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From the Chief Editor's Desk

This issue of Field Forester brings to its readers, stories of success in forestry and related aspects from diverse ecosystems and landscapes. On one hand there are stories from the beautiful mountainous states of Himachal Pradesh and Uttarakhand and on the other hand, case studies from Kerala, Karnataka and Rajasthan.

Thus, the August 2016 issue of Field Forester covers varied management issues spanning forests, wildlife and watersheds as well as articles on individual species, like Agarwood; and *Cordyseps*, a parasitic fungus found in the sub-alpine regions of the Himalayas and *Tectona grandis* (Teak) from the southern state of Kerala. The case studies from Himachal Pradesh includes an article on rosin and turpentine management, a precious resource from the coniferous forests of this state; various benefits accruing from the Mid-Himalaya projects are documented in case studies from Sundar Nagar, Chamba and Mandi districts of Himachal Pradesh. The avian pradise of Pong lake finds mention in articles on habitat management of birds in general and vultures in particular. The extraordinary tale of the harmonious existence of the Bishnoi community with nature and their conservation ethos takes us to the deserts of Rajasthan. Two stories from Karnataka, one on elephant-human conflict in Mysuru district and the other one on creating conservation awareness amongst students in Mangalore district are included in this issue.

These case studies bring fresh and varied perspectives of the Officer Trainees belonging to the State Forest Services and Range Forest Officer batches currently undergoing training various institutions under the Directorate of Forest Education.

FOREST MANAGEMENT

Rosin, turpentine oil as source of revenue

Efficient resin extraction processes and factory functioning have seen a surge in production of Rosin and Turpentine in Himachal Pradesh

Napolean Rongmei

The forest revenue generated from Rosin and Turpentine oil in Himachal Pradesh comes from two major factories set up in Nahan (Sirmaur District) and Bilaspur (Bilaspur district). The administrative and financial control of these factories was under the HP Forest Department prior to the formation of Himachal Pradesh State Forest Development Corporation Limited which came into existence in March 1974. The management of the factories was transferred to the new corporation. The production level and sales of rosin and turpentine oil increased on account of the efforts by the corporation. The installed capacity of both the factories is 1,11,000 quintals of raw resin per ann um. The R&T factory in Nahan has a capacity of 37,000 quintals and Bilaspur 74,000 quintals of raw resin, respectively.

The resin tapping work is done by both skilled and unskilled workers of the corporation through Rill Method. The raw resin is processed by means of distillation. The main products obtained are Rosin and Turpentine and other products such as phenyl, varnish, Black Japan, etc. Under normal conditions, raw resin processing gives 76 per cent Rosin and 18 per cent Turpentine. It is then graded and sold on the basis of colour. The rate list of various grades of rosin and turpentine oil is given in Table 1.

The Rosin produced in both the factories is of standard quality and grade as per specifications of IS: 553-1984.

The main characteristics of Rosin which are considered while deciding the grades are given in Table 2.

Based on values obtained against the various characteristics, the Rosin sample is given a grade which is again compared with the BIS requirement for the particular grade. An example for grading of extra white grade (X) is given in Table 3. Grading forms an important basis for sales as it determines the quality of the product.

The sale of resin in Himachal Pradesh is governed by the Resin and Resin Products (Regulation of Trade) Act, 1981. According to the Act, resin exclusively means the secretion extracted by tapping from Chir or Kail trees. Under this Act, restrictions are made in such a way that no person can tap resin or manufacture any resin or export any resin products unless he/she is registered. The resins and its

Roll No: 19, SFS 2015-17 Batch

Table 1: **Rate list of various grades of rosin and turpentine oil**

Rosin	Grade	Full Name	Rate (Rs. per Kg) ex-factory including packing charges excluding taxes and duties etc.			
			Nahan Factory		Bilaspur Factory	
			Packing in TP Barrels	Packing in PGI Barrels	Packing in TP Barrels	Packing in PGI Barrels
Pale	X	Extra White	89.50	91.00	88.50	90.00
	WW	Water White	84.50	86.00	83.50	85.00
	WG	Window Glass	83.50	85.00	82.50	84.00
	N	Nancy	82.50	84.00	81.50	83.00
Medium	M	Mary	81.50	83.00	80.50	82.00
	K	Kitty	80.50	82.00	79.50	81.00
	H	Harry	79.50	81.00	78.50	80.00
Dark	D	Dark	76.50	78.00	75.50	77.00
	B	Black	66.50	68.00	65.50	67.00
	Turpentine Oil (Vegetable) per Litre (Naked ex-factory on cash basis)					
	T. Oil		Nahan		Bilaspur	
			88		87	

Table 2: **Determining Characteristics of Rosin**

S.No	Characteristics
1	Grade
2	Colour Value (Lovibond) (Red/Yellow)
3	Softening point, 0C. Minimum
4	Relative density at 270C
5	Acid Number, Minimum.
6	Saponification Number, Minimum
7	Volatile matter percent by mass, Max
8	Ash content, percent by mass Max
9	Matter insolvable in toluene, percent by mass, Max
10	Unsponifiable matter, percent by mass, Max

products can be sold only to the state government or an authorised officer and at the same time, purchasing of the same can be done only by the state government or an authorised officer. Restrictions are also in force for the transportation and sale of resins and its products. The fixation of price and royalty is done by the state government.

As per 2011-2012 data, about 15,76,148 blazes were handed over to the Himachal Pradesh State Forest De-

Table 3: **Grading of extra white grade (X)**

S.No.	Characteristic	BIS Requirement for type Extra Pale	Rosin Sample of R & T Factory, Nahan Extra Pale
1	Grade	X	X
2	Colour Value (Lovibond) (Red/Yellow)	1.35,13.0	1.35,13.0
3	Softening point, 0C. Min.	70	72 -75
4	Relative density 270/270C	1.050 To 1.080	1.061-1.065
5	Acid Number, Min.	160	165-173
6	Saponification Number, Minimum	165	170-183
7	Volatile matter percent by mass, Max	1.5	0.365-1.000
8	Ash content, percent by mass Max	0.05	0.02 -0.04
9	Matter insolvable in toluene, percent by mass, Max	0.10	0.04 -0.08
10	Unsponifiable matter, percent by mass, Max	6	2.5 – 5

velopment Corporation for tapping by the Forest Department. The quantity of raw resin reported to have been extracted by the corporation for the particular year was 58,251 quintals. The rate of royalty decided by the pricing committee of the Government of Himachal Pradesh fixed for the year was Rs. 65 per blaze. The total royalty payable by the Corporation amounted to Rs 10,24,56,770. This is the total revenue earned only through rosin and turpentine industry in Himachal Pradesh.

Himachal Pradesh is clearly a pioneer state in Rosin and Turpentine extraction in the country. The practice carried out under Forest Department and now by the Corporation, has been generating revenue for the state. Other Himalayan states have species of Pine which yield better quality of resin but are not commercially extracted, like *Pinus kesiya* in the North-east. By following the procedure in Himachal Pradesh, these states too can extract the resource which will reduce the dependence to import and at the same time provide a source of livelihood for the local villagers.

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WATERSHED MANAGEMENT

Stepping towards prosperity through watershed management

Water harvesting structures and high-value crops have changed the economic condition of villagers in three Sundernagar Gram Panchayats in Himachal Pradesh

M Sonowal & K Das

Sixty per cent of risky, un-irrigated and under-invested areas of India support 40 per cent of the population which contributes 40 per cent of foodgrain and a vast array of livelihoods and environmental services. Climatic changes are compounding challenges to livelihood, increasing distresses and require managing of vulnerabilities, adaptations, coping and mitigation. Participatory integrated management of resources within watersheds consisting of transparency, contributions, equity, farming systems and all inclusiveness is a major driver of the current rural development process. The recent strategy focuses on enhanced farm productivity, diversification and income generation through non-farm activities for landless, asset-less and micro-enterprising. Improvement in productivity and diversification aims at enhancing self-sufficiency and mopping of marketable surplus of small, marginal and subsistence producers. Improved technologies, credit, insurance, innovative safety nets, collective purchase of assured quality inputs, sale of outputs and value addition have been argued.

As far as Himachal Pradesh is concerned, in spite of the fact that the State receives on an average 1300 mm of rain annually, most of it drains down the slopes without adding anything to the productivity of the crops. At present, the State has irrigation facilities on around 19 per cent of the cultivable area and it is estimated that if all the water resources are exploited or harnessed, then only 40 per cent of the cultivable area can be brought under irrigation. This shows that even after full exploitation, available surface and groundwater, 60 per cent of the cultivable area will remain rainfed and suffer from vagaries if proper management of rainwater is not ensured.

Watershed management is a holistic approach to managing water resources for quality and quantity. This approach is an ongoing cycle of tasks which include important steps like planning, data collection, assessment and targeting, strategy development and implementation. In planning phase, the watershed unit and resource personnel are identified. Assessment and targeting compare the current water quality to the established standards for water

RFO Batch 2014-16 at FTI & RC Sundernagar, HP

uses and water quality management in water supply.

The Rs 60-million Mid-Himalayan Watershed Development Project is aimed at reversing the process of degradation of the natural resource base, improve productivity and raise rural household incomes. So far, around 6,151 water harvesting tanks, 103 ponds/tanks, 287 dams 263 lift/gravity irrigation schemes and 43 small underground tanks used for irrigation purpose have been constructed. Apart from these, 203 kms of irrigation channels have been developed under the project. The benefits from these structures have reached some 200,000 families.

The project has converted about 9,000 hectares of rainfed area into irrigated land through watershed management techniques. At the mid-term review (November 9-18, 2009), there was an increase in yields of paddy (236 per cent), maize (163 per cent) and wheat (90 per cent), which has surpassed the end of project target of 50 per cent. The increase in milk yield was 11 per cent. It has also played a vital role in reversing the degradation of natural resources and has brought about significant increase in biomass and water availability in project areas, allowing expansion of irrigated lands with subsequent improvements in agricultural yield and household income.

The characteristics of the project include people's participation and encouraging community efforts, in addition to environment protection and common development cultural schemes. It also inspires formation of Panchayati Raj Organisations, user groups, self-help groups and increases their efficiency in capacity building. It also provides money on the basis of work progress and empowering all sections of society and increases income sources.

The main objectives of the Gram Panchayat Watershed Development Project is to increase forest cover and provide opportunities for medicinal plantations, check soil erosion, use of fuel, fodder, bamboo and timber. It also aims at working with all sections of the society, especially women and weaker sections, and empowering them in the process. In addition to promoting horticulture by planting good variety fruit-bearing plants and providing knowledge for orchard management; it also increases breed of cattle and provides good fodder. The project also suggests modern agricultural techniques, which contribute in an increase in yield of crops and fruits and reduces use of chemical fertilizers.

The Mid-Himalayan Watershed Development Project is an integrated multi-sectoral project implemented in mid hills and high hills zone of Himachal Pradesh with financial assistance from the World Bank. The project became operative in 10 districts of the State from October 2005 and covered 602 Gram Panchayats of 42 development blocks. Mandi, one of the districts sanctioned under the project, covers four Watershed Development Committees (WDC) under which Sundernagar WDC has 21 Gram Panchayats (GP) covers an area of 6685 hac. The villages under study—Naun,

Chichyot and Tunna—come under the Sundernagar WDC. The average rainfall of the project area is 1,100 mm, physiography of the soil is moderate slope and undulating topography. To implement the project in these villages, the Forest Department conducted several meeting with the people and discussions carried out about the programme and how it can be helpful for the villagers for their development. After that, a WDC was formed in the villages for implementing different activities.

Problems

Prior to the project, there was a problem of drinking water and irrigation. People had drinking water facility only in the rainy season. But, in winter, they had to walk about 3-5-km from the village for drinking water. The groundwater table was very low—about 45-50 mm—in the project area. Due to the undulating topography, water drained away from the fields and so the famers could not take double crops in their field. People also failed to grow vegetables and cereal crops. Irrigation facilities in the villages were not available.

Impact

New storage tanks and outlet

1.1 New water storage tanks and outlet was constructed in Naun village. The cost of the tank was Rs 4.21 lakh. This structure had water storage capacity of 20,000 litres. This helped the farmers to irrigate 10 hectares land in the surrounding area. Before the construction of this structure, farmers could take only one season crop (*kharif*). Now the farmers use this water for irrigation purposes and have increased their income for growing maize and vegetable crops as well as *rabi* crops.

1.2 Another storage tank was constructed in Chichyot in 2008-09. The cost of the tank and the outlet was Rs 827,449. This structure has water storage capacity of 20,000 litres and can irrigate 5 hectares of surrounding agricultural fields. This structure helped the farmers to grow vegetables and other crops in their field. The water in this tank is available throughout the year. Many farmers are able to take three season crops in their field.

Check dam

A check dam was constructed with the assistance of the Forest Department in Chichyot village, in the year 2010-11. The cost of the masonry dam was Rs 257,673. The storage capacity of the check dam is 3,066.8 cubic metres. In 2012, another check dam was constructed at an expenditure of Rs 491,074. Water is available in this structure all over the year. This structure covers about 8-10 farmers' fields. Now they grow cash crops like winter vegetables, maize and other cereal crops. The income of the farmers also increased significantly from this.

