Elephants destroy thousands of dollars' worth of crop each year in Asia. The device will help in reducing crop damage. A spray can hold about one kg of a mixture of pepper and oil. As it is difficult to use a spray can close to wild elephants, a compressed air launcher can be used that would throw the can as far as 200 metres. The launcher lobs the spray can in an area near the elephants, where it begins to spout after hitting the ground. The elephants freeze, sneeze, and leave the area quickly (*New Scientist*, Vol. 154, No 2078).

Elephants cannot stand chilli peppers and if they're liable to get a mouthful of chillis with the crop, they're more likely to avoid it. Other ways to use chilies to deter elephants include:

- Mix chilli pepper with old engine oil. Paint twine or string with this mixture and hang the twine around your field or garden.
- Collect elephant dung. Pile chilli pepper onto the dung and burn it. The pungent smoke will release chilli pepper residue into the air. These can also be made into "chilli-dung" bricks or balls if you know how to fashion them this way.
- Mix capsaicin oil with grease to a solid barrier such as a fence or even a string or rope suspended



(source: westdeangardensblog.com)

above a fence has the same effect on the elephant, repelling them upon contact or close proximity.

- Tobacco might also work when ground up and mixed with engine oil and ground chilli. Smear this concoction on ropes surrounding the food garden or crops. Tobacco dust from tobacco factories can also be used, even without chilli.

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FOREST MANAGEMENT

Kotwalia Bamboo Artisan Project

A collaborative project between the government and civil society under Mandvi (North) Range, Surat Division, shows the way for others

Rajiv Engti

The Kotwalias are one of the most primitive tribes of south Gujarat. Almost all of them are landless since ages. Traditionally, they have been engaged in making bamboo baskets. They are known for their bamboo craftsmanship and depend entirely on bamboo works and basket making. They used to live near forests to ensure regular supply of raw materials for making bamboo items which they sell in the market. All the family members contribute in making bamboo artifacts. They are economically and educationally very backward. The literacy rate is very low. With the passage of time, the availability of bamboo in the wild became scarce and the tribe had to travel long distances to collect raw material. This coupled with other socio-economic factors resulted in the dwindling of their numbers. According to the latest census, out of the total population of 21,453, the district of Surat houses around 14,194.

Apart from getting raw materials, the other major problem faced by the tribe is that of fetching a good price for their finished products in the local markets. Since 1976, the Forest Department has been trying to improve their economic conditions by launching the Kotwalia scheme of supplying bamboo at very low cost of just Re. 1 per piece to be used to produce traditional bamboo crafts and utilities for commercial trade. This scheme continued till 2003-2004. In 2004, the scheme was renewed under the Ambedkar Hastkala Yojna to train traditional bamboo workers in modern and niche bamboo products for 622 families from Mandvi Taluka and Umarpada. All along the biggest challenge was to adapt to the changing scenario of products and market demands. This forced the Forest Department to adopt a new vision. During 2013-2014, the AKRSP (Aga Khan Rural Support Program) was taken on board. AKRSP works under the Aga Khan Foundation and is dedicated to improving quality of life and rural development throughout the world. AKRSP took care of the training of tribals in bamboo craft and creating market linkages for finished products.

Kotwalia Bamboo Artisan Project

The Kotwalia Bamboo Artisan Project resulted as a joint initiative of the Forest Department of Gujarat, Tribal Sub-Plan (TASP) and AKRSP. The project was executed with Rs. 55,80,400 (fifty

SFS Trainee, 2015-17 Batch, CASFOS, Dehradun

The project was funded in the following pattern:

Project	Forest Dept. Support (40%)	AKRSP Support (20%)	TASP Support (40%)	Total Fund (100%)
Bamboo Artisan Project (Kotwalia)	2220400	1140500	2219500	5580400
Total	**2220400**	**1140500**	**2219500**	**5580400**

five lakh eighty thousand and four hundred).

Infrastructure Development: The infrastructure developed in the unit include a godown, workshop, product outlet and offices near State Highway Number 6 at Mandvi Zankhaw Road under Mandvi (North) Range, Surat Division.

Training and skill development: The Aga Khan Rural Support Program (AKRSP) took upon itself the responsibility of training the members of Kotwalia Tribes in bamboo works. Earlier, the items produced by them were confined only to baskets, containers, brooms, mats, fans, etc. Apart from training them on how to give a good finishing to their traditional items, they were taught to make furniture, lamps and other appliances made of bamboo. They were taught to work with modern tools and implements resulting in fine tuning of their craft according to market demand.

Currently, the workers engaged in the bamboo handicraft unit are placed in three categories, viz. unskilled, semiskilled and skilled and their remuneration ranges from Rs.160 to Rs. 320 as per their skill. Mr. Dhermesh Chaudhary is the head of workers who maintain the overall works while the management is looked after by Mr. Vinit who is a part of AKRSP. The active involvement of AKRSP has ensured that the work culture is healthy and the finished products find its way to the market fetching good prices. The participation of women members of the tribe is encouraging as money in the hands of women is more likely to benefit the whole family unlike their male counterparts who tend to spend their hard-earned money on alcohol.

The strategic location of the unit near a busy state highway ensures good sales from the product outlet. The demand for finished products is increasing and the unit is finding it tough to meet orders. What is most striking to note is the journey of Kotwalias from traditional baskets to modern furniture. The fact that the handicrafts are finding its way to intended market is a contrast to the earlier scenario when they were forced to sell their products to the middleman at throwaway prices out of poverty and ignorance. That was the prime reason why despite the best effort of the Forest Department to enhance livelihood options for the Kotwalias, poverty continued to be prevalent.

The success of this project has had a direct impact on the socio-economic status of this tribe in Mandvi Taluka of

Surat District. At present, the handicraft unit registers earnings of Rs.150,000 per month on an average. The surplus amount after disbursing the salary of workers and other management staff is distributed among the workers as bonus. The direct indication of benefit to the tribal workers is seen from the fact that some of them have graduated from bicycle to motor cycle. Due to their enhanced economic status and surety in monthly income, local shopkeepers and traders have started to give them goods on credit. Their children are getting education and are no longer malnourished.

Present Challenges

One of the biggest challenges has been to change the attitudes of tribal workers. The workers who are used to freebies from the government have the mentality of working less and demanding full remuneration. Maintaining a good work culture is difficult. Once their lifestyle of bamboo craft becomes their means of livelihood, they tend to shy away from giving their 100 per cent. Getting good raw materials is also a concern as the availability of local bamboo has become less. At present, raw material is being sourced from the north-eastern states.

This kind of project is equally relevant for the states of NE India where due to lack of value addition, the true potential of bamboo has not been realised in terms of livelihood means. The above project is a terrific example where the government can collaborate with NGOs to usher prosperity in tribal lifestyles with lasting impact on rural economies. Replication of such projects with required changes based on habit and lifestyles of individual tribe is the need of the hour to combat other problems plaguing the north-eastern states like unemployment and insurgency.

Acknowledgement

I would like to express my gratitude to Smt. Meera Iyer, IFS, Faculty CASFOS, for coordinating with all the concerned DCFs of the Divisions where we were supposed to visit. Also the tour would not have been possible without the kind cooperation of Puneet Nayyar, IFS, DCF, Surat Division who arranged all the logistics for me. I would also like to make special mention of Janak Thakar, ACF; SN Surma, RFO, Mandvi (N); JP Rathore, RFO, Mandvi (S) and all the forest officials of Surat Forest Division for their immense support in helping me complete my case studies.

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FOREST MANAGEMENT

Restoration of grassland ecosystem

Grasslands in India have not got the dserved attention of conservationists. Urgent steps need to be taken to restore them as they support a large variety of wildlife.

G.Vasanth Baskar

The semi-arid savanna grasslands of peninsular India are unique habitats that support a vast proportion of India's agro-pastoralist community. They are also home to critically endangered species such as the Great Indian bustard (*Ardeotis nigriceps*) and lesser florican (*Sypheotides indicus*) and other endangered and endemic species such as the Indian wolf (*Canis lupus pallipes*) and blackbuck antelope (*Antilope cervicapra*). Unfortunately, savanna grasslands have not received the attention of conservationists or policy makers, resulting in a lack of protection for endangered and endemic wildlife that occupy this habitat. Ironically, one of the biggest threats to this important ecosystem has come from forestry activities pursued by the State forest departments all over India. Perceiving these habitats to be degraded or wastelands, there has been a massive drive to afforest such areas under various government schemes. Unfortunately, this afforestation drive has resulted in monoculture plantations of exotic tree species such as Glyricidia and Eucalyptus and native species such as neem and some Acacias. This has resulted in loss of habitat for many obligate grassland species such as GIB, blackbuck, lesser florican, and wolf.

Objectives

- Development of grassland at suitable sites.
- Development of the degraded, Prosopis-infested and high saline areas into productive grassland.
- Development and reclamation of grassland areas affected by heavy grazing and infestation of *Prosopis juliflora.*
- Development of water harvesting structures to enhance the soil moisture of the area.

Criteria for selection

- Size of reserve forest.
- Percentage of reserved forest under plantation.
- Area of native grasslands outside the Reserved Forest (RF) within a 2 km radius.
- Area of large contiguous native grasslands outside the RF.
- Priority areas for restoration.
- Priority areas for conservation.

Grasslands of India

Grasslands extend over 24 per cent

FRO (Trainee), TNFA, Coimbatore

of the world's vegetation. However, prior to the impact of man and domesticated animals, its extension was approximately 40 per cent. In Asia, the grassland accounts for 20 per cent of land cover. In India, grasslands constitute one of the major biomes. All the natural and semi-natural grasslands maintained by livestock/wildlife are collectively known as Rangelands. In India, 13,813 sq. km area of the land falls under this category. Between 1954 and 1962, the Indian Council of Agriculture Research (ICAR) conducted grassland surveys and classified the grass cover of India into five major types — Sehima-Dichanthium, Dichanthium-Cenchrus-Lasiurus, Phragmites-Saccharum-Imperata, Themeda-Arundinella and Temperate-Alpine cover. The physiognomy, phenology and diversity of grasses vary with rainfall, topography and type of soil. Grazing is another major problem. Large herbivores are known to speed up the nutrient turnover rate. However, excessive or overgrazing leads to massive degradation. Continuous heavy grazing prevents renewed change from ephemeral to perennial vegetation when weather conditions change. *Prosopis juliflora* infestation is believed to be a major cause in reducing the productivity of pastureland and hindering the growth of grasses. Unwanted thorny bushes need to be removed out mechanically or manually to eliminate the competition.

General recommendations

For restoration and conservation, we recommend the following:

1) Remove exotic tree species and allow for regeneration of native woody cover such as Acacia, Zizyphus, etc. Use manual root stock removal without the use of heavy machinery.
2) No creation of unscientific deep trench-cum-mounds as this can hamper movement of wild animals as well as disrupt normal hydrological flows. In the same way, soil conservation measures are not necessary as good grasscover will prevent runoff.
3) Allow moderate levels of grazing by livestock and sheep to maintain soil fertility.
4) Monitor for presence of invasives such as Lantana and Prosopis. Active removal of these should be prioritised.
5) Prescribed cool-season burning should be carried out on a rotational basis.
6) Ensure no domestic predators, such as dogs from neighbouring villages, are allowed to roam through the grasslands. A strict policy in this regard should be followed.
7) No ploughing or furrowing of the soil as this tends to encourage weedy species.
8) No planting of exotic grass species. Natural reseeding and regeneration will occur from surrounding grasslands.

Management

1. Check grazing in the grasslands.
2. Introduction of native and indigenous species in the degraded lands.
3. Eradicate exotic species and invasive species in the grasslands.

FOREST MANAGEMENT

Biofuel, a sustainable alternative

Biofuels, obtained from biomass in gaseous as well as liquid form, can be used as substitute for either petrol or diesel by partly mixing them with fossil fuel or used independently in pure form

Chandrapal Singh Chouhan and Sunil Gupta

As an alternative fuel for compression ignition engine, biodiesel is the principle renewable and carbon neutral source. The Government of Karnataka took the initiative to establish Biofuel Park, Madunuru, in Hassan District, to find ways and means to produce, propagate and popularise the raising of the biofuel species and production of biofuel in Karnataka.

A case study was carried out to evaluate the efficacy and performance of Biofuel Park, Medunuru. The case study revealed that the Biofuel Park has been imparting training to farmers and also motivating them to produce biofuel tree species on their wastelands and bunds of farms and use of biofuel in pumpsets, tractors and for illumination in houses and its by-products, like cakes, in their agricultural crops and glycerol in soap making and other uses as medicine and in paint industry.

It needs sufficient budgetary support from the Government of Karnataka to carry out further research and development and also to make the project viable and sustainable.

Context

India consumes petroleum products worth Rs 4 lakh crore annually, including 40 million tonnes of diesel. It is ranked fifth after the US, China, Russia and Japan, among top fossil fuel consuming countries and fifth largest emitter of carbon di-oxide in the world.

Rapid industrialisation and exploitation of forest fuels with the depletion of domestic crude oil output have compelled the search for indigenous, renewable and viable alternate sources of energy, leading to focus on biodiesel.

On the initiative of the Department of Biotechnology, the Government of India and persuasion by former President APJ Abdul Kalam Azad, the University of Benguluru developed a biofuel programme in a systematic way.

A mega project on biofuels at Agriculture Research Station, Medunuru, Hassan, 190 km from Benguluru, with the support of the Government of Karnataka was started on May 15, 2006, by the Chief Minister of Karnataka. Hassan was chosen due to its unique character of representing approximately all types of climate and soil found in Karnataka. The foundation stone of the building was laid on July 9, 2007, and new building was inaugurated on

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October 19, 2008. At present it is under the Karnataka State Biodiversity Board (KSBD).

Data collection: The data was collected from Biofuel Park offices and Forest Department offices, followed by interviews and interactions with DCF, ACF, farmers, researchers, project coordinator, field investigators and foremen working on oil expellers unit and staff in the nursery.

About Biofuels

Biofuels are obtained from biomass in gaseous as well as liquid form and used as substitute for either petrol or diesel by partly mixing them with fossil fuel or used independently in pure form. Biofuel has three components – biogas, biodiesel and bioethanol. They are of three generations –those obtained from food crops like sugarcane, maize and beetroot; those obtained from either non edible oil or edible oil; and, those obtained from algae.

Biofuel species under experiment: The species that are being experimented are: *Pongamia pinnata, Jatropha curcas, Azadiracta indica, Madhuca indica* and *Simaruba glacua*. These species give approximately 30 per cent oil, except *Simaruba* which gives 60- 65 per cent oil. These species give oil after 3 to 5 years of planting in the field, except *Madhuca indica,* which gives oil after 10 years of planting. The detailed specification of the species is given in Table 1.

Nursery Techniques

First, freshly collected seeds of oil yielding trees are collected and are sown in the root trainers composed of decomposed coir pith, and, after one month, they are transferred to polybags of different sizes, like 5*8", 6*9", 10*16", having potting mixture of fym, sand, red soil as 2:1:1. Plants are kept in the nursery for one year under regular care.

Table 1

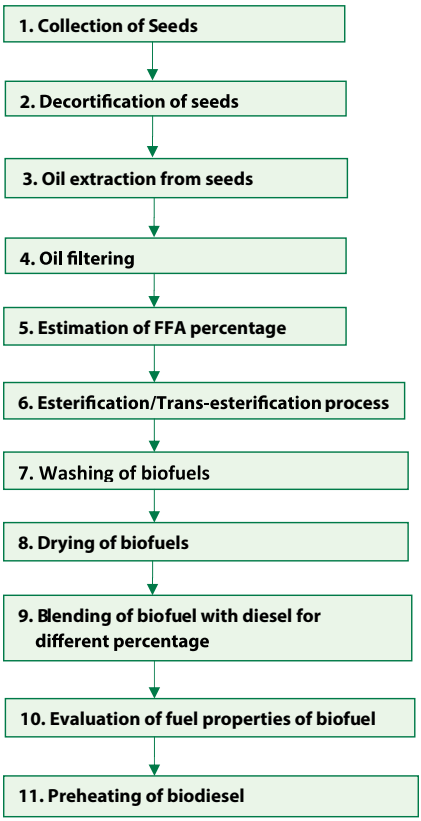
Details of species	*Pongamia pinnata*	*Jatropha curcas*	*Azardicta indica*	*Madhuca indica*	*Simaruba glacua*
Flowering season	March-May	May-Aug	March-May	March-April	Dec-Feb
Harvest season	Jan-March	Aug-Oct	June-May	June-Aug	Feb-April
Uses	Biodiesel, cake soap production, leather industry	Biodiesel, cake, medicine, insecticide	Biodiesel, medicine, cake, soap industry	Biodiesel, cake, manure, soap industry	Biodiesel, medicine, cake, insecticide
Yield starts	5 years	3 years	5years	10 years	4 years
Seed Yield (in kilogram)	15-40	1-2	10-25	10-40	10-25
Oil per cent	27-35%	35-40%	28-35%	30-35	60-65%
Rate (Rs per kg)	20-25	10-12	12-15	10-15	12-15

Proper watering and weeding is done with application of pesticide and NPK. Seedlings are distributed free of cost to farmers who are really interested to raise the plants of oil yielding species.

Yield of Oil

Generally, 100 kg seed of any oil yielding variety gives 70 kg cake and 30 kg Oil, which can be directly used as biofuel. On treating the seeds with process of esterification and trans-esterification, biodiesel is obtained which is approximately 27 kg and 3 kg glycerol.

Process of biodiesel formation



Benefits and Importance of Biodiesel

1. Biodiesel can be produced from straight vegetable, animal oil/fats, and waste cooking oil.
2. Biodiesel is bio-degradable, non-toxic and has significantly fewer emissions than the fossil-based fuels.
3. Biodiesel is an alternative fuel similar to conventional or fossil petroleum.
4. Biodiesel has a viscosity similar to petroleum diesel.
5. Biodiesel is a better solvent than petroleum diesel and has been known to break down deposits of residue in vehicles that have been run on petroleum diesel.
6. Biodiesel can be used in pure form (B100) or may be blended.
7. Cake, the protein-rich fraction obtained after the oil has been extracted from seed, is used as good manure and for biogas.
8. Glycerol has numerous applications in oil and chemical industries, such as cosmetics, pharmaceuticals, food and paint industries.
9. Biodiesel has higher flash points than petroleum diesel, so it is safer in the event of crash.
10. Biodiesel reduces the emission of less harmful pollutants, mainly particulates, from diesel engines; 80 per cent less carbon dioxide and sulphur dioxide.
11. Biodiesel have high cetane number. This number is a measure of fuel ignition quality. The high cetane number of biodiesel contributes to easy cold starting and low idle noise.
12. Last but not the least, it can extend

the life of diesel engine because it is more lubricating and exhaust odour of petroleum diesel with a more pleasant smell of popcorn.

Achievement of Biofuel Park

1. Created awareness in 2,119 villages out of a total of 2,559 villages in Hassan district.
2. 1,338 trainings were conducted in the villages.
3. 323 on-campus training were conducted.
4. 479 biofuel associations were formed.
5. 23 oil expellers units were distributed to the villages.
6. Created 2.5 lakh mandays.
7. Provided a total benefit of Rs 2.5 crore as income to the villagers.

Results and discussions

If in 1 ha we plant biofuel species along the bunds at a spacing of 5 metres, then total plants for 1 ha will be 80. If we take total maintenance cost of a plant for five year in the nursery and in the field@ Rs 30 per plant, then the total cost per plant for five years would be Rs 150. The total cost of 80 plants would be 80*150=12,000. Let us take the example of *Pongamia pinnata* plantation. After 5 years, we will obtain an average yield of total 28kg.@per tree. So, the total yield by 80 plants is 80*28=2,240 kg. Now, assuming that the market rate of *Pongamia* seed is Rs 22/kg, the total income from sale of seed is 2,240*22=Rs 49,280. If oil is obtained, then the total yield of biofuel oil is 0.3 kg per 1 kg seed. So, the total yield of bio-oil is 2,240*0.3=672 kg and the amount of cake will be 1,568 kg. If this oil is processed for biodiesel, then the quantity of glycerol will be 67.2kg @10 per cent of 1 kg biofuel. Now, if the cost of cake is Rs 25/kg, the total amount will be Rs 39,200 from it. The oil is sold at the rate of Rs 80/per kg, so the total amount by sale of oil is Rs 53,760. The cost of biodiesel formation comes around Rs 10-12/per kg. So, it is costlier than diesel available in the market. But, if we consider other advantages of by-products, then the whole system of biodiesel formation becomes a lucrative business. On the same line, this analysis can be replicated for the all other tree species. The economic analysis is tabulated in Table 2.

Table 2

Species	Seeds (KG.)	Costper kg	Amount in Rupees	Cake (quantity in kg)	Cost per kg.	Amount	Oil (quantity in kg.)	Cost per kg	Amount in Rupees	Glycerols (Quantity in kg)	Time of yield After planting
Pongamia	2240	22	49280	1568	25	39200	672	80	53760	67.2	5 years
Jatropha	120	11	1320	84	25	2100	36	80	2880	3.6	3 years
Azardicta indica	1440	14	20160	1008	25	25200	432	80	34560	43.2	5 years
Madhuca indica	1200	13	15600	840	25	21000	360	80	28800	36	10 yrs
Simaruba glacua	1360	14	19040	952	25	23800	408	80	32640	40.8	4 years

Benefits and Cost Analysis

If we consider the use of by-product cake and glycerol, then it gives a positive conclusion. For example, the cost of raising and maintaining *Pongamia* plants for five year would be Rs 12,000. The cost of seed by sale would be Rs 49,280. If we extract oil and cake, the cost would be Rs 53,760 and Rs 39,200, respectively. Thus, the benefit by selling the seeds alone would give a benefit of Rs 37,280 per hectare after five years. If we extract oil and cake and then sell the items, then the combined benefit would be Rs 80,960 per hectare.