Baudi *or stepwell*

'The *baudi*', or the stepwell, is a deep-stoned pit, which is dug where water percolates naturally from the earth's surface. Its shape gently slopes towards the pit in the centre. The *baudis* were constructed at public places, acting as rainwater harvesting structures.

Foot bridge construction

To win the goodwill of the people, a foot bridge was constructed in Tunna Panchayat in the year 2008-09, with an expenditure of Rs 530,757. It had a length of 21.40 metres and a breadth of 1.80 metres. A similar type of foot-bridge was also constructed in Naun Gram Panchayat.

Results/Impacts

Within the project area, following activities were undertaken as per land capability, suitability and actual need of the farmers.

1. Afforestation
2. Check-dam construction
3. Stepwell construction
4. Connecting these water harvesting structures through drainage line treatment and thus making water available to the fields even during non-rainy seasons.
5. Promoting cultivation of flowers, vegetables and other cash crops.

Impact on groundwater level

After the watershed harvesting structures like ponds, check dams and stepwells were Constructed, the storage of water started there suddenly and the groundwater level increase up to 35-40 mm. Now the farmers don't dig any structure for drinking water. They are able to get drinking water at a depth of only 1 feet. Farmers are also growing vegetables, flowers and maize crop and majority of the farmers have benefited by double crops. All the structures are built by carefully side selection of the drainage line so that maximum storage of water is possible.

Impact on agriculture production

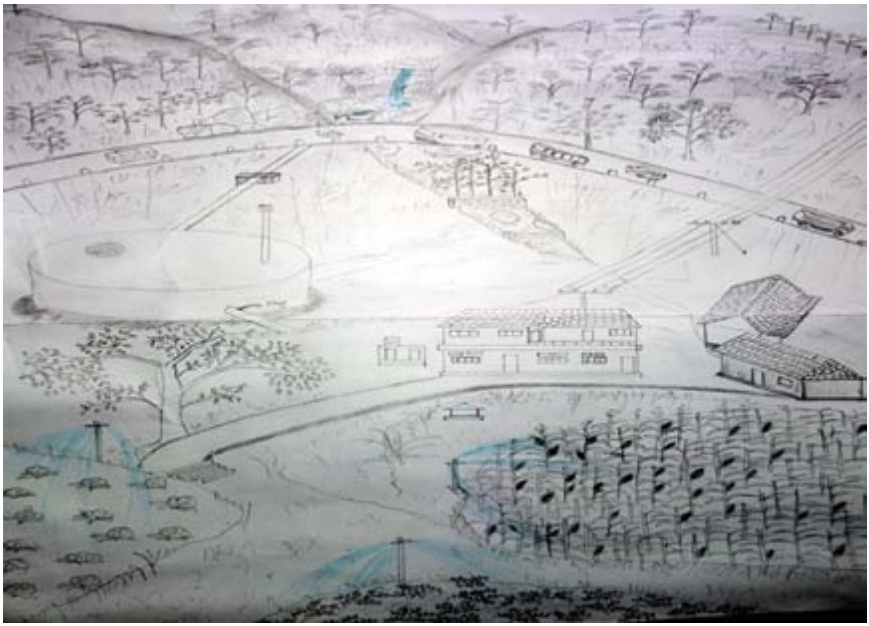
Before the implementation of the project, farmers took only one season crop that was dependent on the monsoon and the undulating topology. A drought was also common within 4-5 year in that village. Therefore, farmers could not grow cash crops like maize, vegetables and double season crops. But, after the implementation of the project, rainwater is conserved in water bodies like check dams, ponds and stored tanks. This water is available in these structures throughout the year. Farmers now grow cash crops as well as *rabi* crops. About 80 per cent of the farmers use organic manure (vermicompost) in their fields now. The production of crops also increased significantly.

Other impacts

- Increased availability of water and other livelihood activities provided employment to the farmers and generated income opportunities.
- Migration (permanent as well as seasonal) of the people reduced up to 20 per cent because people were able to get employment in their village.
- Afforestation and other vegetation activities reduced the vulnerability of the area to drought conditions.

Conclusion

The overall impact of the watershed projects under the Mid Himalayan Watershed Development Programme has been positive and significant. There has been a marked improvement in the access to drinking water in the project



Plan showing water harvesting structures and drainage to agricultural fields for irrigation

areas. Crop yields have risen and there has been a substantial increase in area under cultivation in the *rabi* season, leading to rise in employment and reduction in migration of labour. Availability of fodder has also improved, leading to a rise in the yield of milk. Thus, it is evident that the project has not only increased the productivity of land, but also improved the economical condition of the people. It has also resulted in greater women participation, greater access to income generating opportunities, sharing of benefits by community and reduction in migration from these villages and, above all, restoration of ecological balance and overall environmental improvement.

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NON WOOD FOREST PRODUCTS AND MEDICINAL PLANTS

An insight into Agarwood

An ideal Integrated Nutrient Management application in Agarwood (Aquilaria malaccensis) promotes quality seedling production, reduces the nursery period and achieves maximum growth in field conditions.

Dr. K Jayachandran & V Priyanka

Introduction

Agarwood is a resinous substance occurring in trees of the genus *Aquilaria*, a member of the Thymelaeaceae family found growing along the foothills of the Himalayas and extending upto the rain forests of Papua New Guinea. *Aquilaria malaccensis* (synonyms: *A. agallocha*) is one among the 15 species in the Indo-Malaysian genus *Aquilaria*. The agarwood tree is a large evergreen tree, attaining a height of about 15-40 m, a girth which varies from 0.6-2.5 m and has white flowers. This resinous wood is also known as agar, aloeswood, eaglewood, *gaharu* and *kalamabak*. The term agarwood, is however widely used to refer to the members of the Aquilaria genus, more specifically referring to the resinous heartwood from the Aquilaria tree.

Agarwood in general has three principal uses *viz*., medicine, perfume and incense. Apart from these, the non-infected part of the wood is used for carving and furniture purposes. Agarwood has also been a traditional medicinal source for Ayurvedic, Tibetan and East Asian medicine and has been widely used for the treatment of pleurisy. Agar is frequently found in young trees about 20 years old, but the infestation takes time to mature and trees about 50 years old have shown the highest concentration (yield approximately 2 - 3 kg per tree). The occurrence of the tree itself does not guarantee the presence of the resin. Scientists estimate that only 10 per cent of the *Aquilaria* trees in the natural forest contain agarwood. The price of agarwood ranges from a few dollars per kg for low quality material to more than US$ 30,000/kg for top quality wood. Similarly, agarwood oil fetches high prices, thus there is a need for establishment of commercial plantations to achieve the maximum infection intensity in order to obtain higher yield to meet the future demands.

Integrated Nutrient Management in Agarwood

Nursery

For raising *Aquilaria malaccensis* seedlings are planted in polybags filled with standard soil mixture 2:1:1 (Soil: Sand: Field Yard Manure). The INM treatments of N, P_2O_5 and K_2O (200:300:200 mg) to each seedling are given along with vermicompost (5g), *Azospirillum* (5g) and *Phosphobacteria*

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(5 g) and proved to be an ideal dose to improve the seedling growth parameters. The INM treatments were found to improve N, P and K content of *Aquilaria malaccensis* seedlings. Similarly, the treatments positively influenced the available soil nutrient status soil. This INM treatment reduced the nursery period by 60 days and produced good quality seedlings.

Plantation

Under field conditions the plant height and plant basal diameter of *A. malaccensis* seedlings increased by INM application in the ratio 150: 225: 150 kg ha^{-1} of NPK. Each plant was also treated with vermicompost (4.5 g), *Azospirillum* (4.5 g) and *Phosphobacteria* (4.5 g). This was found to be the best treatment for enhancing the dry matter production, chlorophyll 'a', chlorophyll 'b' and total chlorophyll content.

Characteristics

Anatomical characteristics

For anatomical characteristics - vessel length, vessel diameter, vessel arrangement, vessel frequency, ray height, ray width, ray frequency, fibre length and fibre diameter - for three, five, seven and nine year old non-infected *Aquilaria malaccensis*, wood samples were systematically collected from the pith, middle and periphery wood sections of the radial positions. The mean values of vessel length (109.31, 121.04, 144.14 and 169.57 µm), vessel diameter (113.75, 136.25, 169.50 and 198.75 µm), vessel frequency (6.66, 8.99, 9.47 and 11.01 sq. mm^{-1}), ray height (486.25, 605.75, 715.50 and 857.24 µm), ray width (33.75, 46.25, 62.50 and 72.50 µm), ray frequency (2.63, 8.98, 9.31 and 9.79 sq. mm^{-1}), fibre length (953.75, 1118.75, 1324.28 and 1587.50 µm) and fibre diameter (38.28, 43.11, 54.14 and 68.27 µm)were recorded for three, five, seven and nine year old *Aquilaria malaccensis* wood samples respectively.

Mechanical characteristics

Better knowledge about the mechanical properties of non-infected *Aquilaria malaccensis* wood samples at different age gradation (five, seven and nine year old) helps in knowing the suitable age for interior house construction and decorative purposes.

Oil characteristics

The analysis of different grades of *Aquilaria malaccensis* (Agarwood) essential oil through Gas Chromatography Mass Spectrometry (GC-MS) has indicated that the presence of aromadendrene 2 and valencene 2 plays an important role in grading of agarwood oils. The G1 (highly infected wood) oil contained more aromadendrene 2 (24.76 %) and valencene 2 (17.53 %) than the G2, G3 and G4 wood oils.

Conclusion

This study has clearly brought out the ideal INM application to promote quality seedling production, reducing the nursery period and to achieve maximum growth in field conditions. The measurements on the anatomical and mechanical properties are widely used as an indicator of wood quality which provides a basis for improved

wood utilisation. The characterisation of oil through GC-MS helps in grading the quality of oil. This information could be utilised for further tree improvement aspects of this species with reference to wood quality and to bring out its potential utility for future.

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Table 1: **Mechanical properties of non-infected *Aquilaria malaccensis* at different ages**
(at 12 per cent moisture contentcomparing with Tectonagrandis)

Mechanical Properties	Age in years			Teak
	5	7	9	
Density (Kg m^{-3})	428.70	458.30	470.90	676.00
Specific gravity	0.50	0.52	0.55	0.60
Static bending strength (FS at LP) (Kg cm^{-2})	313.50	464.30	542.30	651.00
MOR (Kg cm^{-2})	692.60	758.30	811.90	959.00
MOE (Kg cm^{-2})	63872.20	69212.50	74384.50	119060
Compression strength parallel to grain at LP (CS at LP) (Kg cm^{-2})	252.00	269.60	289.30	376.00
Compression strength perpendicular to grain at LP(CS at LP) (Kg cm^{-2})	44.80	72.80	98.20	101.00
Hardness (static indentation)				
Radial (Kg)	170.40	268.30	304.00	502.00
Tangential (Kg)	254.90	365.90	418.30	524.00
End (Kg)	252.30	290.40	398.40	488.00
Shearing stress parallel to grain (MSS)				
Radial (Kg cm^{-2})	97.50	98.60	105.40	96.87
Tangential (Kg cm^{-2})	68.60	79.30	102.70	108.09
Tensile stress parallel to grain (TS)				
Tensile stress at proportional limit ((Kg cm^{-2})	412.90	589.40	640.50	-
Tensile stress at maximum load ((Kg cm^{-2})	751.30	898.40	942.30	-
Tensile stress perpendicular to grain (TS)				
Maximum Tensile Stress ((Kg cm^{-2})	43.40	51.40	61.30	66.28

Nail-holding power				
Radial (Kg)	110.60	167.10	195.90	93.00
Tangential (Kg)	74.30	128.50	147.00	93.00
End (Kg)	63.40	72.40	96.90	85.00
Screw-holding power				
Radial (Kg)	289.40	355.90	391.30	388.00
Tangential (Kg)	296.90	374.20	403.40	410.00
End (Kg)	236.00	253.20	279.00	283.00
Brittleness by Izod impact (Kg cm^{-1})	142.40	179.80	194.30	-
Brittleness by Charpy impact (Kg cm^{-1})	59.30	71.60	83.80	-
Cleavage strength parallel to grain (Kg cm^{-1})	58.60	67.30	71.30	-

Table 2: **Constituents of different grades of Agarwood oil**

Highly infected Agarwood (G1)			Moderately infected Agarwood (G2)		
RT (min)	**Components**	**%**	**RT (min)**	**Components**	**%**
30.86	Aromadendrene 2	24.76	3.05	Methyl-î-caprolactone	39.10
30.86	Valencene 2	17.53	38.96	7-(Hydroxymethyl)-2-methoxy-xanthone	32.06
30.47	Calarene	9.63	35.43	2,3,4,12-Tetrahydrofuro[2,3-b] naphtho[2,3-b]pyrrolo-5,10-quinone	9.09
30.25	1(5),6-Guaiadiene	8.76	38.10	1-Deutero-2-allyloctanol	7.26
25.10	Spathulenol	7.45	42.54	(Z)-9-Docosene-1,22-diol	3.57
27.29	Peroxygibberol	5.90	40.67	11-Hexadecen-1-ol	3.40
31.14	Eremophilone	3.51	30.33 25.81	2,3,5-Trimethylenehexane Aromadendrene 2	2.36 1.58
31.14	Quindoline	3.51	25.81	Valencene 2	1.58
31.64	trans-1,2,3,4,4a,5,6,7-Octahydro-à,à,4a-trimethyl-2-naphthalenemethanol	3.50			
29.91	Octahydronaphthalene	3.46			
32.78	Aristol-9-en-12á-ol	3.32			
33.19	Lepidozenol	1.62			
28.58	(7R,10R)-carota-1, 4-dien-14-ol	1.43			
28.58	Santalal	1.43			
32.31	Benzene, (1-Pentylheptyl)	1.43			
24.48	à-Helmiscapene	1.38			
33.39	1-Ethyldecylbenzene	1.38			

RT - Retention Time, % - Percentage

Less infected Agarwood (G3)			Healthy Agarwood (G4)		
RT (min)	**Components**	**%**	**RT (min)**	**Components**	**%**
3.05	Methyl-î-caprolactone	39.10	39.09	3-Carbethoxy-3-butenyl Crotonate	29.12
38.96	7-(Hydroxymethyl)-2-methoxy-xanthone	32.06	39.09	3-Methyl-3-buten-1-yl 4-(4-methyl-4-pnten-1-yl) benzenesulfonate	29.12
35.43	2,3,4,12-Tetrahydrofuro[2,3-b] naphtho[2,3-b]pyrrolo-5,10-quinone	9.09	3.05	Methyl 5,5-dimethoxy-4, 4-dimethyl-3-hydroxy-2-vinylpentanoate	24.68
38.10	1-Deutero-2-allyloctanol	7.26	36.24	1-Butyl-2-(1-hexynyl)-3, 4-dimethylbenzene	7.34
42.54	(Z)-9-Docosene-1, 22-diol	3.57	35.56	(Z)-6-methyl-1-trimethylsilyloxy-1-heptene	6.27
40.67	11-Hexadecen-1-ol	3.40	32.57	Ethyl 1-Methyl-4-phenylpyrrole-3-carboxylate	3.47
30.33 25.81	2,3,5-Trimethylenehexane Aromadendrene 2	2.36 1.58			
25.81	Valencene 2	1.58			

RT - Retention Time, % - Percentage

FOREST MANAGEMENT

Improved Teak Management

Thinning in teak plantations is an important silvicultural operation and leads to the development of a better and promising crop as seen in Konni Forest Division, Kerala

Rajesh Kumar Sharma &
Chandra Mohan Gupta

Teak (*Tectona grandis*) is one of the most well known timbers in the world and has been widely used in India for more than 2000 years. Teak wood is a valuable multipurpose timber preferred for quality, strength and durability. Due to its excellent wood qualities and commercial value, it has been introduced in around more than 70 countries all over the world. Teak wood has high ratings in most of the timber qualities such as strength, durability, and workability. It offers lightness with strength and ease of seasoning without splitting and cracking. In the ancient times, ships as well as huge gate of forts were built of teak due to its high strength and durability and long lasting nature even in adverse weather conditions.

Konni Forest Division

The opportunity to see the teak plantation in Konni Forest Division, Kerala, was provided during the month of December, 2015. In Konni Forest Division, the first commercial extraction of teak was started before 1800. Konni has been the home of scientific management of teak plantation ever since 1867, when the first teak plantation of Travancore region was raised here. Konni Forest Division accounts for approximately 8,000 ha of teak plantation out of the existing 75,000 ha under teak plantation in Kerala.

Climatic Conditions in Konni Forest Division

Konni Forest Division has the largest teak plantation in Kerala and has an ideal climate for growth of teak. The Forest Division has a moderate hot and humid climate, with more hours of sunlight and the average annual rainfall received is above 250 cm. The plantation sites have a strong effect on the growth, development and wood quality of teak. Soil texture, pH, temperature, rainfall, moisture and sunlight play a very important role.

Range wise distribution of Plantation in the Konni Forest Division:

No.	Range	Area (Ha)
1	Konni	1558.73
2	Naduvathumoozhy	3974.00
3	Mannapara	2453.85
	Total	**7986.58**

SFS (2015-17), Coimbatore

Site quality is considered good if the height of the trees standing there is high. For teak plantation a spacing of 2m x 2m is followed for better scientific management of the plantation.

Silvicultural Operations at Konni

The silvicultural system to be followed in this working circle is clear felling of the mature stands that reach the rotation age of 60 years followed by artificial regeneration to ensure the renewal of a successful forest crop. The thinning cycle proposed for pure teak plantation includes mechanical thinning at the 5th year and silvicultural thinning at 10th, 15th, 20th, 30th, and 40th year. The plantation is managed intensively for 5 years. Other practices at the plantation include mechanisation of the plantation management, special tending operations and fencing.

Spacing

A spacing of 2m x 2m is suggested for the plantation. Before planting operations are carried out the stumps need to be treated with an application of fungicide and root hormone.

Thinning

Thinning in teak plantations is an important silvicultural operation and leads to the development of a better and promising crop. Mechanical thinning is carried out at 5th year, then silvicultural thinning are carried out at 10th, 15th, 20th 30th & 40th years, followed by final felling at the age of 60 years.

No.	THINNING	YEARS	TYPE OF THINNING
1	1st	5th	Mechanical (M)
2	2nd	10th	1st Silvicultural (S1)
3	3rd	15th	2nd Silvicultural (S2)
4	4th	20th	3rd Silvicultural (S3)
5	5th	30th	4th Silvicultural (S4)
6	6th	40th	Final Thinning (S5)
7	Final felling	60th	Final felling (F)

Mechanical Thinning

The prescription for thinning can be only of a general nature. Since the growth and stock in many of the plantations is not satisfactory, thinning should be carried out with much caution. The mechanical thinning can be carried out only if the area satisfies two conditions; (a) The area should be fully stocked and (b) the canopy is close enough in the year intended for thinning. Initially, the spacing between the trees is kept at 2m x 2m. However as the initial years pass by, there is a heavy competition for food and nutrition from soil, along with dense canopy formation leading to tough competition for sunlight. So alternate diagonal rows should be removed which would give an even spacing of tree which can receive proper sunlight and nutrition.

Problems in Teak Plantations

Many factors affecting the success of teak planting include site selection, seed supply, seed quality, nutrients, proper sunlight and the canopy formation and removal of weeds. Teak is a light demanding species and its growth and development is reduced sharply under poor light conditions, hence intensive weeding is necessary during early establishment of the teak plantation

during the first three years. Financial assistance for weeding practices should also be introduced at the later stage after completion of initial five years. This is needed because some plantation failure which occurs due to climbers and other weeds is also encountered at the later stages too. Climber cutting needs to be done from time to time at specific intervals so that bending of trees can be reduced so as to get the straight trees.

Damage due to insects is a serious problem in teak plantations. The most common insects which cause severe damage to the plantations are defoliators and stem borers. Defoliator insects cause severe defoliation which reduces the growth rate. The most important defoliators causing severe damage in teak plantation are *Hyblaea puera* and *Eutectona machaeralis*. Stem borers also causes severe damage in young plantations (1-5 years old), damaged trees may die back causing a reduction in growth rate and stem quality.

Silvicultural treatments such as weeding, climber cutting, thinning may be the only methods which can reduce the insect populations. Silvicultural thinning needs to be carried out, hence the teak trees to be removed preferentially are:

(1) Dead, dying and diseased trees
(2) Trees damaged by elephants
(3) Trees with broken tops

Thinning in Teak Plantation

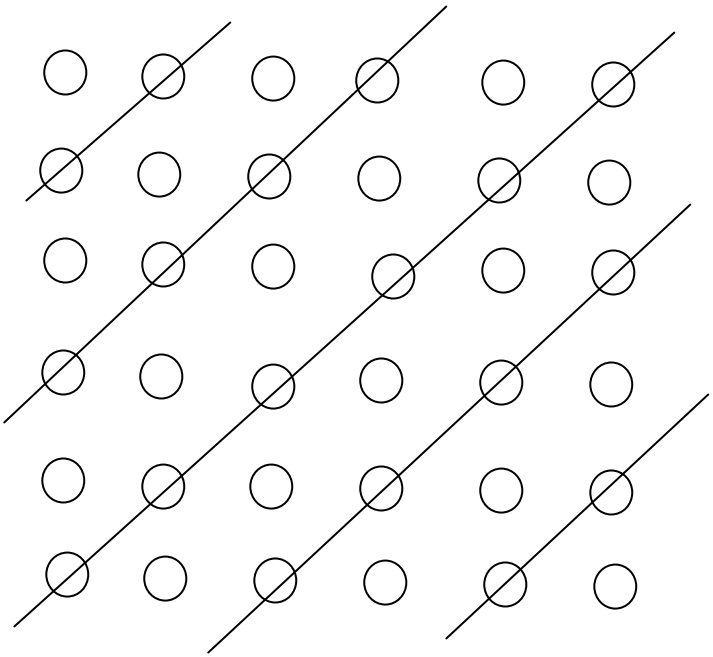

Figure 1: **Initial Mechanical Thinning after 5 year]**

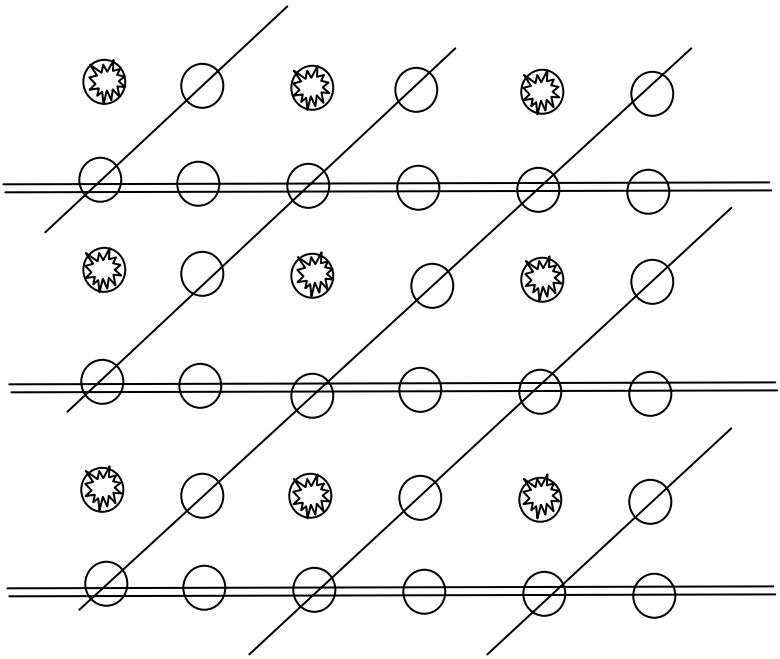

Figure 2: **Second Thinning after 10 years**

(4) Suppressed trees
(5) Trees attacked by stem borers

Damages due to elephants in teak plantations is very high which can be classified in to four categories such as breaking of branches, breaking of main stem, complete damage and uprooting of trees. Teak plantations of 1-5 years of age are severely affected by the damage caused by the elephants.

Suggestions

Water bodies like ponds for drinking water for wildlife should be constructed away from the plantation site so as to minimise damage to the plantation. Elephant trenches and solar fencing should be constructed on the boundaries of the plantation so that elephants can be stopped before they enter the plantation area, thus leading to the minimum damages to the plantation.

Konni Forest Division produces 12,000 Cu M/ Year Teak at a value of Rs 120 crore. The rotation age for the final felling was initially 70 years as per the first working plan which was reduced to 60 years as per Government Order for maximisation of revenue from the existing Teak Plantation.

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This study is based on the field experience of the author. The photographs were taken in field visits and the statistical information have been provided by the Deputy Conservator of Forest, Konni Division, Kerala.

PEOPLE AND FORESTRY

Changing face of rural development

The Mid Himalayan Project in Himachal Pradesh has ushered in hope in the poverty-stricken Chowari division of Chamba District by providing multiple opportunities

Pankaj Kumar Bora & Pinku Singh

Educated up to Class VIII, Om Prakash had no choice in life but to accept it the way it came to him. The youngest son of a five-membered poor family of Banikhet in Chamba district of Himachal Pradesh, Om Prakash had an indomitable will to do something for himself and his family. But, there was no one to help him out. However, one day Om Prakash got an opportunity to enrol himself in an electrician training programme, organised by a office called 'Mid Himalayan' at Banikhet. This was the opportunity Om Prakash was looking for and there has been no looking back since then. After successful completion of the training, he started his own 'electrician services shop' at the Banikhet market. Once the employee of a stationer, Om Prakash now becomes the employer of two employees. With his handsome earnings, Om Prakash is now maintaining his family happily. His daughter is studying in a good school.. The elated Om Prakash expressed it like this: *"I could not be fortunate to study more, but I cannot let my daughter to be like me. I will always be indebted to 'Mid-Himalaya' for changing my life and now I am trying day and night for the well being of my family"*.

It is not just the story of Om Prakash alone, but of all those hundreds of under-privileged people living in Bhattyat village for whom the Mid-Himalayan Watershed Development Project brought in a fresh lease of life.