Manure can be used for biogas production. Farmers of nearby villages have started the use of cake in crops of banana, coconut, ginger and potatoes. According to the research carried out in the Biofuel Park, the quantity of biogas will be 7 times more than gas obtained from gobar gas. Cake can be used as cattle feed after removing toxic chemicals. Cake is very rich resource of NPK .Quantity of NPK is 10 times more than obtained from gobar gas. Oil can be used as a biofuel directly, without converting into biodiesel. Some farmers in the village Kirrannhaly use oil directly in their pump sets, tractors and also for illumination when electricity is not available to them. Oil is mixed with water and sprayed on crops like banana, ginger, coconut, potato and tomatoes as pesticide. Oil is also used for skin diseases. It can be used as lubricant in machinery. Oil also finds its use in preparation of soap and varnish industry.

Limitations & Observations

1. Budget allotment is not sufficient to carry out further research and development.
2. Absence of logistic support in the villages.
3. Non-availability of biodiesel feed stock for biodiesel formation.
4. Several stakeholders and several interactions among them.
5. Timely delivery of required quality and quantity of biodiesel feedstock for smooth and continuous functioning of biodiesel production centre is also a critical factor.
6. Environmental concern exists for largescale biodiesel production and use in India.
7. Social barriers could greatly impede heavy investment in the biofuel industry.

Suggestions

1. Improving the production of biodiesel by using good plus trees and clones by tree improvement and breeding techniques.
2. Creating and developing the demand side of biodiesel.
3. The government should provide subsidy to lower the price of biodiesel in comparison to petroleum products.
4. The government should set up a separate body to cater to the needs for administration, finance, communication, technology, planning and logistics at the village, tehsil and district levels.
5. Supporting decentralised set-ups at the village level, or for clusters of

villages, can be initiated.

6. Need of the hour is to carry out a serious study on the potential of biodiesel in rural India.
7. Direct link between farmers, KSBDB, NGOs and R&D centres can smoothen the functioning and enhance the effectiveness of the biofuel programme.
8. There is a need to research further advancement in the use of biodiesel by-products.

Acknowledgements

We express our gratitude to all those who inspired us and guided us to prepare the case study of Biofuel Park, Mednuru, Hassan district. We thank our mentor, Mr N Vijay, IFS, for his guidance and support during the preparation of the case study report. We are grateful to Project Co-ordinator, Professor Balkrishna Gowda, University of Benguluru, Dr Raghu, Assistant Professor, Agriculture Research Station, Hassan, and Dr Helesh C for their guidance, constant support and encouragement. We are also grateful to the staff members of the Biofuel Park, especially Ms Vatsalya, Mr Nanje Gowda, farmer Lohitakshya and field investigator AC Srinivasan for providing congenial atmosphere and support for completion of our case study work. Finally we extend our gratefulness to our SFS friends of batch 2015-2017 who helped us directly or indirectly to complete the case study work successfully.

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WILDLIFE MANAGEMENT

Relocation and rehabilitation in Bhadra Tiger Reserve

Apart from adequate compensation, the people relocated out of the reserve area now have access to health care, education and markets

Pradeep Kumar and Sumit Bansal

Relocation of human populations from within areas notified for wildlife conservation has been undertaken in several countries, as a means of trying to reduce pressures on wildlife. This requires payment of compensation (rights settlement in addition to the relocation package offered under the CSS at present). Chapter IV of the Wildlife (Protection) Act, 1972 (Section 24) provides for acquisition of rights in or over the land declared by the State Government under Section 18 (for constituting a Sanctuary) or Section 35 (for constituting a National Park). Sub-section 2 of Section 24 of the Wild Life (Protection) Act, authorises the Collector to acquire such land or rights. Therefore, payment of compensation for the immovable property of people forms part of modifying / settling their rights which is a statutory requirement.

The ongoing study and the analysis of the available research data on tiger ecology indicate that the minimum population of tigresses in breeding age, which are needed to maintain a viable population of 80-100 tigers (in and around core) require an inviolate space of 800-1,000 sq. km. This will also ensure viable populations of other wild animals (co-predators, prey) and forest, thereby ensuring the ecological viability of the entire area / habitat. Thus, it becomes an ecological imperative to keep the core areas of tiger reserves inviolate for the survival of source populations of tigers and other wild animals. However, it is also not easy for the villagers living in the reserve area, sometimes for over three generations, to leave the place they consider home. People have emotional attachments with that land.

This study analyses a relocation and resettlement project in Karnataka's Bhadra Wildlife Sanctuary. We studied the relocation experience of 419 households who moved to two villages (M.C. Halli and Kelagur) located outside the reserve. We interacted with the people and they were satisfied with their quality of life. All households have access to electricity, water, schools, health care, transportation, and communication facilities. Many households have increased their income and assets. Whereas people living inside the reserve faced intense wildlife conflicts: animals raided crops, killed livestock, injured and killed people.

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They also lacked basic amenities (no access to electricity, and running water, quality health care, and schools, transportation, and communication).

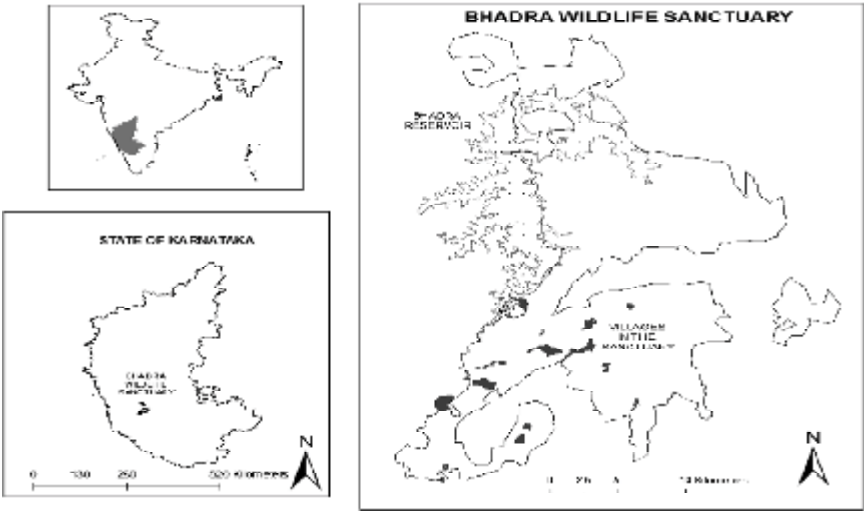
Study Area: Bhadra Tiger Reserve

Bhadra Wildlife Sanctuary is located in India's Western Ghats (75_150 to 75_500E and 13_250 to 13_500N), and covers an area of 492 sq. km in the district of Chikmagalur and Shimoga. Realising the ecological importance and the potential to support high density faunal population, this sanctuary was upgraded to the status of Project Tiger Reserve by Government of India in November 1998.

Relocation and Rehabilitation

As per the notification, 16 villages inside Bhadra Wildlife Sanctuary comprising 736 families were to be relocated. The Deputy Commissioner, Chikmagalur issued 4(1) and 6(1) notification under Land Acquisition Act for 12 villages, out of which 10 villages have been totally rehabilitated consisting of 429 families in M.C. Halli and Kelagur. The total outlay of the rehabilitation project was Rs.1,765 lakh. The compensation package given to villagers was based on the land and plantation/crop. Families having land of 5 acres and more at Bhadra, were given 5 acres land at the relocated site and given plot size was 90'x60'. Families having land 1-5 acres at Bhadra, were given 3 acres land and given plot size was 80'x50'. Families having land less than 1 acre or landless at Bhadra were given 1 acre land and the given plot size was 50'x40'. Families having no crop, rice crop or coffee plantation were given Rs 63,000 per

The vegetation includes dry and moist deciduous forests, evergreen forests, and Shola grasslands that are unique to this biodiversity hotspot.



acre. Families having supari plantation were given Rs 517 per tree (approx. 500 trees in 1 acre).

Prior to relocation, people faced intense conflicts such as livestock predation, crop raiding and occasional death/ and injury to people. People lacked basic facilities such as electricity, running water, poor school, medical and transportation facilities. After relocation, they feel they have limited access to firewood, non-timber forest products, and grazing land. People have had to supplement their income by working as labourers. Some people are unsatisfied with plot sizes and their inability to expand their land. Benefits for villagers were land titles and fair distribution of other aids. All households now have access to electricity, running water, phones, television, solar lights and gas cooking stoves. All children are in school and have access to primary and secondary education. Health care centre and hospitals have been established. People have expanded their income sources from just farming to shops, restaurants and other businesses. The people do not face crop raiding or livestock depredation. People have access to markets, cities and transportation facilities.

Implication on Bhadra

- Recovery of 8-10 per cent of forest area disturbed by human activities.
- Removal of grazing pressure from more than 4,000 livestock and improved forage available for wild herbivores such as gaur, sambar, chital, etc.
- Recovery of species that were collected for fuel wood unsustainably.
- Recovery of non-timber forest products such as bamboo, amla, acacia species, fruits, and honey.
- Decrease in small-scale localised fires inside the park.
- Decrease in poaching and fishing activities inside the park.

JOINT FOREST MANAGEMENT

Follow the Periyar model

The Community Based Ecotourism programmes in Periyar Tiger Reserve not only create employment for local people and tribals but also help in strengthening protection and conservation activities

Subhash K.B. and Pramod Kumar Dhakad

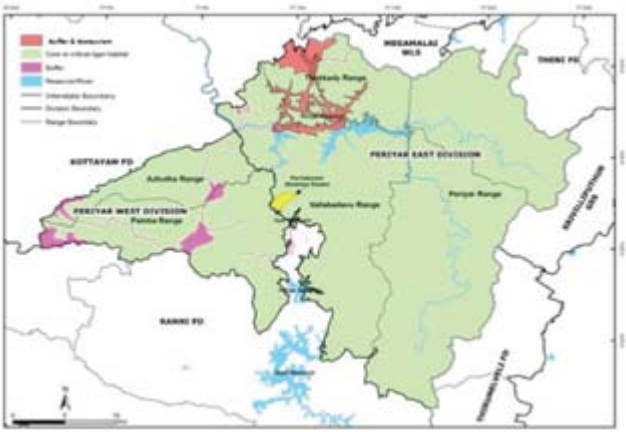
Introduction

The success of any forest-related conservation programme depends upon the whole-hearted participation of forest-dependent local people. Ensuring sustainable alternate livelihood opportunities or a constant source of income in the form of ecotourism activities or forest protection with a slight motivation and guidance from the Forest Department automatically earns the people's confidence and their co-operation in conservation. It even makes possible the magical transformation of poachers to watchers. Periyar Tiger Reserve serves as a model for the entire country in successful implementation of ecotourism while effectively conserving the park.