The concept of Participatory Rural Appraisal had come into play in India in the 1980s which aimed at decentralised governance of rural development activities. In view of its success in the last decades, it has now become an integral part of our all rural development planning. The Mid Himalayan Watershed Project, started in 2005, also had incorporated the PRA approach of rural development. It has also resorted to the principles of Joint

Forest Training Institute and Rangers' College, Sundernagar, H.P.

Forest Management while dealing with the forest fringe area people. Although it was basically a rural development project but, considering the stake of the forestry sector, the State Forest Department had been given the charge of the nodal implementing agency, dovetailed with the State agriculture, veterinary, irrigation, health and education departments. The project operated at the grassroots level by forming UGs, CIGs, SHGs and their confederations, and also through various PRIs. Decision making was decentralised and works were prioritised through PRA. The District Watershed Development Officers (DWDOs), with the help of Watershed Development Co-ordinators (RFO level officer) at the sector level, implemented, co-ordinated and monitored project activities. At Chowari, Mr R P Sharma, the DWDO, let us know that the basic thrust areas for the project were like rainwater harvesting, creation of irrigation facilities, creation of livelihood, capacity building, tackling the livestock management issues and establishing road connectivity to the inaccessible panchayats, etc., within an altitudinal zonation of 600 m to 1,800 msl. The project encompassed 16 Gram Panchayats (GPs) in the study area, having a population of 500 to 1,200 in each GP. The following paragraphs will try to explain the reader how the Mid Himalayan project transformed the socio-economic scenario at Bhalai in a positive direction.

Amongst the most significant project interventions as noticed in the area, the development of the Mokhuwal type rainwater harvesting structures and their efficient utilisation for irrigation was quite inspiring. The project constructed brushwood dams at the

A Mokhuwal type structure

source of water, then did drainage area treatments, dry stone damming, wire crate damming in the course way, erected the Mokhuwal type water harvesting structure, constructed reservoirs and finally installed sprinkler systems to enable irrigation. After completion of the construction works, the structures were handed over to the UGs for their maintenance and control. The project not only enhanced irrigation and cropping intensities, but also ensured self sustenance of these water harvesting structures by raising a maintenance fund from 10 per cent beneficiary share taken against the total project cost and also by levying a fee of Rs 5 per hour of irrigation. This activity massively transformed the agrarian economy of the project area. Not only multiple cropping is practised there now but the shift from less remunerative monoculture of maize and wheat to cultivation of cash crops like ginger, turmeric, tomato, *bhindi*, chilli, etc., has also become possible taking a direct positive bearing on the economy of the farming community.

A knitting CIG at work

The second important project intervention noticed was the formation of hundreds of Common Interest Groups (CIGs) for knitting of woollen garments. To mobilise knitting activities and for its self sustenance, a confederation of the CIGs was developed, named Community Empowerment Organisation for Rural Development (CEORD), and registered under the Societies Registration Act, 1860. The project provided the CIGs with trainings on knitting, supplied wool at cheaper rates and also supplied knitting machines against a beneficiary share of 10 per cent. This activity empowered by generating subsidiary income to hundreds of women, who otherwise were living in a condition of extreme economic and social backwardness. At the same time, it also encouraged personality development among the women folk and also created socio-political awareness amongst them. Currently CEORD has two sales outlets for selling CIG products with an annual turnover of Rs 12.71 lakh (2014-15).

The service sector trainings provided by the Mid-Himalayan project, we thought, was the third significant intervention, which transformed a good number of unskilled youth to a highly productive skilled human resource. These trainings included training for tourist guides, plumbing, mobile repairing, knitting-cutting-tailoring; training of electrician, etc. As many as 901 beneficiaries were trained in various disciplines up to March, 2015,

The writers with the tourist guide group at Khajjiyar

out of which a majority had established their own ventures like. Om Prakash.

Apart from the said activities, the Mid Himalayan project also brought in numerous other benefits to the people of these grossly underdeveloped Panchayats in a number of ways. For instance, the RCC foot bridges constructed to connect the inaccessible GPs to the main roads lessened the plight of the people. On the other hand, the Community plantations (a JFM activity) went a long way in solving the problem of uncontrolled grazing. Moreover, seeds (HYVs/Hybrids) of agricultural crops, goats and chicks provided free of cost for rearing/farming; livestock vaccination camps; training on vermicomposting technique; etc., were some other supports areas which went a long way in alleviating poverty. In fact, the study revealed that all these project interventions ushered in a new era of rural development at the Bhalai sector of Chowari, bringing in many positive changes.

To sum up in the words of the Khajjiyar Tourist Guide Group: "We were poor and half literate, we had the energy but didn't know what to do and how to do. The Mid Himalayan project showed us the path. We were trained by them and now we are leading a good life by our own income". The Mid Himalayan project is a story that now echoes in all spheres of Bhalai.

PEOPLE AND FORESTRY

Bishnoi: A community in harmony with nature

Given their inherent culture and tradition of not harming any living thing, the Bishnoi community has been assisting the Forest Department in Rajasthan in several ways

Vahneichong Singson

In the western part of Rajasthan where the temperature rises up to 50°C in summer and sinks to 0°C in winter and rainfall is scarce with drought occurring thrice in every ten years, the Bishnoi community has been living in harmony with the environment.

The Bishnoi community is a socio-religious group founded by Guru Jambeshwar in the fifteenth century. He laid down 29 tenets to be followed by his followers, which relate mainly to maintaining personal hygiene and basic health, healthy social behavior, worshipping God, conserving biodiversity and good animal husbandry. In fact, the word 'Bishnoi' is derived from bis-meaning twenty and noi-meaning nine. In Rajasthan, the Bishnoi community lives in the districts of Jodhpur, Barmer, Nagaur, Churu and Hanumangarh. They are also found in the states of Madhya Pradesh, Uttar Pradesh, Haryana and Uttarakhand.

One of the main Bishnoi settlements is Khejarli village, 26 km away from Jodhpur city. The name of the town is derived from Khejri (*Prosopis cineraria*) trees that were once abundant in the village. The village is inhabited by the Bishnois, who live in groups of three to four houses called *Darni* on their farmland. They mainly depend on rainfed kharif crops and animal husbandry for their livelihood. They also depend on the Khejri tree. The Khejri provides them fuelwood, fodder in the form of its leaves and edible pods high in protein content. The pods can be made into pickle and stored for a long time. The dependence on Khejri tree for food and fodder increases during times of drought. The Bishnois have sustained themselves by constructing water storage tanks or *Kunds*. The Bishnoi community also supplied milk in most parts of Rajasthan when drought hit the state. The fodder obtained from Khejri leaves have high nutrient content and the cattle produced more amount of milk when fed with it.

The Bishnoi are known for their role in conserving biodiversity. They do not cut green trees. They fell dead trees and use the deadwood and fuel-cakes made of cowdung and fodder waste for their cooking purposes. They are also against the use of blue clothes so as to minimise the cutting of a large shrub which is used for obtaining blue dye (indigo). Though

Roll no.34, SFS 2015-17 Batch, CASFOS

they worship Lord Vishnu, they do not cremate their dead bodies; instead they bury their dead bodies with the concept of giving the elements back to the earth as well as saving trees from being used as fuelwood for burning the dead bodies. They filter water and milk with a piece of cloth and clean their fuelwood before lighting up so as to prevent any insects or living beings from being harmed.

Given their inherent culture and tradition of not harming any living thing, the Bishnoi community has been assisting the Forest Department in several ways. They participate in animal rescue operation, reporting any injured animals encountered by them. Bishnoi youths have formed an organisation which provides volunteers for rescue operations. They are also against the practice of poaching and hunting. Any offender caught by the community members is beaten up, heavily fined or handed over to the forest officials. They also feed animals like blackbuck and chinkara, which they considered as sacred animals. These deer are found freely roaming around Bishnoi villages. They are ready to give their food and water to these animals even if it means that they will go hungry. Bishnoi women are also known to suckle an orphaned deer calf.

In the month of September, a fair is held in Khejarli village every year to remember and pay homage to the 363 people led by Amrita Devi who sacrificed their lives in saving the Khejri trees. This mass sacrifice occurred in the year 1730 AD when the King of Jodhpur (Maharaja Abhay Singh) asked his soldiers to gather wood for burning lime to build a new palace. The soldiers went to Khejarli village to gather wood and started felling the Khejri trees. Amrita Devi protested, proclaiming "A chopped head is cheaper than a chopped tree" and hugged the tree to give her life for saving the trees. She was followed by other villagers and the mass sacrifice continued until the news reached the King. The king stopped his soldiers and apologised to the Bishnoi

Members of the Bishnoi community meeting to discuss arrangements for the Khejarli Fair

community and banned felling of trees and hunting on Bishnoi land. In memory of the martyrs, 363 Khejri trees were planted at the spot and a cenotaph was constructed. Every year thousands of trees are planted during the fair. The Forest Department also spreads awareness among the public by displaying posters and distributing pamphlets regarding biodiversity conservation.

The Government of India under MoEF has instituted an award called Amrita Devi Wildlife Protection Award. The Rajasthan Government has also organised a state level award called Amrita Devi Bishnoi Smiriti Paryavaran Award. Both awards are given in two categories: individual or institutional level and community based organisation, from rural areas including Gram Sabha, showing exemplary courage or work for protection of wildlife.

The Bishnoi community are an exemplary community whose principles and believes can be applied to anyone regardless of their faith, origin or status. When species are threatened and are on the verge of extinction, they have done their part in conserving the biodiversity although they have been living with limited resource and harsh environment. Such commitment and faith are truly the need of the hour.

Acknowledgement

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WILD LIFE MANAGEMENT

Elephant-Human conflicts: A case study

Competition for resources in Mysuru District has led to people penetrating deeper and deeper into the habitat of wild elephants giving rise to conflicts

Jagdeep Singh Dahiya & Ramesh kumar

From the time immemorial man and wild animals are integral components of all forest ecosystems. Their mutual presence affects each other even in normal conditions. They live in harmony unless their interests conflict and their activities start harming each other. Karnataka accounts for highest number of Asian Elephants (20%) in the country. The human-elephant conflict is quite pronounced and the forest department has taken up a number of management steps to prevent and mitigate the conflict. It is observed that the forest areas of the region are excellent habitats for the wild animals in general and elephants in particular.

The Jenkurba and Kadukurba tribes and other forest dwellers have been traditionally living in co-existence with wild animals since ages. However the entry of wild elephant in non-forest areas like agricultural fields and human habitation in the vicinity of forest areas has increased alarmingly in recent years. The competition between man and elephant for food and water in the fringes, habitat fragmentation, encroachments of the forest areas and corridors are the main causes leading to human-elephant conflict in the region.

Geographical features of Mysuru District

Mysuru district is situated in the southern part of the Deccan peninsula in southern Karnataka and forms the southernmost district of Karnataka. Geographically, the district lies between 11^0 48′ – 12^0 22′N and 76^0 15′ – 77^0 08′ E. The highest altitude in the district is 1047 m (Chamundi Hills) and the lowest altitude is 634 m MSL at Talakadu. The total geographical area of Mysuru district is 6854 sq km out of which 1069 sq km is forest area comprising of Reserved Forests, National Parks and Wild Life Sanctuaries. Mysuru territorial division manages 161.52 sq km of forest area. This forest division is bounded on the north by Mandya forest division, on the east by Kollegal forest division, on the south by Chamrajnagar wildlife division and Bandipur National Park and on the west by Hunsur territorial and wildlife divisions. Here tribes like Jenukuruba, Kadukurba and other forest dwellers have been living in and around forests since ages.

ACF Trainees, 2015-17 Batch, CASFOS-Coimbatore

Man-Elephant conflicts in the area

The distribution of elephant population in Karnataka is mainly in the areas of Mysuru Elephant Reserve (MER). The MER which is spread over nearly 6725 sq km accounts for 5945 elephants out of a total of 6072 elephants in Karnataka, only 127 elephants are in other districts of Karnataka (Elephant Census – 2012). Thus MER is home to 97% of the State's elephant population. Furthermore, the Govt. of Karnataka had extended the MER by adding Bhadra Wildlife Sanctuary as core area (455.80 sq.km) and neighbouring areas (876.14 sq.km) as buffer area.

Conflicts between humans and wild elephants are not new. In the wild, Asian elephants live in tropical deciduous forests that provide ideal conditions for the well-being of the species - space, climate, vegetation, water and social interactions. These conditions have in fact allowed and determined the evolution and the survival of the species over millions of years. Human interference and deforestation causes destruction of elephant corridors, to some extent due to change in climatic conditions, the entry of wild elephant in non-forest areas like agricultural farms and human habitation in the vicinity of forest areas has increased in recent years. Competition for natural resources, poses heavy biotic pressure on these forests and people have started penetrating deeper into the habitat of wild elephants giving rise to conflicts between them. Sometimes conflicts are

Number of wild elephants in Karnataka (1997 to 2012)

Census year	1997	2002	2007	2012
No. of elephants	6088	5838	4035	6072

Table 1: **Compensation paid in Mysuru forest division year wise from 2005-06 to 2013-14**

Year	Crop loss	Cattle loss	Human loss	Human injury	Property loss	Ex-gratia (lakhs Rs)
2005-06	1834	6	1	11	-	16.65
2006-07	1401	5	1	3	-	17.73
2007-08	816	5	-	2	-	10.00
2008-09	3771	43	3	10	-	51.96
2009-10	3556	52	1	5	-	27.05
2010-11	2331	19	2	15	-	32.08
2011-12	3131	49	1	15	7	51.00
2012-13	1221	21	2	-	1	22.15
2013-14	1872	61	-	-	-	28.85

Source: Mysuru forest division working scheme for 2014-15

Table 2: **Details of ex-gratia paid in Mysuru Circle for the year 2015-16 (up to 30.11.2015)**

Name of division	Crop damage		Human death		Human injury		Loss of property		Total	
	No. of cases	Amount (lakh)	No. of cases	Amount (lakh)	No. of cases	Amount (lakh)	No. of cases	Amount (lakh)	No. of cases	Amount (lakh)
Mysuru	1143	21.60			6	0.69			1149	22.29
Hunsur	3	0.13							3	0.13
Mandya	8	0.50	1	5			1	0.07	10	5.57
WL Mysuru										
Total	**1154**	**22.23**	**1**	**5**	**6**	**0.69**	**1**	**0.07**	**1162**	**27.99**

Source : CCF-Mysuru

only because of accidents and without any kind of intention, either by man or elephant. Almost every month, some incidents of man-elephant conflict are coming to the notice resulting either in loss of life of elephant or loss of life of human being or property or crop.

Action in case of loss of elephant life is taken by forest officials as per provisions laid in Wildlife Protection Act 1972. However loss in human life results in agitation by people and makes it difficult for forest officials to work efficiently in such areas. To overcome this situation, the Forest Department of Karnataka provides compensation for loss to human life. Rs. 5 lakh is given for death of a human, to his / her dependents, Rs. 50,000 for permanent disability and in case of injuries the entire cost is borne by the department.

Management of elephant-man conflict and crisis management

Whenever information is received regarding movement of wild elephant in private lands, especially in cultivable lands or rural / urban habitation areas, the task to push back such elephants back into the forest area becomes a challenge for forest officials and the action performed by the forest department is generally criticised. To minimise and manage such conflicts, forest department has set up seasonal Anti Depredation Camp (ADC) also known as 'Elephant Scaring and Driving Squads' in sensitive areas adjacent to the Rajeev Gandhi (Nagarhole) National Park and Bandipur National Park of HD Kote, Sargur and Nanjangud Range of Mysuru division which are temporary in nature and are set up during the month of August to January (the crop season) which is the period in which majority of crops are fully grown and attract the elephants.

Such camps comprise of a team of local people and forest watchers who are well versed in elephant behaviour. These camps are manned by local people and they are provided proper uniforms, First Aid box, blankets, jerkins, cooking utensils, ration, torches, crackers etc., including insurance. Normally elephants do not invade non-forest areas during day time so such teams are active during night and rest during day

time. Trained elephants from nearby elephant camps are also being used for anti depredation programme.

The Karnataka Government has also issued a notification regarding imposing Section 144 of Code of Criminal Procedure to control the mob during rescue operations carried out by the Forest Department when elephants stray into human settlements or come out to raid the agriculture fields. On demand or recommendation of concerning DCF, the concerned district collector has to impose the Section 144 in the areas as recommended by DCF and has to direct the police to maintain the law and order and also provide all necessary help sought by the Forest Department at that time. Whenever Section 144 is imposed during such situations, forest officials are in a position to rescue elephants from the affected area with ease.

Preventive measures

To check the movement of wild elephants from forest to non-forest areas, forest department is carrying out habitat improvement programmes by planting species like bamboo in box trenches and other palatable species deep in the forest, so that sufficient food material is available to them within the forest areas. Besides this, optimum numbers of water bodies are also being constructed within the forest areas so that water is available for elephants during the stress period. To check the elephant movement Elephant Proof Trenches (EPTs) are constructed. These ditches (3m wide on top, 1.5m wide in bottom and 3 m deep) are dug around the outer boundaries of forest areas which are more susceptible to elephant movement. To check soil erosion along the EPT, on the outer side of the mounds, sowing of *Prosopis juliflora* seeds is done or these planted with Agave, Euphorbia / Jatropha species or Glyricidia cuttings. Besides this, the forest area is fenced with solar fencing in which 9 Volt DC current is allowed to flow. Regular maintenance of such fencing is done through tender basis. To check the elephant movement through the path of streams or other water channels and swampy areas, such area are covered by erecting "spike pillars' and "spike floors / beds". The spike pillars are 0.45m x 0.45m x 1.65m and 0.45 m apart from each other having pointed spikes on their surface. Such types of spike pillars are more effective and hence in some forest areas which are more prone to the elephant movement, a long stretch of forest area is covered with these spike pillars. At the entrance and exit of new forest plantation, spike gates are constructed. All such types of spike structures have shown effective results.

To overcome the injury effect of spike pillars the forest department has erected rail barriers as part of a pilot project in swampy / streams areas in Nagarhole Tiger reserve. For this two horizontal rails are placed on 8 feet high pillars made of rail. For such type of fencing two rail lines in horizontal position are used. The top one is at a height of 7.5 ft. and the lower on at 3 ft. above the ground and these cost around Rs 60-65 lakh per km.

It has been observed that sometimes

man-animal conflict becomes unavoidable due to lack of knowledge in people regarding wild animal behaviour. The unwanted gathering of people in the form of crowd and sudden actions taken by such crowd like shouting, throwing of stones etc. irritates the elephant and provokes them to cause damage. To get rid of such situations regular awareness programmes are being organised by the Forest Department to familiarise the local people about elephant behaviour and to let them know about 'do's and don'ts' in such situations. The Forest Department has also involving various NGOs and VFCs. To control the situation, public address systems have been installed in forest vehicles. Such vehicles are also provided with wireless system for mutual communication. For prompt capture of wild elephants in urban areas, the Mysuru Forest Division has modified two trucks as "Elephant Rescue Vehicle" costing Rs. 23.6 lakh each with a specially designed cage. Apart from the measures cited above, the Forest Department also resorts to translocation of problematic elephants from one forest area to another as a conflict management strategy.

Discussions and Conclusion

Though different types of barriers in the form of EPT, solar fencing, spike pillars and beds and rail barriers are being raised by the Karnataka Forest Department, these cannot be erected everywhere as well as the effectiveness also differs from area to area. EPTs are adversely affected by soil erosion during rainy season and thus regular maintenance in the form of earth work is required and the availability of budget is another constraint. EPTs are rather ineffective in rocky, swampy areas and between the course of seasonal water channels and streams. Digging of EPTs in sloping and undulating areas is also not effective due to heavy soil erosion. For better management in such areas, the Forest Department has raised RCC spike pillars and spike beds in continuation of EPT. To avoid invasion of elephants from forest areas to agricultural fields and human habitation, forest boundaries are also fenced with solar fencing. However it has been observed that elephants are quite used to solar fencing and a current of 9 volts is ineffective for some elephants. In some areas, elephants use tree trunks to break solar fencing and thus enter the agricultural fields with ease. To overcome this situation forest department is keeping two types of fencing - solar fencing on the inner side and EPT on the outer side. The Forest Department has also started raising rail barriers surrounding water bodies, swampy areas and between the course of seasonal water channels and streams which are more susceptible to elephants. However, it is likely that such rail posts may corrode in future due to presence of salt in water and soil and may not last for a long period of time.

The elephant census report of Karnataka indicates that in the last ten years the elephant population has increased (50.48% from 2007 to 2012), which is an indicator of better management techniques adopted by Karnataka Forest Department forest officials. This result


E.P.T. at Bommalapura of H.D. Kote Range


Spike gates


Spike Pillars & bed

Solar fence and gate at H.D. Kote Range

Elephant rescue vehicle

is also supported by the decrease in number of crop raid cases since 2008-09 to 2013-14 (Tables 1&2).

Recently, the Forest Department of Tamil Nadu with the help of World Wide Fund (WWF), has installed a passive infra-red early warning system to alert villagers about wild elephant movements at Kandiyur in the Mettupalayam Forest Range and at Vedar Colony in the Sirumugai Forest Range of Coimbatore Forest Division. The system costs about Rs. 3,000 and can be easily assembled. Its components include a 20 watt solar panel, an infra-red motion sensor, an LED light and siren. The system emits a sound that reaches up to 200 meters and thus villagers get to know about the wild animal movements. The system gives prior information to the farmers, so that they can burst crackers and divert the animals with lights before they enter into their fields. After the installation of the system, visits by the wild elephants into agriculture fields have started coming down. Seeing the success of this system, it is suggested that the same be installed by the Karnataka Forest Department in high conflict prone areas of MER.

Human needs and activities are mainly responsible for present day situation with respect to problems faced in elephant management not only by forest officials but by innocent villagers too. Forest officials in spite of all hurdles and limitations are doing their best to carry out suitable remedies regarding management of elephants in wild. Mutual understanding and knowledge of animal behaviour is the key to minimise such conflicts. Plastic bottles filled with small pebbles or some other sound producing materials may be tied on the wires of solar fencing at optimum spacing, so that such articles may produce peculiar sound due to their vibration along with

flow of natural wind and such sound may restrict the elephant movement in the conflict prone areas. Some sound producing instruments which can function on current produced by solar energy could also be tried. The agriculture department can also play a key role in this regard by creating awareness on the cropping pattern in the fringe areas of elephant reserves. Erection of solar fencing and EPTs along with their maintenance should be encouraged in the private lands through community participation. The Govt. of Karnataka should provide subsidy to villagers who are willing to create barriers surrounding their agricultural fields through social fencing. Maintenance of such barriers raised by forest department could also be done on community participation as they are the primary sufferers.

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NON WOOD FOREST PRODUCTS AND MEDICINAL PLANTS

Impact of *Cordyceps* harvesting

New guidelines are needed for extraction, transit and sale so has to enhance the benefits through better management in Uttarakhand

Waikhom Romabai

Till the year 2000, the people of Uttarakhand were unaware that the occurrence of *Cordyceps sinensis* was going to make a drastic change in their economy. Cordyceps was not used in the Indian System of Medicine. Moreover, it had no market in India. *Keera ghaas* or caterpillar fungi or *yarsha gumba* as it is known commonly is a parasitic fungus thriving on Lepidopteran larvae which is found in sub-alpine regions from 3,200 to 4,000 msl in the grasslands of the Himalayas. It is widely distributed in the mountainous regions of Tibet, Nepal, Bhutan and India and is highly valued for its incredible medicinal properties.

Cordyceps was discovered about 1,500 years ago in Tibet by some herdsmen who observed that their cattle became energetic after consuming a grass-like mushroom and even the older livestock became vigorous. In local Tibetan language, it is known as *yartsa gunbu*, meaning 'summer grass, winter worm'. This miraculous fungi is vastly used in Tibetan and Chinese medicine for the preparation of energetic and revitalisation formulations as well as relief for asthma, bronchitis, blood pressure, weakness, immunity strengthening, malfunction of lungs, irregular menstruation, chronic obstructive pulmonary diseases, treatment for impotency and as an aphrodisiac.

This parasitic fungi attacks the host, i.e. the larvae, and the fungal mycellium invades while consuming its host from inside out as they hibernate in alpine meadows. The fungal fruiting body disperses spores which infect the caterpillar at the end of autumn season. The infected larvae tend to remain vertical to the soil surface with their heads up. The fungus then germinates in the living larva, kills, mummifies it, and then the stalk-like fruiting body emerges from the head and the fungus finally emerges from the soil by early spring. The caterpillar found in the Kumaon and Garhwal Himalaya has not been positively identified. However, caterpillars of *Hepialus oblifurcus* (Hepialidae) are reported to be host of *Cordyceps sinensis*. And *Rhododendron anthopogon* (Sunpati) is identified to be the main associate species and *Cordyceps'* habitat are sometimes indicated by the presence of pellet of musk deer, blue sheep, dung of yak, etc.

In Uttarakhand, *Cordyceps* are

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primarily found in Chiplakot, Ultapara, Brahmkot, Najari and Nangnidhura – Munsiyari region of Pithoragarh district, Chiplakedar, Darma Vyas and Ralamdhura in Kumaun Himalaya and Ghat, Dewal, Niti and Mana valleys of Chamoli district in Garhwal Himalaya. During the last 5-6 years, extensive trading of *Cordyceps* was being carried out along the border villages where traders from Nepal and Tibet are the main stakeholders, offering a price which ranges from Rs. 60,000-80,000 per kg to the primary collectors. However, the international market offer is Rs. 2,50,000-3,00,000 per kg.

The collection method varies from using a knife to digging a small hole to carefully pull out *keera jari* from the ground. The caterpillar fungus is more valuable before it sporulates or in its early stage sporulation. In the final stages of sporulation, the host larva becomes soft and undesirable and the upper part of the mushroom sometimes splits.