Location & Profile of PTR

Periyar Tiger Reserve is situated in the Southern Western Ghats of Kerala extending 925 sq. km. The Core Zone consists of 881 sq. km and Buffer Zone is 44 sq. km. The Buffer Zone is divided into Eco-Development Zone, Pilgrim Zone and Tourism Zone. PTR is divided into two divisions, viz. Periyar East Division and Periyar West Division and has five territorial ranges, three in

Figure 1



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East Division and two in West Division, and three functional ranges, viz Flying Squad, Eco Development Range and Research Range. The Administrative and Management division of PTR is shown in Figure 1.

The PTR has diverse habitats and rich biodiversity. Of the total area, 36.99 per cent is under evergreen forests, 24.13 per cent under semi-evergreen forests and 21.54 per cent under grassland. Out of 1,988 species of flowering plants reported from here, 149 are in the threatened category. Two species, *Crotalaria penduncularis* and *Smithia venkobarowii*, formerly considered as extinct have been recently reported from PTR. Fauna includes 63 species of mammals, 323 species of birds, 48 species of amphibians, 72 species of fish and 257 species of butterflies. The major endemic and endangered animals are Tiger (*Panthera tigris*), Lion Tailed Macaque (*Macaca silenus*), Nilgiri Langur (*Semnopithicus johni*), Nilgiri Tahr (*Hemitragus hylocrius*), Nilgiri Marten (*Martes gwatkinsi*), among others.

More than 5,000 tribals belonging to six tribes, viz Mannans, Paliyans, Uralis, Ulladar, Mala Arayans and semi-nomadic Malampandarams, are residing in and around the PTR. More than 225,000 people living on the fringes depend on PTR directly or indirectly for their various needs.

History of Tourism in PTR

A dam now known as Mullaperiyar Dam was constructed across the Periyar river in 1885 and reservoir so formed became the Periyar Lake. The catchment area of the reservoir was declared as Periyar Lake Reserve in 1889 and in 1934 it was declared as the Nellikampetty Sanctuary by the erstwhile Maharaja of Travancore. It was declared as Periyar Sanctuary in 1950 and tourism activities started commencement with boat cruising through the lake. From 1971 onwards, creation of infrastructure for mass tourism started in the area and in 1978, it was declared as a Tiger Reserve. Subsequently a part of the sanctuary was declared as National Park in 1982 and in 1991, it become the 9th Elephant Reserve of the country. Boat cruising in the Periyar Lake, which has been conducted by the Forest Department and the Kerala Tourism Development Corporation, was the main tourism activity in PTR. Due to the ever increasing tourist flow, the Park authority is still unable to provide boating facilities to all. More than 6 lakh tourists visit the park annually and only about one lakh people get the opportunity for boating. The peak period for tourism is from December to January.

Prior to 1996, only a few local people get benefited from the tourism in PTR and lot of pressure was on the forest in fringe areas due to heavy dependency on these forests for grasses, fuel wood and other forest produce. Sandalwood smuggling, poaching, illicit collection of cinnamon bark, black dammar gum, etc., were prevalent and it was very difficult to prevent these activities due to the vast stretch of porous interstate boundary, inaccessible locations and lack of adequate staff.

Community Based Ecotourism (CBET Programme)

Community-based ecotourism activities were started in PTR during the implementation of the India Eco-Development Project (1996-2004) funded by the Japan Bank of International Cooperation as an initiative to enable participation of local forest dependent communities in the management of the park and creation of livelihoods through ecotourism activities. Five Professional Eco Development Committees were formed during 1998-2002 exclusively for implementing ecotourism activities. The membership of these EDCs was unique in nature and the members were highly dependent on the forests. For instance, all the 21 members of Vidiyal Vana Pathukappu Sangam EDC (Vidiyal EDC) were previously active notorious sandal smugglers and poachers from nearby Goodalloor area of Tamil Nadu. The Ex-Vayana Bark Collectors EDC and the Ex-Thelly Bark Collectors EDC were formed with illicit collectors of cinnamon bark and black dammar gum, respectively. The Tribal Trackers EDC and the Tribal Heritage EDC are formed exclusively from tribes who are traditionally trackers and have thorough knowledge of local flora and fauna. The daily wage watchers engaged in protection purpose formed the Periyar Tiger Samrakshana EDC (PETS EDC).

The main CBET programmes currently going on are bamboo rafting in the lake, nature walk, green walk, border hiking, jungle scout, jungle camp, Periyar tiger trail, bamboo grove, tribal art performance, etc. These programmes are in accordance with the Tiger Conservation Plan approved by

Table 1

Income Generated from CBET Programs (Rs. in Lakh)							
S.No.	**CBET Program**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	
1	Bamboo Rafting	26.98	47.49	70.68	77.24	92.74	
2	Nature Walk	21.70	26.99	27.16	33.72	33.77	
3	Green Walk	11.68	17.26	19.75	22.18	25.2	
4	Jungle Scout	7.39	14.51	21.59	24.34	25.73	
5	Boarder Hiking	8.48	11.66	14.22	16.26	20.01	
6	Periyar Tiger Trail	10.21	19.55	25.62	29.23	21.34	
7	Bamboo Grove	6.46	4.71	14.99	19.51	28.32	
8	Jungle Camp	0.7	.05	8.53	9.11	13.53	
9	Tribal Dance	-	0.65	9.04	9.07	8.88	
10	Pugmark Trail	-	-	.5	.97	1.0	
11	Jungle Inn	0.72	0.16	0.22	0	0	stopped
12	Cloud Walk	3.84	1.93	0	0	0	stopped
13	Bullock Cart Discoveries	4.61	3.01	0.25	0	0	stopped
	TOTAL INCOME	**102.77**	**147.97**	**212.55**	**241.63**	**270.52**	

Source: Periyar East Division

the NTCA and follow the Centre's eco-tourism guidelines and State's guidelines for River Forest Protection Fund. CBET programmes are mostly being implemented in the Periyar East Division and are concentrated in the Tourism Zone which comes under the Buffer of the Tiger Reserve. In each programme, the maximum number of tourists who can be accommodated is fixed. The income generated through the CBET programmes is given in Table 1.

Some of the successful CBET programmes are described ahead.

a. **Bamboo Rafting:** It is the most successful and income-generating CBET programme. It consists of trekking in forests and rafting in the lake. The full-day programme is conducted by Ex-Vayana Bark Collectors' EDC for maximum of 15 tourists and half-day rafting is conducted by Vidiyal EDC for maximum of 30 persons, 5 persons per raft. There is a steady increase in the number of participants and income generated. In 2014-15, 5,448 tourists participated in the programme and income generated was Rs. 92.74 lakh.
b. **Nature Walk and Green Walk:** These are interpretative trekking programmes conducted by Tribal Trackers EDC and Tribal Heritage EDC, respectively. Professional tribal guides well versed in different languages accompany the tourists. There is 6 slots in each programme and the maximum number of person is limited to 6 per slot. In 2014-15, 19,659 tourists participated in these programmes.
c. **Periyar Tiger Trail:** This is an adventure trekking cum camping programme conducted by Ex-Vanayan Bark Collectors EDC. Two packages are there, viz. one night and two nights camping programmes. The maximum number of people allowed is 6 in each package and in 2014-15, 370 tourists participated in this programme and the income generated was Rs. 21.34 lakh.
d. **Border Hiking:** This conservation oriented full-day trekking programme is conducted by Vidiyal EDC. It coveres 20 km through undulating terrains and inter-state boundary. The maximum number of people allowed is 6 in each slot (2 slots).
e. **Jungle Camps:** This is a trekking and night camping programme conducted by PETS EDC in Vallakkadavu Range. A maximum of 30 persons can stay in tents in the jungle.
f. **Jungle Scout:** This is a night patrolling programme conducted by PETS EDC simultaneously in two different locations in three time slots (7-10 pm, 10 pm-1am and 1-3 am) through the sandal bearing areas of Thekkady Range. Besides protection of sandal trees in nights, the programme earns a substantial income also. A maximum of 6 persons is allowed in each time slot.
g. **Bamboo Grove:** This is an accomodation programme run by PETS EDC at Anavachal area. There are 15 huts, including 3 duplexes for tourists. One hut can accomodated two people. There is a tree top machan, an ecoshop, a conference hall and dining cum catering area in the Bam-

boo Grove. One package is for accomodation and food only while the second package also incldes tickets to boating in Periyar Lake, tribal arts performance and green walk apart from food and accomodation.

h. **Tribal Art Performance:** Traditional tribal dances of Mannan and Paliyan tribes are conducted at the Vanasree auditorium at Anavachal area every day (6-7 pm). Besides generating income, this programme makes the tribes proud of their culture and tradition. For the last three years, the number of tourists participating in the programme is stagnating around 3,000 due to the competition from privately run traditional Martial arts and Kathakali performances conducted nearby at the same time for which high agent commission is being given.

The income from the CBET programmes are pooled into the Park Welfare Fund which is created as per the order of the Chief Wildlife Warden, Kerala, with the aim of utilising a part of income generated for conservation, awareness programmes and community development activities apart from distributing wages to the members. Beside the above income, sale proceeds from eco-shops are also pooled in the PWF. The custodian of the fund is the Deputy Director (Project Tiger) of the division. About 10-15 per cent of the income is re-distributed to the community development fund of the concerned EDC. A major portion of the PWF is utilised as wages to tourist guides and trackers and for the expenses of the CBET programmes. Market promotion fee and honorarium for staff involved in the CBET programmes are also met

Table 2

Income generated in PWF and Employment Generated

Year	2010-11	2011-12	2012-13	2013-14	2014-15
Income from CBET (Rs in lakh)	85.31	148.29	212.57	241.64	272.53
Employment Created (in man days)	23930	27141	27603	27083	30200
Wages Paid (Rs in lakh)	48.45	96.08	91.60	104.87	119.86

Source: Periyar East Division

Table 3

Name of the EDC	Award Received	Year
Ex-Vayana Bark Collectors EDC	Jungle Green Guard Award	2001
	International Ecotourism Award	2002
PETS EDC	Sanctuary Asia Award for outstanding individual performance in Wildlife conservation	2007
Vidiyal EDC	Sarvothma Award	2006
	Best EDC award	2007
	4th Green Guard Award	2007
Tribal Heritage EDC	Young Naturalist Award	2007
Tribal Trackers EDC	David Shepherd Wildlife Award	2008

from the PWF. Details of income generated and employment created by the CBET programmes are given in Table 2.