During the prime time of harvesting, i.e. May-June, almost all the villagers camp in the mountains for their collection. The rural villagers are appreciating the role of *Cordyceps* collection in improving their livelihood. On the contrary, this has also created tension among the villagers as everyone is eager to collect as many as possible. So in 2002, the Government of Uttarakhand intervened and issued an order for the collection and marketing of *keera ghaas* through Van Panchayats and Forest Development Corporation for which the Government offers Rs. 50,000 per kg. Earlier there was no restriction against collection so anybody could collect and even people from Nepal used to come to collect from Indian mountains.

Further, the Uttarakhand Government issued guidelines in consultation with the GB Pant Institute of Himalayan Environment and Development, Almora, for the proper and sustainable collection of *keera ghaas* in Uttarakhand to ensure conservation of the species in the wild. The season of collection is specified as May to June, Van Panchayat/ Gram Panchayat is the issuing authority for the collection of *keera ghaas*. The Van Panchayat issues a collection permit to local villagers only and the local villagers pay Rs. 1000 per head to the Van Panchayat. The villagers will deposit their collection to the Van Panchayat Sarpanch. The Sarpanch has to verify the amount and approach the approved buying agencies through the Forest Department. The authorised buying agencies will pay Rs. 5,000 per kg to the Forest Department as royalty and the government rate of Rs. 50,000 per kg. The Forest Department is responsible for issuing "*Ravanna*" or transition pass to the buying agencies.

Some people are concerned over the extent of collection and are demanding a ban on extraction, in order to prevent extinction. But researchers are of the opinion that it cannot go extinct because of extraction as it is a fungal infection on the larva. The infection takes place at suitable temperature and moisture as fungal spores are always present in the air and soil. The only thing that may endanger the species is the destruction of its unique habitat. In fact, greater collection ensures a better

harvest the following year as noticed by the villagers involved in the extraction.

On the other hand, illegal trade of *Cordyceps* is on the rise, particularly due to the wide gap in price offered by the Forest Department and outside agencies. To control over-exploitation and check illegal trading, the Uttarakhand Government is in the process of drafting new guidelines for its extraction, transit and sale which will come under the purview of Forest Department as it is deemed as a forest produce. For the convenience of the local people and to encourage legal transaction, another provision of setting up of forest depot near the collection site has also been suggested by the forest officials.

Villagers are content with the economic boom resulting from *Cordyceps* collection, which has secured their livelihood, but they are least aware of its conservation priorities. Therefore, a better understanding between primary collectors, forest departments and other agencies for the proper harvesting and conservation of this species is the need of the hour.

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WILD LIFE MANAGEMENT

Habitat management of birds in Pong Lake

The avian paradise of Pong Lake and its surrounding areas is facing a number of problems as the villagers in the area are yet to be fully convinced of working in tandem with the Forest Department to save bird habitats

Pradeep Kumar, Pranjal Baruah

Pong Lake, also known as Maharana Pratap Sagar, came into existence after the construction of Pong Dam on River Beas in 1975. This lake is situated in Kangra District of Himachal Pradesh. Initially, the main purpose behind the construction of the dam was storage of water for irrigation and hydroelectric power generation, but later pisciculture started as a major source of revenue generation for the State government. Later, due to increasing environmental concerns, Pong Dam was declared a Wildlife Sanctuary[1] in 1983 (final notification in 1999). In 1994, this lake earned the status of Wetland of National Importance[2] and finally, in 2002, declared a **Ramsar**[3] **S**ite of International Importance.

At present, the lake is globally recognised as the largest man-made wetland in northern India and serves as a resting reservoir for migratory visitors (especially from Central Asia and Trans-Himalayan region)[4] besides as a breeding and roosting habitat for several residential birds.

Habitat classification of Pong[5]

The dynamic processes associated with this freshwater lake have created various unique micro habitats specific to the thriving biota. The diversity of the ecosystems is basically attributed to many limiting factors like food, water, soil nutrients, temporal availability of light and space. The water body and its surrounding features have been developed in due course of time since the creation of dam. Every monsoon the backwater of the dam inundates the periphery of the lake up to msl 1390 feet[6]. At the onset of winter, the level of water recedes down to msl 1280 ft[7], forming the conservation zone which accounts for the largest migratory avian population of the Pong Lake. Apart from this, the lake constitutes some sensitive zones having different ecosystems due to presence of varied conditions of soil and water level. These ecological units provide food, resting and breeding ground for the rare and endangered migratory avifauna during their "stopover" visits to the lake. However, manipulations to the habitat are solely dependent on the activities of either natural or artificial origin. The

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unique features of these habitats can be discussed as follows:-

The mud flats and mud splits are formed due to the receding water of the lake, covering the largest part of the sanctuary. Due to presence of abundant palatable grasses of *Cyanodon* sp., *Typha* sp. and grains, the area is the centre of attraction of the grazing birds like bar-headed goose, ruddy shelduck and common shelduck, while the thriving insects are good food for lapwings, pipits, larks, stilts, mynas, plovers, wagtails, wheatears and other summer breeding birds.

a) ***Open Deep Water***

This constitutes the core lake zone of below msl 1280 feet and bears large number of fish population to support diving birds like pochards, mallards, cormorants, grebes, gulls, terns, Indian skimmers, etc.

b) ***Swamps***

These are formed below the outfall of the dam and terrace and provide suitable shelter for feeding, roosting and breeding ground for a huge number of waterfowl diversity. Rails, bitterns, coots, moorhens, harriers, gadwalls, spot billed ducks, herons and lesser whistling ducks are commonly found in this habitat. Long bushy *Phragmites* and *Saccharum* grasses prevent the downfall of water and form few such areas characterised by swampy water holds consisting of hydrophyte species like *Najas, Potamogeton, Vallisneria, Hydrilla,* etc.

c) ***Shallow Water***

Most shore birds prefer feeding areas that include shallow water up to 3 inches deep and exposed, bare mud flats containing short, sparse vegetation. The shallow water banks account for more than 90 per cent of the total bird population. It is mainly dominated by the congregation of dabbling ducks, kites, shovellers, kingfishers, storks, Eurasian spoon bills, herons, egrets, teals and waders for macro benthos, small fishes and aquatic vegetation of *Spirogyra, Odogonium, Chledophora, Oscillatoria,* etc.

d) ***Dry Sandy Banks***

These are open dry fields devoid of any type of vegetation, but still a suitable area for residential and summer visitors like stone curlews, pranticoles, plovers, shallows, cranes and Egyptian vultures for their food and breeding.

e) ***Open Grassland and Agricultural field (Seasonally Flooded Croplands)***

The open areas are immediately occupied by fringe villagers for illegal cultivation of wheat and native grass patches of *Cyanodon dactylon*, *Cyperus* sp., *Solivia* sp.and *Phragmites* sp. soon after the water recedes. Routine flooding of the periphery regulates the soil regime and prevents invasion by obnoxious weeds and IAS species. Residential birds like wagtails, pipits, larks, bushchats draw food from flourishing agricultural fields throughout the period.

f) ***Scrub Areas***

This is the outermost transition zone of the reservoir, extended up to the woodlands and forest area of the sanctuary. Highest degree of terrestrial species richness is observed in this area. The ecotone terrestrial species include chats, warblers, babblers, quails, doves, bee-eaters, flycatchers, munias, reptiles, many herbivores and few predator species.

g) ***Woodland and Forest Areas***

These are composed of rocky beds and hills all around the buffer zones and small islands, characterised by forests, and have type 5B/C2 – Northern Dry Mix Deciduous Forest and type 9/C1– Himalayan Sub-Tropical Pine Forest with its Sub-type 9/C1a– Lower Shivalik Chir Pine forest. *Pinus roxburghii*, *Ficus sp.*, *Acecia latifolia, Dalbergia sisoo, Bombax ceiba, Embellica officinalis, Cassia fistula,* etc., are some notable fruit bearing plant species which support many terrestrial bird species. These forestlands enrich the fertile health of the lake ecosystem by supplying organic matters essential for the macrobenthos and macrophytes. It is the most favourable habitat of white-rumped vultures, robins, chats, parakeets, shrikes, crows, pheasants, drongos, tree pies, barbets, cuckoos, woodpeckers and hoopoes, etc.

Habitat management

(a) ***Various Issues***

- Unregulated water level fluctuations (Maximum 1390 feet and minimum 1280 feet from msl) resulting in a less exposed area, especially during winters, for the roosting and grazing purpose of migratory birds. If water level does not recede below 1390 feet, it directly affects the vegetation in the shore region and may cause alteration in the destination of winged visitors.
- Water level fluctuations also affect the growth and establishment of aquatic plants in the lake, which is an essential habitat of wetland.
- Increasing siltation of the lake is causing habitat shrinkage.
- Unawareness of the public in the catchment area regarding increasing pollution due to use of fertilizers, pesticides and insecticides. The lake is acting as a sink of Greater Pong[8].
- Dependency of villagers/farmers on agriculture for livelihood. Farmers mainly sow *rabi* (wheat) crop in the winters along the fringe area of the lake. The movement of the people in sanctuary area is resulting in a double threat of poaching and habitat disturbance.

Presence of cattle of Gujjars and stray animals[9] in a wide exposed area in summers leads to a two-way threat of egg trampling of many waterfowls (tern, lapwings, skimmers, partincole, black-winged stilt, sarus crane, etc) and change in vegetation due to compaction of soil.

- Increasing grazing pressure due to the presence of stray animals and cattle of villagers and their relatives is leading to a big obstacle in habitat management.
- The presence of cattle of Gujjars in the fringe area is also causing disease transmission to wildlife and risk of

epidemic diseases in surrounding areas. (More than 40 buffalos of Gujjars died in 2015)[10].

- It is a natural tendency of some of the breeding waterfowl to nest near the water body for successful hatching. But due to receding water in summers, the success of hatching is negatively affected.
- Earlier there was a conflict between the Forest Department and Fisheries Department related to little cormorants feeding on forage fishes, which later was resolved by the initiative taken by the Forest Department.

(b) ***People's aspect***

The Pong Dam (flood in local language) is either directly or indirectly related to people of the surrounding villages. These peoples have their own problems and issues which, in turn, create challenges in front of the Forest Department for habitat management of birds.

As per our interaction with local villagers—Balod and Katholi villages of Nagrota—following issues came to light:

- Resentment of people due to sanctuary formation; this restricts people to cultivate in fringe area. As there is no other source of livelihood except farming and fishing for local villagers, the restriction is causing a conflict between the Forest Department and people.
- According to farmers, a major portion of the newly sprouted shoots of crop (wheat) is grazed by migratory birds (especially bar headed geese). They firmly believe that the birds only come here for this reason.

(c) ***Forest Department aspect***

For the improvement of the habitat of several residential and migratory birds, various protection and remedial measures were adopted by the Forest Department. They are as follows:

- Declaration of bird sanctuary in 1983 (Final notification in 1999).
- Plantation of various fruit-bearing tree species (*Acacia, Syzygium, Mangifera, Mulberry, Ficus, Kachnar, Emblica,* etc). In some regions of Lalpur and Jani Masroor beats, *Pinus roxburghii* is also being planted for the nesting of vultures.
- Some forest guards are assigned with a special duty to check the undersized (less than 4 inch)[11] nets of fishermen and any toxic substances. The Forest Department didn't allow any fishermen to trap fish near the shore area. Every licensed boat is marked with a specific registration number to avoid the chances of illegal activities.
- In Nagrota Surian fringe area, about 7.5 ha land, including 2 ha land area, is especially protected by interlinked chain fenced for the feeding of vultures. A skinner[12] is deployed from the village, who takes dead animals from villages to the feeding station. Generally, dead stray animals are preferred.
- To deal with the egg trampling problem in the breeding season, almost 15 ha area is fenced annually on temporary basis to keep away the cattle of farmers and Gujjars and

other stray animals.

- Under participatory mode of management, 40 micro plans had been prepared by the Forest Department for the surrounding villages of Pong Dam under a centrally supported scheme. However, only 10 micro plans were approved and implemented due to lack of funds. VFDC (Village Forest Development Committees)[13] are formed to involve people in the management approach.
- During winter season, birdwatchers are deployed by the Forest Department on daily basis from the villages. Similarly, in summers, some firewatchers are especially deployed to protect chir pine trees from fire in the vultures' nesting areas.
- Satellite telemetry programme[14] is conducted to understand the behaviour and migratory path of the migratory visitors.
- Tagging and ringing[15] programmes of birds are also initiated with the help of BNHS[16].

Proposed action plan of the department for future

The Forest Department is very keen to resolve various issues related to effective habitat management of birds. The Forest Department is planning for the formation of Pong Development Society, which includes various stakeholders. In future, all the welfare and conservation activities will be related to society.

- Development of ecotourism is one of the proposed plan with the cooperation of other line departments like tourism, fisheries, mountaineering and water sports.
- Species specific approach is proposed by the Forest Department for the conservation of different migratory and residential birds.

Conclusion

As per our observations, the Forest Department has done a marvelous job in the last few years but conservation of the habitat of migratory birds is a big challenge until all the stakeholders come together. The government has to take the initiative to sensitise every individual about the degree of threat to habitat of birds and its consequences.

Endnotes

1, 2, 3, 4 & 5: Wild wings, by: Mr.D.S.Dhadwal, A.C.F WL, Hamirpur division, Himachal Pradesh.