The Range Officer (Eco-development), under the guidance of the Deputy Director (PT), coordinates the ecotourism and eco-development activities in the division. He is assisted by the Ecotourism Officer, the Economist and the Publicity Officer of the Periyar Tiger Conservation Foundation in planning, advertising and evaluating the CBET programmes. For the conservation oriented ecotourism activities, many awards and honours have been received by these EDCs. Some of the well known awards received are listed in Table 3.

Significance of CBET programmes in management of PTR

- **Strengthened protection:** Alternate employment opportunities in the form of CBET programmes and protection activities have transformed the sandal smugglers, poachers and illicit cinnamon bark and black dammar collectors into forest protectors. This has helped in reducing forest and wildlife offences in the park and strengthened the intelligence gathering network.
- **Increased manpower for protection:** Increased fund flow for PA management through ecotourism activities has helped in engaging more protection watchers. Now around 300 daily wage watchers are working in the PTR.
- **Improved livelihood benefits to local community:** Financially poor people, including tribals, are getting sustained jobs as protection watchers and tourism guides. Value addition units and marketing facilities, including eco-shops, help in getting higher prices for fish and honey collected and for agricultural products like black pepper and cardamom.
- It supplements as well as complements the boat cruising programme and gives opportunities to tourists who failed in getting boat tickets.
- Tribal museum and tribal arts performances make the tribes proud of their culture and engaging them as tourism guides acknowledges their traditional knowledge, thus empowering them both financially and socially.
- A source of fund for conservation, education and nature awareness programmes.

Conclusion

The Community based Ecotourism programmes not only create employment for local people and tribals, but also help in strengthening protection and conservation activities of the Tiger Reserve and empowering the tribes. It has helped in transforming poachers and smugglers, who were once a big threat to the park, into watchers of the rich biodiversity of PTR. It also supplements and complements the tourism activities of the Park. Undoubtedly, the CBET initiatives in the PTR is one of the greatest success stories in the annals of joint forest management in India and is a good model to replicate in other protected areas.

WILDLIFE MANAGEMENT

More than compensation

Is compensation an effective measure to mitigate the fallout of man-animal conflict

Abhishek Sharma & Suresh Agrawal

Compensation is considered as a weapon to mitigate the man-animal conflict but is it really so? Is a victim happy to get the compensation? When a case of man-animal conflict arises, whether it is destruction of field of poor farmer or attack on their domestic animals or attack on humans, we foresters fulfill our duty to sanction the compensation amount to the victim. But does it really work?

Several states have framed rules for compensation in cases of man-animal conflict but the problem cannot be solved just by sanctioning compensation amount to the victim.

Why only compensation is not sufficient

1. In cases of field destruction by wildlife, compensation amount is calculated on the basis of what sort of crop was damaged and what was the area of field without caring about the condition of the crop--whether it was just sowed or ready for harvest--or what is the productivity of that soil or what is the availability of soil moisture. The poor farmer works very hard daily in field irrespective of day or night whatever the circumstances may be so he expects a good return from field. Moreover emotions and future dreams of farmers and their family are associated with the crop. The value of such emotions cannot be measured in terms of money. In some states compensation rates are prescribed as per the expenditure on sowing the seeds only but what about the hard work of the farmer or profit presumed to be obtained on harvesting at the proper time. Also, what will he do for the next few months as the season for sowing the field is fixed.
2. In cases related to cattle lifting by wildlife, rates are prescribed for a particular species of cattle irrespective of its utility or productivity. The rate is fixed for lifting a cow whether it is very good milk producer or not, whether it is healthy or diseased. Further, there is a huge difference between the compensation amount and the market rate of purchasing cattle. So, the prescribed amount cannot be considered 'real' compensation.
3. In cases of loss of human life, compensation rates vary from state to state. It is a sorry state of affairs if rates can be estimated for human life, and worse still, how it varies from state to state in the same country.

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Human life is precious and cannot be valued in terms of money alone. If it is to be continued, then at the very least the compensation amount should be made uniform in all the states.

4. In cases of disease transmitted from the wildlife, no rates are prescribed. Recently, the spread of KFD i.e. Kyasanur Forest Disease, was noticed. It spreads through monkeys and twigs totally from the forest. Many lives have already been lost. What is the fault of a poor traditional collector of NTFP whose ancestors were living in forest since the ages. The fatality rate is 3-5 per cent with many human deaths reported from the forest areas of the Western Ghats, mainly from Bandipur tiger reserve and Wayanad Wildlife Sanctuary. There is no provision of compensation for such kind of man-animal conflict. Why?

Delay is the deadliest form of denial. Red-tapism is responsible for the late disbursal of compensation amounts. We, foresters, should feel the pain of the villagers. Villagers often cooperate in protecting the forests and wildlife. I agree that foresters are the advocates of the voiceless wildlife but at the same time, we also have a responsibility towards public welfare.

Rates of compensation may be reviewed at timely intervals by following a proper mechanism like constituting a committee comprising representatives of villagers. Foresters should take prompt action for settlement of compensation cases with sympathy. Some discretionary powers should be vested with the forest officers as each and every situation cannot be dealt with in the same way. Finally, our duty is not finished after prompt sanction of compensation but it actually starts thereafter. We should analyze the area-wise statistical data of compensation applications and chalk out a plan for area-specific protection measures like which areas are vulnerable and prone to man-animal conflict.

FOREST MANAGEMENT

Ecotourism – The Baralikkadu Experience

Ecotourism brings people to the places it wants to protect. Can this paradox work, or would it be better just to leave nature alone

Anand Kumar and Balram Sharma

Tourism is the world's largest and fastest growing industry and ecotourism forms a large proportion of the present tourism sector. It plays an increasingly dominant role in the economy of developing countries. The tourism industry contributes around 6.6 per cent to India's Gross Domestic Product (GDP). A study by the Union Ministry of Tourism says that tourism supports around 40 million jobs. The sector accounts for 7.7 per cent of the total employment within the country.

Ecotourism is defined as "responsible travel to natural areas that conserves the environment and improves the well-being of local people." Its purpose may be to educate the traveller, to provide funds for ecological conservation, to directly benefit the economic development and political empowerment of local communities or to foster respect for different cultures and for human rights. It is in contrast with general tourism where tourist visits are often marketed and organised by private tour and travel companies in government protected areas and the bulk of the profits goes to the private companies and government enterprises. Moreover, ecotourism embraces both collective responsibility and individual initiatives within the community. It is about uniting conservation efforts, communities, and sustainable travel. This means that those who implement and participate in ecotourism activities should follow some important principles such as minimum impact, building environmental and cultural awareness and respect, providing positive experiences for both visitors and hosts, providing direct financial benefits for conservation and providing financial benefits and empowerment for local people.

We had an opportunity to visit Baralikkadu Ecotourism Site during our case study tour which was conducted in December 2015. Baralikkadu is a village situated in Karamadai Range of Coimbatore Forest Division, and is around 80 km from Coimbatore. The novel idea of introducing the ecotourism concept in Karamadai Range by involving the tribal people was aimed to generate sustained livelihood opportunities for the tribal community and also to create awareness among the nature lovers and tourists coming from urban areas. It was initiated in April 2007

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by utilizing the funds provided under peoples' participation in JFMC under the 12th Finance Commission Scheme for sustained income to tribal people and also to improve the basic amenities of the tribal villages, viz. education, sanitation, health, transportation, communication, etc.

Two JFM committees were formed by involving five tribal villages in each. The president of the JFM committee is elected by the members of the committee. The Forest Range Officer of Karamadai range is the Ex-Officio Secretary of the JFM Committees. Individual Bank accounts have been opened for the monetary transactions of the JFM committees. A women's Self Help Group (WSHG) comprising 12 women from the stakeholder villages has also been formed. AN amount of Rs 10,000 was allotted to the SHG towards revolving fund for their income generation. The ecotourism package has been fixed at Rs 400 per adult at Baralikkadu, which includes a coracle ride in the backwaters of River Bhavani, traditional lunch, trekking, nature trail and river bathing. Out of Rs 400, Rs 250 is given to the coracle driver per ride (4 tourists/ride) and Rs. 150 goes to the WSHG per head for providing delicious and hygienic local food (lunch). This ecotourism activity is conducted only on weekends and holidays.

The tourists get firsthand experience of the forests and bio-diversity here. Awareness about the conservation and protection of forests on sustainable basis is created among the visiting tourists. On the other hand, it generates employment for the local communities and their dependency on forests reduces which in turn minimises the degradation of forests. Various welfare measures are also carried out from the ecotourism fund for these tribal people. After the start of this innovative concept, the standard of living of the local communities has improved a lot.

On the other hand, although ecotourism is intended for small groups, even a modest increase in population, however temporary, puts extra pressure on the local environment and necessitates the development of additional infrastructure for providing basic amenities. The ecotourism activities are also having negative impact on the forests and bio-diversity. There is lack of awareness and innovation and there is no effective check on the disposal of non-biodegradable wastes. No study has been done on the carrying capacity of the ecotourism site. Even though, ecotourism looks lucrative, often it is considered as an attempt to fill the financial gap. Thus the concept of ecotourism exercises tremendous financial and political influence and poses a threat to the indigenous culture of the local people. This creates a question mark on whether these practices can be followed on a sustainable basis.

The question is not, how to stop ecotourism but how to get it right so that it can be carried out sustainably without disturbing the ecosystem. Instead of revenue generation being the primary motive, awareness generation about protection and conservation of forests and biodiversity should be given top priority. Awareness through educational and extension programmes

about ecotourism opportunities in local customs, cuisine, festivals, arts and crafts will be instrumental in adding overall attractiveness of the area. An integrated holistic plan based on detailed scientific study, for community based ecotourism should be prepared through the involvement of all stakeholders and implemented through the local people. A strategy for the sustainable ecotourism management should, similarly, be applied for all such areas. Establishment of a mechanism that considers all the biophysical and social aspects of ecotourism is the need of the hour.

FOREST MANAGMENT

Regeneration of degraded forest

Protection and planting activities need to go on simultaneously for better results

Sandeep Kumar and
Dr. Sunil Kumar Gaur

Chitradurga Forest Division occupies central position in the eastern plains of Karnataka and its boundaries are co-terminus with Chitradurga revenue district. The total area of the district is 8,388 sq. km and the population is 16.59 lakh. The study area is dry land characterised by huge undulating plains. Rainfall here is due to the influence of south-west and the north-east monsoon. The average annual rainfall is about 568 mm with an average of 31 rainy days. The maximum and minimum temperatures are 41^{0}C and 16.6^{0}C, respectively. The relative humidity is high during the monsoon ranging between 70-75 per cent, In the rest of the year, the relative humidity is low and may come down to less than 30 per cent in the afternoons. Winds are generally moderate during summer and strengthen during the rainy season.

Chitradurga Forest Division has 129,554.11 hectares of forest land, which constitute 15.44 per cent of the gross area of district. The extent of degraded forest is about 88,288 ha. The forest type varies from dry mixed deciduous to thorny scrub.

Before 1940, the forest division even had tigers and elephants. Initially, the forest area was in very good condition but then degraded due to biotic pressure like encroachments, over grazing, wind mills establishment, indiscriminate extension of agriculture, heavy exploitation of forest for timber and poles, no system for regeneration, stony area, less rain, less fertile soil, regular droughts, forest fire. Excessive soil erosion has added to the malady. There was no working plan and any other systematic management up to 1980. The forest was looked upon as a source of revenue.

The Jogimatti Reserve Forest is situated in Chitradurga Forest Division and covers Chitradurga, Holalakere, Hosadurga and Hiriyur ranges. It is one of the largest reserve forests of Karnataka with 10,718.32 ha area and the highest elevation of the reserve forest is 3,641feet but it is a degraded forest. The area is over grazed and over exploited. The stony-hilly area has less fertile soil.

But of late several measures have been taken for regeneration of the forest area and to tackle the multiple issues leading to the degradation.

Protection

(i) Cattle Proof Trench (CPT): Formation of CPTs of dimensions 1.5m×1m×1m are seen. Seeds of

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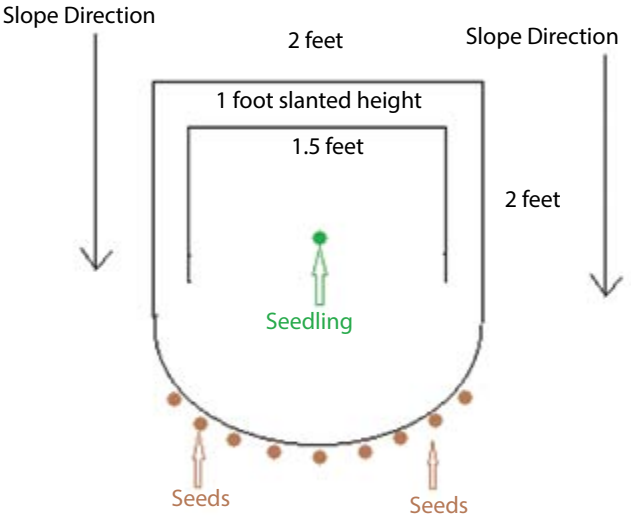
Formation of pit for plantations on hilly area:



Plantation in field

bushy and thorny *Acacia juliflora* and agave were sown on mound of the CPT. These CPT were, however, not well maintained.

(ii) Stone walls and fencing: At the boundaries, somewhere stone walls were present of 2.5 feet height and 1 foot width. Now chain link fencing work is going on and 2 km per year fencing is being undertaken by the Forest Department. The cost of per kilometer chain link fencing is Rs 15 lakh.

(iii) Soil and moisture conservation: Continuous Contour Trenches (CCT) of dimensions 8m×1m×1.5m, gully plugs, check dams and percolation trenches were formed to have greater impact on moisture and soil conservation.

(iv) Fire protection: Before the summer season, a network of fire lines is created every year by clearing the weeds and dried grasses from the areas. The width of the fire lines range from 8 metres to 20 metres. Watch towers are also present for monitoring fire and other incidents.

(v) Reserve forest: Jogimatti is a reserve forest so it has less biotic pressures and more protection.

(vi) Protection by thorny species: At the boundary, thorny species like acacia and bamboo were planted.

(vii) Protection by the forest persons: Jogimatti reserve forest covers 10 beats so 10 beat guards and some daily wages watchers are engaged for patrolling the area.

Planting

Some 25 years ago, seeds of *Santalum album* were broadcasted by the helicopter in the whole area but no management practices were done.

The hilly area has the highest density of *Grewia tilifolia*, *Anogiessus latifolia*, *Acacia sundra* and *Stereospermum chelenoides*, which makes it a good mix of deciduous and dry deciduous forests with good crown density at high hills and towards seasonable streams.

There is a good regeneration of *Acacia leocophoea*, *Albizzia lebbak*, *Boswellia serrata*, *Chloroxylon swietenia*, *Bridelia retusa* along with *Tectona grandis*, *Terminalia* at higher elevation and hilly depression. Exotic species like *Acacia auriculiformis* along with *Eucalyptus* found in good condition.

In order to regenerate the degraded forest, plantation of the *Hardwickia binnata*, *Temarendis indica*, *Santlum album*, *Terminalia tomentosa*, *Casia fistula*, *Poongamia pinnata*, *Acacia juliflora*, *Tectona grandis*, *Azadirachta indica* species were carried out by Assisted Natural Regeneration (ANR) in 160 ha during the year 2014-15.

Conclusion

Degraded forests are rejuvenated through afforestation and various other measures like protection from grazing, fire, promotion of natural regeneration, soil and water conservation works. Wherever there is enough root stock, such areas are protected from biotic pressure thereby encouraging natural regeneration. Alternative plantations are raised in other areas depending upon the requirement of the local people to cater their needs, species of small timbers, fuel wood and fodder are being raised.

Since the last two decades, the Forest Department has taken keen interest in regeneration of endemic species by seed sowing and also taking up assisted natural regeneration. *Santlum album*, *Pongamia pinnata*, *Cassia fistula*, *Diospyros melanoxylon* are present in good under growth position in the area. Due to moisture conservation, *Dalbergia peniculata*, *Diospyros melanoxylon* and *Poongamia pinnata* are growing very well.

For the regeneration of degraded forest, protection against encroachment, soil and moisture protection, illicit felling, grazing, fire, etc., is essential and planting acts an auxiliary factor because by planting, the forest grows speedily otherwise it will take more time to regenerate.

JOINT FOREST MANAGEMENT

Inclusive development of indigenous communities

The model attempted in Madhya Pradesh's Patalkot Valley factors in ecotourism as a versatile joint product and is seen as a precursor for tropical forest conservation

Suneesh Buxy

Tropical forests are abodes of biodiversity and are also the sources of livelihood for hundreds of millions of indigenous people inhabiting in these forests. However, these forests are under various threats, leading to high rates of biodiversity loss. As these landscapes are located mostly in the developing and undeveloped world, they have become the cynosure of various international dialogues on climate change owing to their potentials to contribute to climate change mitigation and adaptation. Besides, several developing countries are dependent on tropical forests for various ecosystem services including biodiversity resources for food security, livelihood protection, social empowerment etc.

The context for the sustainable management of tropical forests has gained significance, as reports indicate that environment related income sources account for about one-quarter of total household income for people living in or near forests; a value much comparable to what these households derive from agricultural crops. This underlines the fact, that contributions of forests and agriculture to food and livelihood security are complementary (CIFOR, 2014). Although there have been several initiatives to support sustainable management of tropical forest resources; the recent propositions have been towards promotion of strategies at ecosystem level to provide a strong platform for solving critical problems in resource management (Daily,1997). The conservation of forest biodiversity at the ecosystem level helps to support various ecosystem services such as maintaining balance of atmospheric gases, recycling nutrients, regulating climate, maintaining hydrological cycles and creating soil (McNeely, 2002). The conservation biologists, policy makers, and citizens have also identified the protection of native ecosystems in low-income nations as a global social objective as well (Ferraro, 2000). A review of the initiatives in the domain reveals that the most popular initiatives have been about the application of development interventions in the peripheral areas of endangered ecosystems which would provide desirable ecosystem services by redirecting labour and capital away from activities that degrade ecosystems as well as by encouraging commercial

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activities that supply ecosystem services as joint products such as ecotourism.

A recent experiment in this direction has been with contrasting approaches to ecosystem conservation. This approach is expected to (i) reduce the set of critical parameters that practitioners must affect to achieve conservation goals, (ii) permit more precise targeting and more rapid adaptation over time, and (iii) strengthen the links between individual well-being, individual actions, and habitat conservation, thus creating a local stake in ecosystem protection (Ferraro, 2002). In this context, this paper reports an attempt made in the Patalkot Valley of tropical forests in the Central Indian State of Madhya Pradesh to develop a model for inclusive development of the indigenous communities living in these forest areas as a strategy to reverse the process of deforestation and forest degradation by factoring in ecotourism as a versatile joint product.

Study / Project Area

Patalkot is a biodiversity rich land parcel located between Satpuda Biosphere Reserve and Pench National Park (Chhindwara) in the Central Indian state of Madhya Pradesh. It is located between 22°25′0″ N and 78°47′51″E and spreads over an area of 79 km^2 with an average elevation ranging between (838-990 meters) above mean sea level. The Patalkot valley is located at a distance of 78 km from the Chhindwara District in Madhya Pradesh. The valley is drained by the '*Doodhi*'river which joins to the Narmada - Tapi major river system.

Chhindwara District has three type of forests (Champion and Seth, 1964); *Southern Tropical Dry deciduous Teak forest (5A/C1b), Southern Tropical Dry deciduous Mixed forest (5A/C3) and Southern Tropical Dry deciduous Peninsular Sal forest (5B/C1c)*. The main forest tree species are Teak (*Tectona grandis Linn*), Dhawda (*Anogeissus*

Fig. 1: **Location of Study Area**

Source: Google Earth, 2014

latifolia Wall), Saja (*Terminalia tomentosa W&A*), Salai (*Bosswellia serrata Roxb.*), Mahua (*Madhuca indica Gmel.*), Bhirra (*Chloroxylon swietenia* DC), Tinsa (*Ougeinia dalbergioides Benth*), Tendu (*Diospyros melanoxylon Roxb.*), Mokha (*Schrebera swietenioides Roxb.*), Sal (*Shorea robusta Gaertn*), Jamun (*Eugenia jambolana Lamk*), Kahuwa (*Terminalia arjuna Bedd*), Haldu (*Adina cordifolia Hook*), Harra (*Terminalia chebula, Retz*), Kullu (*Sterculia urens Roxb.*), Aonla (*Emblica officinalis Gaertn*), Bel (*Aegle marmelos, Correa*), Amaltas (*Cassia fistula L*), Tinsa (*Ougenia dalbergoides Benth*), Kushum (*Schleichera trijuga Willd*), Char (*Buchanania lanzan Spreng*) etc.

The Patalkot valley is predominantly inhabited by indigenous people of Bharia and Gond tribes who reportedly have been inhabiting the landscape for over 500 years. According to the census reports, a tribal population of 2012 individuals (1017 males and 995 females) in 13 tribal hamlets inhabits the area in 12 villages (Acharya, 2006). The horse – shoe shaped valley has a satellite pattern of settlement with several villages viz., Chimtipur, Gujja Dongri, Sahra Pachgol, Harra-ka-Char, Sukhabhand, Dhurnimalni, Jhiram, Palani Gaildubba, Ghatlinga, Gudichattri, Gaildubba, Kareyam, Ghana, dotting landscape.