6 & 7: As per article of Mr.D.S.Dhadwal, published in TIGER PAPER (October–December 2008), Vol.XXXV.No.4.

8: The Greater Pong may include Pong Sanctuary, the watershed in general and the buffer zone in particular, and the various stakeholders around Pong Lake.(TIGER PAPER (October–December 2008), Page no 21,Vol.XXXV.No.4.

9: A domestic animal (cattle here) that has wandered away from its place of keeping. **(Neither domestic nor wild).**

10: As per our interaction with local villagers, (citation needed).

11: As per our interaction with Mr.D.S.Dadwal, A.C.F WL, Hamirpur division, Himachal Pradesh.

12: A skinner is a person who removes the skin of the dead cattle. (Dalip Singh, local skinner).

13: Raj Kumar, President, VFDC, Katholi village, Nagrota Suriya.

14: One kind of satellite based tracking programme to know the habitat & migratory path of wing visitor.

15: Bird ringing or bird banding is the attachment of small, individually numbered metal or plastic tag to the leg or wing of a wild bird to enable individual identification. (A report on the bird banding programme, 18 Jan 2004 to 09 Feb 2004, Pong dam, District Kangra, Himachal Pradesh, .S.Balachandran, S. Asad Akhtar).

16: Bombay Natural History Society.

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WATERSHED MANAGEMENT

Harmonisation of watershed and community development

This case study of Kotadhar village in Mandi District of Himachal Pradesh studies the impact of the Mid-Himalayan Watershed Development Project

Kaushik Phookan & Jwala Prasad

Watershed denotes a hydrologically defined unit, an area of land which is draining into a common body of water such as a lake, river, or ocean.

The Mid-Himalayan Watershed Development Project (MHWDP is operational in Himachal Pradesh with effect from October 1,2005 with financial assistance from the World Bank. The Project targets an area covering around 272 micro-watersheds, that spread over 602 GPs, 42 blocks and 10 districts. The Mid Hill and High Hill zone of the state within the altitude range of 600-1800 metres is covered.

In addition to the primary objective of MHWDP cited above, another objective is to support policy and institutional development in the State to harmonise watershed development projects and programmes across the State in accordance with best practices.

The total cost of the Project is about Rs. 337.50 crore. Out of this, the World Bank share is about Rs 270 crore, State share is about Rs. 67.50 crore (20 per cent). There is also a Beneficiary Contribution of Rs. 27.50 crore. The latter will not contribute towards the capital cost of the Project but will be maintained in a separate account of the respective Gram Panchayat and utilised as Village Maintenance and Development Fund.

The Project consists of four main components to fulfill its objectives.

1. ***Institutional Strengthening:***

Initiate and support the process of building and strengthening self reliant, self managed and sustainable local institutions that work for the rural people.

2. ***Watershed Development and Management:***

- To empower and strengthen natural resources dependent community.
- To develop and support mechanisms for taking up watershed activities that are common to more than one Gram Panchayat.
- Improve the productive potential of the degraded land in watershed and enhance biomass production and carbon stock.
- To build rural infrastructure.

3. ***Enhancing Mountain Livelihoods:***

Introduce high value crops and promote value addition in the produce,

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livestock and NTFP. It will focus on demand side, marketing and establishing linkages between farmers and buyers.

4. ***Project Management/Co-ordination:***

Facilitate overall co-ordination, implementation and management of the project at State, division and Gram Panchayat level.

This paper studies the harmonisation of watershed, with special reference to Kotadhar Gram Panchyat under the MHWDP in Hmachal Pradesh. The study is focused on the aims of the MHWDP, which is the reversal of the process of degradation of the natural resource base and improvement of the productive potential of natural resources and income of the village dwellers. It contains a report based on field visits, observations, interactions with the local people, data collection and analysis about the implementation, management and achievement of the goals of the project.

Profile of Kotadhar Village

Gram Panchayat Kotadhar falls in the Beas catchment area on the right bank in Sanor Valley of Mandi District. It is 45

Guiding Principles of the Project:

- Comprehensive watershed treatment.
- Identifying the poor and the poorest and mobilise them, especially women into self-help groups.
- An integrated watershed management framework for incorporating all technical information on productive capacity and conservation planting by using water as a time-bound nucleus for a time-bound community based programme.
- An integrated livelihoods enhancement framework for improving the livelihoods of the people.
- Adding value to agricultural production.
- Building the skills and capacities of the poor.
- Facilitation and technical support .

Activities under the project:

- Protection and reclamation of arable and non-arable lands.
- Afforestation - with local species as per site condition and needs of the stack holders
- Vegetative measures - grass seedlings, grass tufts, brushwood check dams (local vegetation).
- Mechanical measures - gully plugging, dry stone check dams , crate wire structures, etc.
- Soil and moisture conservation in arable lands - vegetative field boundaries, in-situ soil and water conservation measures.

km away from the district headquarters, Mandi. The WDC unit selected for field visit was Panarsa.

It is located at an altitude of 1,300 msl. The soil here is sandy loam and the underlying rock is mainly quartzite. The annual rainfall varies from 300-800 mm, with rain occurring during the monsoon and winter months. The climate is sub-tropical.

Demographic data for the area under study was collected. There were a total of 589 households, with a total population of 2,994. Gender break-up shows the count as 1,460 males and 1,534 females. A count of livestock population put the cow/ox count at 805 and sheep/goat at 950.

The total geographical area is 580 ha, with 201 ha under agriculture and horticulture. About 159 ha is culturable blank forest land while 220 ha is forest land.

The main forest species found are Chil, Kail, broad leaved species like Robinia, Ban, Poplar, Daru, Kachnar, Bihul and Kahu; among bushes, Rubus, Berberis, Rosa. Animals like monkey, jackal, jungle cat, porcupine, etc. are found.

Interaction with the local people

We conducted meetings with villagers who informed they are earning Rs. 3,000-12,000 per month by selling quality seedlings, agro products and farm yard manure (FYM). Irrigation facilities have been improved which is helping to increase the total available water.

Gram Pradhan Bhoop Singh told us that the economy of Kotadhar GP has improved in all respects, i.e. agriculture, horticulture, animal husbandry, farming capacity, quality seedlings, handlooms, self employment generation and skill development.

Some of the beneficiaries under the project with whom we interacted are Mahindra Kumar, Reshma Devi, Savitri Devi, Tikami Devi, Sunil Datt, Mor Singh Negi, Daulat Ram, Kikar Singh, Totaram, Sunder Lal, Prem Lal and Chandramani. They have declared earnings in the range of about Rs.5,000-10,000 each per month by producing quality seedlings, woollen and other handicraft items.

Initial problems

Before the implementation of the plan, several problems existed as outlined by the people with whom we interacted with. Few are listed below:

- Degrading water resources and forests.
- Poor soil quality and less productivity.
- Excess use of chemical fertilisers and pesticides.
- Non introduction of cash crops
- Weak irrigation channel system.
- Lack of awareness among the local people.
- Less employment generation.

Observations after project implementation

Using a community-driven development approach, the MHWDP has improved water harvesting, increased the area under irrigation to diversify agriculture and horticulture, and conserved and

sustainably developed soil and water resources.

- Reduction in water and soil degradation which resulted in availability of drinking and irrigation water.
- Increase in fertility of the soil by use of bio-fertilisers, resulting in more productivity of crops.
- Construction of mangers and other concrete structures which reduced dependability on forest fodder.
- Introduction of cash crops which improved the financial condition of the villagers.
- Improvement of water irrigation channels resulting in less loss of water.
- Empowerment in various skill development programmes like knitting, embroidering, plumbing, electrical works, farming, handloom, etc.
- Increased practice of stall feeding for livestock.
- 8.6 Ha land brought under high value crops.
- Use of vermicompost increases soil productivity leading to the enhancement of the output of HVC and traditional crops.

As a result of the above impact, the overall living condition of the local people has improved manifold. The project has also empowered the communities through capacity building, transfer of decision making powers and resources and communities are involved from the very beginning of the process of identification of problems, their possible solution, preparation of plan, implementation of activities, monitoring and evaluation and sustainability of assets created.

WILD LIFE MANAGEMENT

Conservation of vultures in Pong Dam Sanctuary

Sustained efforts by the Forest Department for over a decade have resulted in an appreciable rise in number of vultures in Kangra District. The successful initiative can be replicated in other areas in country too.

Prashant Hindwan & Ravindra Pundir

Currently, when India is struggling hard to protect many of its natural resources, the silent but strong and steady conservation success story of vultures could be a good lesson for various conservation lobbies. Popularly called the *ugly bird*, but not so ugly in its behaviour and contribution to clean the environment, which includes our society.

In India, nine species of vultures are found. *Gyps bengalensis* is the most populous. In 1980s, about 80 million vultures of this species existed. But, with the beginning of 1990s, a trend of rapid downfall was seen all over the world. In India, 90-99 per cent decline was recorded in different populations of vultures. This was an alarming situation for the country. It was initially registered in Schedule-IV of the Indian Wildlife Act-1972. In 2002, the status of three species—*Gyps bengalensis, Gyps tenuirostris, Gyps indicus*—was changed to Schedule-I, part III, of the Indian

RFO Batch 2014-16 at FTI & RC Sundernagar, HP

Wildlife Act-1972. IUCN had already declared these species as critically endangered. In March 2000, the Ministry of Environment and Forests, Government of India, sponsored a project for nationwide survey of vultures.

In 2003, a major breakthrough was achieved when Dr Lindsay Oaks and his team zeroed in on 'diclofenac' as the main culprit. It is a painkiller given to the cattle, which after entering the body of vulture results in renal failure. Finally, in 2006, the government banned this drug throughout the country. After that several campaigns were started in the country to save this bird.

Kangra District of Himachal Pradesh tops with the highest number of white-rumped vultures in the country. In 2004-05, 26 nests were recorded; now there are over 250 nests. The wildlife wing of Himachal Pradesh Forest Department made a strategy to protect this master bird in its habitat by providing appropriate and undisturbed breeding places and feeding spaces. This can be clearly seen not only on paper but also on ground. Mr DS Dadwal, ACF (WL), and his staff devoted their efforts in protecting the species and that resulted in the proliferation of numbers of vultures in the district. Kangra District now tops in the country in breeding of *Gyps bengalensis*. According to the wildlife wing of Nagraota Surian, 293 nests were counted in the year 2011-12.

Study area near Pong Dam Lake Sanctuary

Pong Dam is located in the Kangra District, within 30º22'40'' to 33°12'40'' North latitude and 75°45'55'' to 79°04'20'' East longitude. It is a Ramsar site visited by 1.5 lakh birds annually. It has an area of 207 sq km. The area has good vegetation of conifers, chir pine, mixed species of *sisoo*, *catechu*, *mangifera indica*, *ficus spp*.

Many vulture breeding stations have been demarcated here. In our study area of Nagrota Surian range, six breeding stations are delimited, spreading in four forest beats. We visited Lalpur station, which has the highest count of vulture nesting.

Kangra District tops in the entire country as far as breeding of *Gyps bengalensis* is concerned. The number of adult white-rumped vultures here was 293x2=586. This is a healthy sign for this master bird and its numbers have been increasing every year.

Introduction

Vultures are scavenger birds, feeding mostly on carcasses of dead animals. Vultures have bald heads, which plays an important role in thermo-regulation. The species of vultures found in India are:

- *Gyps bengalensis* (White-rumped vulture)
- *Gyps tenuirostris* (Slender billed vulture)
- *Gyps himalyanensis* (Himalayan griffon vulture)
- *Gyps fulvus* (Indian griffon vulture)
- *Gyps indicus* (Long-billed vulture)
- *Neophron percnopterus* (Egyptian vulture)
- *Aeguypius monachus* (Cinereous vulture)
- *Gypaetus barbatus* (Bearded vulture)

- *Sarcogyps calvus* (Red headed vulture)

Distribution & Behaviour

All these species are found in Himachal Pradesh and no big mortality has been recorded in the State yet. *Gyps bengalensis* has the largest population amongst all species. Observations are done mainly on this species.

In the Pong Dam area, white-rumped vulture is resident up to 40 km of the dam. Himalayan griffon migrates in winter with most other raptors. It is large in size, a resident of the areas in the Dhauladhar range of Kangra District, but for feeding it flies over to Pong Dam Lake Sanctuary area. Among Egyptian vultures, some are migratory and some are residents of the area. They can be spotted easily in the sanctuary area. Eurasian vultures are completely migratory. They form nests in colonies; in a nest, one male one female and one fledgling resides. The incubation period of vulture is 25-30 days.

Conservation Initiatives

Conservation of any species in a region depends upon various strategies. Mainly it requires protection, habitat management and enough prey base to survive. Fortunately, all three phenomena are fully developed in Kangra District.

Protection

The significant decline of *Gyps bengalensis* was a challenge 10-15 years ago. The ban on dichlofenac was not enough as illegal sales continued in many areas. The circumstances required public awareness about conserving avifauna. Following continuous campaign by the Forest Department on the protection of vulture, villagers understood the need for protecting vultures. In recent times, not a single case of vulture death due to drug has been identified.

Habitat Management

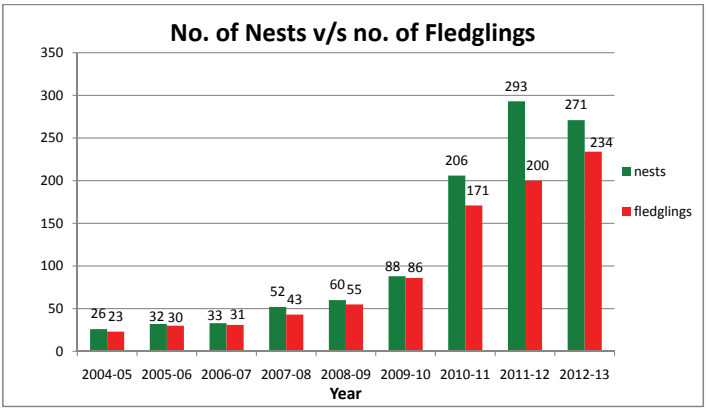
A healthy habitat, where food and shelter is easy to find, is essential for conservation. Vulture is very choosy in making its nest. It prefers a tall tree with forked branches that can withstand its size and provides a commanding view. The Pong Dam Lake Sanctuary has a high percentage of *Pinus roxburghii,* a tree suitable for the vulture to build its nest.

Breeding Station

The wildlife wing started work on this in 2004-05. It surveyed the areas where successful breeding of vultures takes place in the wild. Vulture breeding colonies have about 3 to 30 nests per colony. Each breeding area generally varies in size from 5-20 hectares. At present, 46 breeding stations have been recorded here and are now being protected for vulture breeding.

In these stations, commercial forestry operations are banned. Felling of trees, resin tapping, collection of fodder and fuelwood is not allowed in these areas. Lalpur, Bhuted-1, Bhuted-2 are the stations where these areas are fenced with barbed wire. No commercial forestry is done here by the territorial wing.

The graph shows a trend where the population of nests and vulture fledglings in Kangra District has been increasing every year. It has been



observed that sometimes the young ones remain unattended during the night as their parents remain out for one reasons or other.

Feeding Stations

The unique feature in the conservation of this master bird is the selection and construction of a spot as a feeding point for vultures. A decade ago, starvation problem was observed. Vulture feeds on animal carcasses, but it is important that the prey must be easily visible to the vultures. Villagers used to throw the carcasses in bushes or down the hills, resulting in poor visibility for vultures.

The objective of making feeding stations was to encourage villagers to throw their dead cattle at these locations. The department pays Rs 200 for each cattle body. The area is about 7.5 hectare large, fenced by barbed wires and interlinked chains. Interlinked chains stop feral dogs and jackals from trespassing.

Skinners/cobblers also get benefitted as they remove the skin from animal carcasses and then carry the body to stations. They receive Rs 400 for this by the Forest Department. Currently, two such stations are in operation, one in Nagrota Surian and another at Gaglara. Vultures feed in gap of 4-5 days. Hence, there is enough prey base in the area.

Besides these stations, many other spaces are open where people throw waste materials. Vultures frequent these areas too.

Monitoring

Forest staff plays an important role in the conservation of vultures in the Pong Dam area. Census and regular monitoring of vultures and its nests are important activities done by forest officials. Each year, in the months of February-March,census is done. Teams of 2-3 guards are sent to different breeding stations. These teams carry cameras of good quality to capture images of nests, fledgling, adults and their direction. In these months the visibility is good. The area, its latitude and longitude, number of nests and number of fledglings are recorded. As vultures lay eggs in November and hatching takes place in December-January, February-March is the ideal

time for conducting the census.

Regular monitoring of the areas is done by beat officers. Fortunately, villagers are cooperative. In some areas, like Lunj, Jani-Masroor and Lalpur, where there is proper fencing, the numbers goes rise incredibly. The maximum number of nests are in Lalpur breeding station—32 nests in 2012-13 census.

Fire is another important issue here. The maximum canopy cover is of chirpine trees, thus the area is prone to fire hazards. During fire season, it creates a lot of difficulty. Fire causes destruction of trees and, subsequently, vulture nests. The problem is resolved by clearing the fire lines before the season and engaging fire watchers to keep a vigil over such hazards.

Problems & Prospects in Conserving Vultures

- **Fencing**

  Kangra District has 46 vulture breeding stations. The area overlaps with the wildlife and territorial divisions. Commercial activities are being pursued in the forest to meet demands of the people. This is a hurdle in many areas. Due to this, several mishaps occur. Though green tree felling is banned, felling of dry and dead trees sometimes destroy the nest of vultures in another trees. Such cases are dealt by forest guards.

- **Shortage of Forest Staff**

  In the study area of Pong Dam, there were only nine forest guards for patrolling. Fortunately, the area is not sensitive otherwise it would have been difficult for such small staff to deal with all issues.

- **Increment of Feeding Stations**

  These stations are like a restaurant for vultures. But there are only two feeding stations and one is being constructed. Rapid urbanisation is also a problem. The need is to search areas which are open, outside the human habitat and where there is a continuous supply of human carcasses by human beings.

- **Rescue & Research Centre**

  The Pong Dam attracts a large number of migratory birds from as far as Europe and Siberia. More than 1 lakh birds regularly visit the area in winter. The biodiversity is very rich. So, there is a demand for a rescue and research centre to deal with day-to-day problems and various bird management issues.

  Several issues can be resolved by establishing such a centre. However, an Interpretation Centre is being maintained in Rancer Island inside the lake.

- **Development of Eco-Tourism**

  Activities such as eco-tourism help officials to resolve the problems globally. Many researchers and scientists give their suggestions. If the people are aware of the programmes, they help in conserving the species.

FORESTRY EXTENSION

Creating awareness among students

A case study on Chinnara Vanya Darshana, a programme for Class IX students in Mangalore, Karnataka

Dr. Amit Chouhan and Vijay

Forests play a significant role not only in ensuring the environmental stability but also achieving economic benefits. The role of Forest Department is important not just in the in the conservation and development of forests but also in ensuring their contributions to livelihoods and ecological and environmental security.

For ensuring success of forest conservation programmes, active support and co-operation from people is indispensable. It is, therefore, essential to inculcate among people an awareness of the value of the trees, forests and wildlife and their contribution towards a healthy environment. This may be achieved through involvement of educational institutions, where the children are at a stage to be suitably informed.

It is with this premise that the Karnataka State Government launched the **'Chinnara Vanya Darshana (CVD)'** programme for 9th class students in schools close to forest areas. The objective is to create awareness in students regarding forests, to seek their participation in conservation, protection and development of forests and wildlife and to inform them about the work of the forest department. The Government of Karnataka has initiated the CVD programme in all the districts of the State during the financial year 2015-16.The students will get to spend time up close and personal with nature and learn more about what keeps the environment and ecology ticking. With an outlay of Rs. 2 crore, the CVD programme will cover nearly 10,000 high school students from schools located near the fringe areas of forests. To implement the scheme a handbook consisting of proper guideline is issued.

CVD Programme – Mangalore Circle

A study was undertaken to understand the Chinnara Vanya Darshana (CVD) programme in the Mangalore circle of Karnataka forest department. Mangalore is one of the Forest Divisions in Karnataka and comprises of three sub-divisions and eight ranges. The total area of notified forests in Mangalore division is 1128.16 km^2. The areas visited under the study included Ontibatte Govt. Higher Primary School, Moodbidri; Govt. High School, Sarapady, Bantwal Range, Puttur; Bhagwati Nature Camp; Seetanadi Nature Camp; Byndoor Range.

The Chief Conservator of Forests

SFS Trainee 2015-17, CASFOS, Coimbatore

(CCF), Deputy Conservator of Forests (DCF) and the Range Forest Officer (RFO) were interviewed for specific information on the status and nature of the CVD and its features. The status of the programme and the student's attitudes towards forest, trees and CVD were also assessed. The interviews were carried out with the help of the Forest Department, Karnataka and the school administration.

CVD Scheme Strategy

The premise of the CVD scheme was to create awareness in the students of entire Karnataka State. However, there are 14,472 Govt. High Schools in entire State and it is not possible to collect all the children and arrange a forest visit for them. Thus it was decided to include only 9th standard students from various schools as per the following preference:

(i) Govt. schools near the National Parks and Sanctuaries
(ii) Govt. schools near the Reserve Forests
(iii) Aided schools

CVD Programme

The CVD programme in the Mangalore circle covers nearly five government schools per range for the financial year 2015-16. The preparation and implementation of CVD will be done as per the guidelines issued by the Government of Karnataka. Under this, students visit the Range Office, nursery, forest area (*Daivya Van*), timber depot, nature camp respectively where they are provided information about the forest and the working of the forest department.

At the Range Office, the Range Officer provides the basic overview about the forest department to the students including organizational hierarchy, duties and responsibilities, uniforms of the staff, forest area of the nation, state and district etc.

In their visit to the forest nursery, the students study about photosynthesis, various parts of the plant like root, stem, leaves, fruits, flowers, the tree itself and collection of seeds from it. They also learn about proportion

Chinnara Vanya Darshana programme activities

Visit to nursery, Moodbidri

Play performed by students at Bhagwati Nature Camp

Special session by environment specialist

Soil and water conservation session

of sand, soil, fertilizer for growing a particular seedling and preparation of organic manure.

Students are taken to the forest area where they get chance to interact with the forest ecosystem and understand that forests are not only for trees but are home to millions of species. Students are made aware about the necessity of forests for medicinal plants, soil and water conservation, shelter of birds and animals and ecosystem services like timber extraction, fire wood, water and fodder. The Range Forest Officer explains the role of forest department in protection of forest, effect of forest fires, protecting forest from fires and creating fire lines.

At the nature camp students are informed about various aspects of the forests through numerous activities and fun games. This includes, observations of leaves, barks, cracks, fruits, flowers, birds, nests, insects, creating an idea that tree provides shelter to many living organisms and discussions on the food chain.

Several activities are planned at the schools such as essay, quiz, drawing and story writing competitions on topics related to the experience of students during their forest visit, planting of local and commonly known species in the school area and their maintenance, identification of birds and butterflies within the school boundary.

Assessment of CVD at Moodbidri and Byndoor

The CVD scheme was introduced in the Ontibatte Government Higher Primary School, Moodbidri range, Mangalore, on an experimental basis under the directions of CCF, Mangalore Circle, the Range Officer of Moodbidri arranged a two day programme for students including a visit to Range Forest Office, forest nursery and Bhagwati Nature Camp (Kudremukh National Park). Various creative activities and games including tree identification, reading information and sign boards, quizzes and nature games were arranged to inculcate awareness amongst students for trees and forest. At the end of the programme, seedlings of local species (*Mangifera indica*, *Sygyium cummni*, *Tectona grandis*, *Acacia catechu*, *Saraca ashoka* and *Mahogani*) were distributed to every student for planting in the

school premises and at their homes and neighboring areas. Maintenance, watering, weeding and other activities for the plants at the school are done by the students under the guidance of forest staff and school staff.

Range Forest Officer, Byndoor range, Kundapura Division of Mangalore circle successfully implemented the CVD programme for more than fifty children of different Government schools. An expert lecture by a noted environmentalist Mr. Manohar was arranged for students along with other activities on the biodiversity and flora and fauna of Western Ghats.

The programme was fruitful and effective in the sense of its objective as the students showed enthusiasm and were united in their support for conservation and development of trees and forests. They were made familiar to the working of the Forest Department and provided important species of flora and fauna. It is expected that they would spread awareness among their families and relatives, neighbours and in their village.

Conclusion

Under the CVD programme, children got an opportunity to come close to nature and understand its importance for existence of life. They were also made aware of the efforts of the forest department in the protection and development along with the administrative structure of the department. Being future assets of the country, children can carry the message regarding the need to saving the forest ecosystem and spread in

society. Eventually they will be helpful in strengthening Forest Department to achieve its objectives.

The Forest Department has decided to cover only a limited number of students under CVD in the current financial year. This is due to the restricted resources of the department and the budget allotted for CVD. Some suggestions to enhance productivity of CVD programme are as follows:

(i) A MoU with the education department can be signed and expenditure can be on sharing basis.

(ii) NGOs, environment experts and local government agencies could help in addressing the problem of limited manpower and resources.

(iii) Local artists can be used to perform some nature based activities for the children. This will provide employment to local artists and the children will learn with fun.

(iv) Modern concepts like carbon sequestration could also be illustrated to the children.

(v) The children covered under CVD can spread awareness message among other students of their respective schools through plays or by other means. Paintings or posters related to nature can be displayed on the wall of the school.

References

This article is based on the field experience of the authors and personal communication with Chief Conservator of Forest, Deputy Conservator of Forests, Assistant Conservator of Forests and Range officers concerned. The statistical information and some of the photographs have been provided by the Department of Forest, Mangalore, Karnataka.

Websites:

http://aranya.gov.in/

https://en.wikipedia.org/wiki/Geography_of_Karnataka

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

Contributions Invited

The Field Forester invites articles from serving as well as retired forest officers and others working in the forestry sector. The Field Forester offers a unique platform for forestry professionals to share their work and experiences. The article should be interesting and entertaining to read and should be written in a lively and concise style.

Evaluation and Review System

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

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

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

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

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