The native indigenous community of Patalkot has been subsisting on the natural resources for their livelihood since time immemorial. The landscape is identified with the Bharia tribal culture which has evolved indigenously over the years. The communities are strongly connected with and are dependent on the forest biodiversity for food, clothing, medicine, construction of dwellings etc. The community is also known specially for preservation of their indigenous knowledge through a unique system of knowledge transfer with the link operating between grandparents to grandson (Buxy, 2009).

The indigenous communities in the

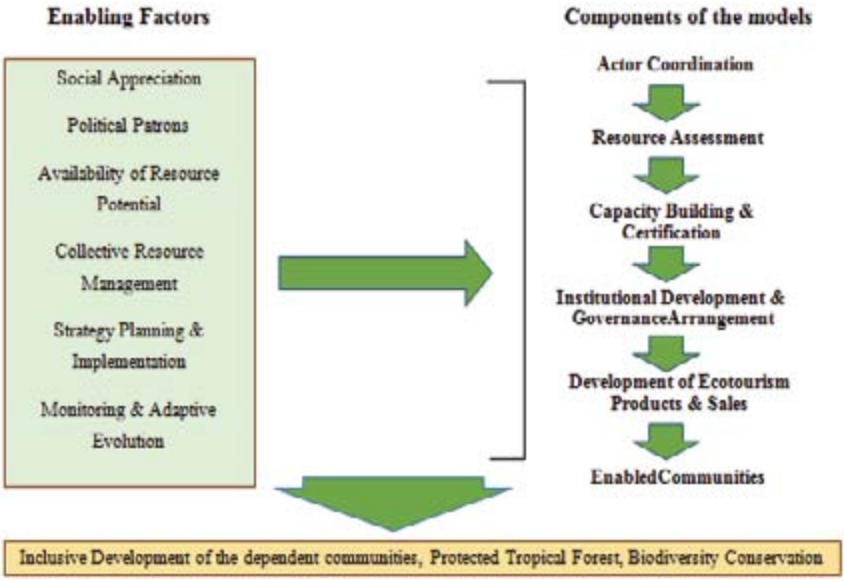
Fig. 2: **Patalkot Valley surrounded by the Tropical Forests of Satpuda ranges in Central India (Photo: Suneesh Buxy, 2009)**

Patalkot valley live in social harmony and are known to possess technical skills in preparation of herbal pulps, extracts, powders, mixtures, decoctions as well as in the use of edible nuts, mushrooms, fruits, herbs, spices, gums, fodder, fibers for medicinal, cosmetic or cultural uses. They also possess indigenous knowledge for treating many illnesses including, dysentery, fever, measles, cholera, hypertension, diabetes, cough, snake bites, and even pains of various kinds, etc.

However with pervasive influence of modernisation; the communities have come in contact with outsiders over the years. The systems and patterns of resource utilisation by the communities became vulnerable to forces of exploitation over the years and market forces began influencing the tribal economy and its sustenance. In the course of time, the tribal community members started selling valuable herbs, endangered medicinal plants, and timber resources extracted from forests. Although Patalkot has rich forest wealth, due to lack of institutional arrangements, the tribal population succumbed to forces of economic exploitation and were also forced to sell the producers at sub profitable rates to various intermediaries which led to unsustainable exploitation of biodiversity and severe degradation of the forests in the locality. The various threats to the tropical forest ecosystem identified in the area included;

- Over exploitation of species such as *Strycnous potatorum (*Nirmali*), Andrographis paniculata (*Kalmegh*), Shorea robusta* (Sal), *Buccnania lanzan* (Chironji), *Drossera indica* (Moheeni), *Rauwolffia serpentina* (*Sarpgandha*), *Termanalia chebula* (*Harra*), *Mangifera indica* var. (kare-aam), *Curcuma caesia* (Kaali Haldi), *Costus speciosus*, (Keokand), *Curculigo orchioides* (Kali Musli), *Chlorophytum borivillianum* (Safed Musli), *Hamidesmus indicus* (Anant mool) ,*Asparagus racemosus* (Satawar) etc.
- Increased vulnerability of the forest system due to an erosion friendly landscape configuration, unsustainable agricultural practices such as *dhaiya* cultivation (shifting cultivation), heavy application of fertilizers leading to loss of soil and crop productivity and development of other biodiversity threats.
- Escalating biotic pressure from nearby hamlets areas for requirements for fire wood, timber and other disturbances such as man induced forest fires due to unscientific burning of crops as well as due to setting of ground fires for collection of Mahua flowers.
- Loss of regeneration of various ground flora members such as Pteridophytes and Bryophytes (*Psilotum nudum, Equisetum* and *Cyathia gigantica*) due to excessive resource extraction as well as due to the impacts of the changing climate.
- Development of water scarcity during summer seasons due to poor ground water recharge and increased surface run-off affecting the dependent communities in the catchment as well as the resident and migratory wildlife.
- Development of a near to collapse kind of situation of the tribal

Fig. 3: **Community Based Ecotourism Model**



Source: Buxy 2013, District Olympic Association, Tamia, Patalkot Valley, Madhya Pradesh, India

ecological-economic linkages and consequent ecosystem degradation and the consequent migration called "Chaitua Palayan" of the tribal population to other areas in search of better livelihood options.

Development of Ecotourism Road map

In this context it is worth to appreciate that biodiversity conservation and community development assumes that nature-based tourism managed by indigenous communities will result not only in conservation of natural resources but also in increased development. However in practice, indigenous communities have often failed to implement successful ecotourism projects due to a combination of factors such as isolation and lack of financial resources, management skills, and infrastructure (Jessica and Calfucura, 2011). To address this, initiatives on inclusive development of the Patalkot were mooted to synergize the various potentials of the area to develop an integrated model for resource use and development with the expected outcome of conservation and sustainable use of the biodiversity rich tropical forests.

The model aimed at developing operational strategies to promote sustainable management and development through inclusive development of indigenous communities with per capita income maximisation as the key contributing dynamic variable. It endorsed sustainable promotion of the ecotourism potential, ecosystem

services, productive engagement of the unemployed tribal youth, capacity building, technical knowledge development and technology transfer. The potential assets that could contribute to ecotourism development in the locality included the panoramic landscape, potential for development of adventure tourism, trekking, cultural diversity, ethnic cuisine, environmental quality, natural water bodies, ethnic knowledge in health care, friendly nature of the communities, their self confidence and an aptitude for forest conservation.

The friendly and adventure loving nature of the tribal communities facilitated the process of local planning and development of adventure based ecotourism in the area. Conceptual planning was facilitated through contact-cum-experience sessions with certified and well known professionals in the domain. This was followed up with development of teams for various activities after screening the participants according to the level of skills possessed by them.

The year long ground assessment and resource appreciation led to the development of a model with the involvement of the Bharia indigenous community in Patalkot in consonance with prevailing trends in ecotourism based biodiversity conservation initiatives. The process was started 2009 and advanced in two Phases. In the Phase I, 300 Bharia youth were selected for imparting the required capacity building with the assistance of the District Olympic Association, State Forest Administration and Centre for Forest Research and Human Resource Development Chhindwara, MP Tourism, Ecotourism Board, etc. The initiative also received strong support, patronage and involvement from the Cabinet Ministers of the State Government of Madhya Pradesh, Member of Parliament of the Constituency and the Union Minister for Transport, Government of India, Members of the Legislative Assembly and Representatives to the Upper House of the Parliament from the area and the State.

In the Phase II of the model development, the institutional arrangements required for governance of the development process was conceived and implemented. In order to give a platform for the organisation and maintenance of the ecotourism activities an organisation named as Bharia Patalkot Adventure Society was constituted on democratic lines with representation from each household. The institution has legal legitimacy under the Societies Registration Act, 1980. The various resources required for the institution were mobilised through the District Administration of Chhindwara District, District Olympic Association of Chhindwara, Madhya Pradesh (M.P) Ecotourism Board, M.P Tourism Development Council and the Govt. of Madhya Pradesh. The adventure sports group of Patalkot which is run by Bharia tribes, was also given advanced training and skill certification by the certified instructors from the Sahsi Adventure institute at Manali, in Himachal Pradesh. Phase II took a full fledged shape with the launch of annual seven days Satpuda Adventure Sports Festival which was organised successfully during the years 2009, 2010 , 2011 and 2012. The

Fig. 4: **Group of Bharia tribes trained in Ecotourism by the Centre for Forestry Research & Human Resource Development, Chhindwara (M.P)**

various elements which were considered in the development of the ecotourism model along with the framework of their interactions and the outcome of the model are summarised in Fig 3.

Ecotourism Products Developed

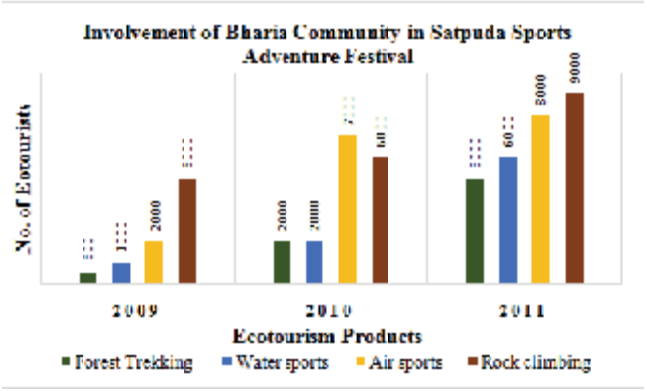
The Patalkot model of ecotourism in the course of its evolution has been successful in developing a set of well branded ecotourism products with the involvement of the indigenous communities through capacity building, convergence, and socio-economic institutional development. The various products developed through the model are listed below in brief.

a. **Forest Trekking Routes:** Trekking in forest areas is the most sustainable aspect of ecotourism activities in the area. In order to facilitate the product development, four trek routes were developed with an average trek route lead of 5 to 7 km traversing the river Dhoodhi and rich tropical forests. The required training for tribal youth involved in the activity was imparted at the Centre for Forestry Research and Human Research Development, Chhindwara, to enhance their capacity for identification of flora and fauna of the region, and they were also skilled to use required accessories. The trekking routes were also branded for product development and promotion as Rajakho trek, Rated trek, Chimtipur trek, Kare-aam trek, Vulture point trek etc.

b. **Water sports:** Water sport products like Banana riding, water parasailing, paddle boating and river rafting were developed in two rivers of Tamia region which are surrounded with beautiful forests and mountains with necessary safety equipments.

c. **Aero-sports:** Aero sports promoted in the project area included parasailing, paragliding and para-mo-

Fig. 5: **The trend of consumption of various ecotourism products developed in the Patalkot Valley**



(Source: District Olympic Association Patalkot, 2013)

tor etc. The required materials and equipment were supplied through the District Olympic Association with licenses from Sahsi Mountaineering Institute, Manali, Himchal Pradesh, a certified training institute affiliated to the Indian Mountaineering Institute.

d. **Rock climbing:** As the valley is surrounded by mountains and the Bharia youth are natural rock climbers the potential was harnessed for development of rock climbing. Necessary equipment like shoes, ropes, carabiners, harnesses and other accessories were provided through the District Olympic Association.

e. **Vulture Point** This point was developed with the view to encourage protection of diminishing vulture population in Patalkot and the surrounding hills. Three species of vulture the Griffon Vulture (*Gyps fulvus*), *Egyptian Vulture* (*Neophron percnopterus*) and Long Billed Vulture (*Gyps indicus*) are endemic to the area. The necessary awareness was imparted among the tribal community to avoid the use of diclofenac for their cattle through the Veterinary Department.

The successful launch of the ecotourism products, their availability as well as the successful conductance of the annual ecotourism festivals led to increase in the acceptance and consumption level of the various ecotourism products. The trends in the consumption pattern of different ecotourism products under the model could be inferred from the Fig. 5.

Discussion

Adventure sports and ecotourism activities were never considered in the management paradigm of tropical forests of Madhya Pradesh. This initiative pioneered a conservation model for tropical forest conservation with unemployed tribal youth by promoting

their livelihood opportunities through ecotourism. This conservation model has led to the reversal of the degradation and deforestation in the tropical forest of Satpuda hills as the tribal community members could generate alternate sources of income to support their livelihood through ecotourism initiatives. It has also checked the ethnic cultural loss and disintegration due to over exploitation of indigenous tribes going out of their communities for employment opportunities outside their habitat.

The attenuation of indigenous tribal knowledge due to modernisation was also checked through this model and their indigenous knowledge provided them ample opportunities to share their wisdom with tourists and to generate additional income. The local cuisine has also got developed and documented because of tourist interest. As a result of the sustainable income generation in the society, the overall living standard and quality of life has improved and biotic pressure over the biodiversity rich tropical forest has got reduced over the years.

It could also be observed over the years that the Bharia community has developed the capacity to maintain and promote the various ecosystem products developed over the years, while reducing the pressure on the tropical forest resources. The continued and adaptive evolution of this ecotourism model in the community has paved the way for inclusive development of the area with the accrual of additional income, employment, social capacity development, empowerment, conservation and development of various ecosystem services thus leading to the realisation of the outcome on forest conservation and sustainable utilisation

Future development of the model

- Creation of eco-friendly infrastructure in twelve villages down in the valley.
- Tent facilities for ecotourists for adventure skills in the valley and identification of more trekking and mountain bike routes for exploring the flora and fauna of the area.
- Development of an interpretation centre.

Conclusion and Recommendations

It was observed from the trends in the consumption of the various ecotourism products over the study years that, the Patalkot model of ecotourism with the involvement of the indigenous communities has demonstrated its operational deliverance, adaptive development and has also emerged as a successful model with elements for replication. The encouraging and motivating results of the experiment and the operational efficiency supported the model to possess potential for appropriate replication in connection with the long term support strategies on restoration of valuable natural assets in the tropical forests which are already under pressures of deforestation and degradation. The model has already been replicated in 12 districts of Madhya Pradesh (Jabalpur, Panna,

Guna, Hoshangabad, Bhopal, Muraina, Gwalior, Shahdol, Mandu, Indore, Dewas and Vidisha) with slight changes as per the potentials available in these districts by MP Tourism. The model was also commended by an award for excellence by the Chief Minister of Madhya Pradesh in year 2010-11. The instant model has also been successful in securing the local stakes on the anvil for ecosystem protection.

Acknowledgement

The paper has been developed based on the doctoral thesis work carried out by the author and also based on his personal experience as the Secretary and Officer in charge of the District Olympic Association, Chhindwara, Madhya Pradesh, India, during the period 2006-2011.

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FOREST MANAGEMENT

Economic contribution of farm and agro forestry

Agro forestry has significant potential to provide employment to rural and urban populations through production, industrial application and value addition ventures in Kolar, Karnataka

Anil Yadav and Vikash Arora

A landlocked district, Kolar is the eastern gateway to Karnataka. It is famous for its erstwhile Kolar gold mines. Kolar is popularly known as 'City of Gold, Silk farming, Mangoes and Milk'. It is bounded by Bangalore Rural district in the west, Chikkballapur district in the north, Chittoor district of Andhra Pradesh in the east and on the south by Krishnagiri and Vellore districts of Tamil Nadu.

Kolar has been undergoing rather drastic shifts in land utilization in the recent past. The major rainfed crops in the region have been Ragi (*Eleusine coracana*) and Jola (Jawar–*Sorghumvulgars*) which are also the staple food of the local population. Due to small landholdings and higher input costs, farmers are not getting enough returns. Further, deforestation prevents farmers from satisfying their basic requirement of fuelwood, timber and fodder. Also industrial demand of timber and pulpwood is hard to meet. In backdrop of this, recently they have started growing trees along with the crops. The Forest Department is giving them technical and financial assistance. The present article analyses the economic impact of agro forestry practised so far in the district of Kolar in the state of Karnataka.

Potential of agro forestry

Agro forestry is about the practices developed and employed by farmers over many centuries to cultivate trees on farmland together with crop and animal husbandry. While agro forestry comprises agriculture and forestry in seemingly separate land uses, its essence is of an integrated tree-based farming system. The potential of agro/farm forestry is very high in the district and there is need to tap the same by involving the local people in a massive way by popularising various tree growing activities through the Forest Department and other institutions. Tree growers' societies/association may also be formed to encourage these activities and to ensure good marketing of the produce. Farmers can have small timber from their own agriculture lands and not from the forest.

At present, species such as Neem (*Azadirachta indica*), Deshi babool

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(*Acacia nilotica*), Nilgiri (*Eucalyptus* sp.), Sharu (*Casuarina equisetifolia*), Ardusa (*Ailanthus excelsa*), Teak (*Tectona grandis*), Bengali babool (*Acacia auriculiformis*) and Bamboo are dominant and they are the main economic species in agro-forestry plantations.

The economy of this district is basically agriculture based. In the drier parts, Ficus species (especially *Ficus bengalensis*) is very popular in agro-forestry. Eucalyptus is extensively planted on the mounds/bunds as well as in the agricultural wastelands. Besides these other species that are planted commonly are *Albizia lebbeck*, *Thespecia* sp., *Glyrecidia* sp., *Pongamia pinnata*, *Bamboosa bambos*, *Azadirachta indica*, etc. Though the forest area in the district is only 12.64 per cent of its geographical area, it is because of the widespread practice of agro forestry that most of the demand of small timber and firewood is met locally. The World Bank aided Social Forestry Programme in the 1980s had contributed considerably to the supply of seedlings to farmers through decentralised nurseries. In the Integrated Wasteland Development Programme and in the JBIC programme, participation of farmers/local people in tree planting programmes, supply of seedlings and providing technical know-how to the farmers have been further encouraged.

Sandalwood as an Agro-forestry Species

General constitution

Sandalwood trees are found throughout Kolar district. But there is a constant decline in the number of sandal trees. The factors contributing to the depletion of this species are rampant smuggling, fire and grazing. As a result, it is difficult to find sandalwood trees with more than 30 cms girth any-

Example of Progressive Farmer

A farmer, named Mr Venkattapa, has grown sandal plantations along with many other trees like *Melia dubia*, Tamarind India, Toor Daal and Drumstick. These plants while acting as a host to the sandalwood plantations provide the minor fruits to the farmer even in case of drought and flood situations. Jowar is the fodder crop grown on the same land as shown in the picture. In 1 acre, 200 trees are grown; 1 tree has the potential of 15 kg heartwood. Hence the total value of the produce after 15 years is 6000x15x200 = Rs 1.8 crore.

where in the division. Therefore, there is no possibility of getting mature trees for extraction. Only dead trees, stumps and roots of illicitly felled trees are recommended for extraction.

Growing condition and regeneration

Sandalwood tree is an obligate root parasite. It can parasitize over 300 species from grass to another sandal plant. Under gregarious growing conditions, self parasitism is common. Sandalwood establishes historical connections with the host plants and depends on them for its requirement of nitrogen, phosphorus and potassium. It can obtain other nutrients on its own. Seedlings are found to survive without a host for three years but thereafter they tend to die.

Initially, seedlings need shade for survival, and in the sapling stage they need diffused light for proper growth. However, once the trees are nearly 4 metres high, they can grow under full overhead light. Plants growing under full exposure have yellowish leaves while those under lateral shade have dark green leaves. Growth rate of sandal in natural forests in favourable soil and moisture conditions is around 5 cm per year at GBH. Heartwood formation starts at 10-13 years.

The usual trench mound technique adopted for afforestation for other species of trees has also been adopted for sandal. Growth of sandal is found to be much better, if at the time of planting in the field, a perennial host can be planted adjacent to the sandal seedling. Some of the good hosts are *Casuarina equisitifolia, Acacia nilotica, Pongamia pinnata, Melia dubia*, and *Wrightia tinctoria*. Miscellaneous secondary host plants like *Moringa oleifera* (Drumstick tree) are also planted in the alternate row. This method has proved successful in many areas.

Further Suggestions

1. Policymakers should incorporate agro forestry in all policies relating to land use and natural resource management. They should also encourage government investments in agroforestry related infrastructure, research and education and in the establishment of sustainable enterprises.
2. Development administrators should create an institutional framework to ensure coordination between various elements of agro forestry scattered in existing missions and programmes.
3. Farmers should demand improved agro forestry science and technology from the public research and extension systems, loan and insurance products from financial institutions, and adopt suitable varieties and agronomic practices.
4. Scientists and researchers should develop location-specific tree-based technologies that complement the crop and livestock systems for sustainable livelihoods, factor in gender concerns, and incorporate the feedback from local communities.
5. Extension agencies, NGOs and farmer organiaations should demonstrate new technologies, build capacities of farmers and help in linking producers to markets and value chains.
6. The private sector is to invest in agro forestry both as a commercial enter-

prise as well as through the route of Corporate Social Responsibility.

7. The media should communicate the benefits of agroforestry to user communities.

Conclusion

So far, agro forestry has not become the movement it should have. For a long time the subject fell between the cracks of "agriculture" and "forestry" with no ownership by either sector. Unlike the credit and insurance products available for the crop sector, the provisions for growing trees-on-farms are minimal. Weak marketing infrastructure, absence of price discovery mechanisms and lack of post-harvest processing technologies further compound the situation.

Despite all this, agro forestry has significant potential to provide employment to rural and urban populations through production, industrial application and value addition ventures. Current estimates show that about 64 per cent of the country's timber requirement is met from trees grown on farms. It is also recognized that agro forestry is perhaps the only alternative to meeting the target of increasing forest cover.

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Evaluation and Review System

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

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

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

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